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Developing a Measurement Model for Indian Airport Services Perceived by Air Passengers

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Abstract:
This paper attempts to revise level of various service quality of the airline industry and arrange these, with their relative importance using fuzzy approach. And utmost care was taken to ascertain these attributes, with fuzzy Delphi technique. The study was conducted in Hyderabad city, India. To gather the relative information, structured questionnaire was taken with proper validation and consistency. As the airline is the one of major medium to access the globe, as well as in the international transport, time demand to study quality of services in airline industry. Due to services and quality are related to combining activities of different factors, and again it concern to human judgment, it is difficulties to measure the same. Therefore the study attempts to fill the gap in the existing literature with a different approach for evaluating airline service quality. At last, some valuable conclusions and useful suggestions are provided to airline industry, to improve the service quality further.

Key words: *Service quality, Fuzzy, Aviation, Airports, Defuzzification*

1. Introduction

Effective and integrated public transport system of a country ensure to a stable and productive society. It would also enable a comparative advantages as well as economic efficiencies for the suitable in the user costs. Again an adequate and reliable infrastructure for transportation and its allied services are the primary dimensions which contributes to the capacities of a nation for international trade and have strong and positive platform for foreign direct investment. For this government has a major contribution in this angle. Even there are some industry, which suffers from high level of cost in terms of logistic and resource mobilization. Therefore it is the time to address the development of the all modes and means of transport in an integrated ways which will be lead to the concretization of an inclusive, sustainable, balanced, profitable and safe transport facility for the socio-economic benefits. Again availability of a competitive and non-discriminative fare in transport system will support progressive symbol to the country.

A country cannot develop without a developed transport system. Good public transport systems are an essential part of safe, clean and affordable transport for development. The system should be quickly, safely, and securely moves people and goods through the country and overseas. From a social perspective, public transport is the only means of transport for the poor. Transports related infrastructures facilitate human as well as resources mobilization in a society.

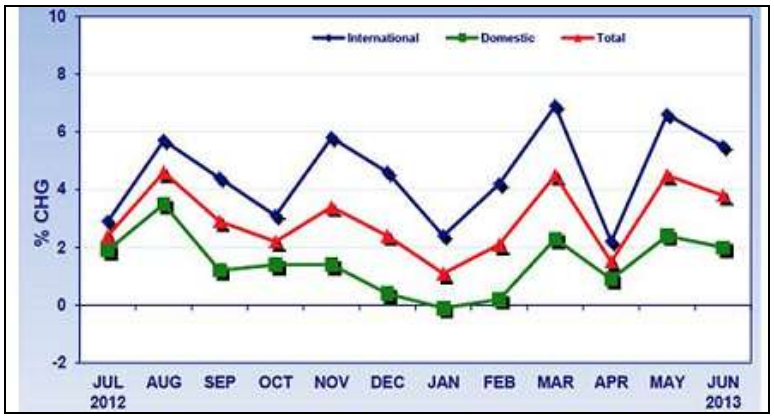

Figure 1

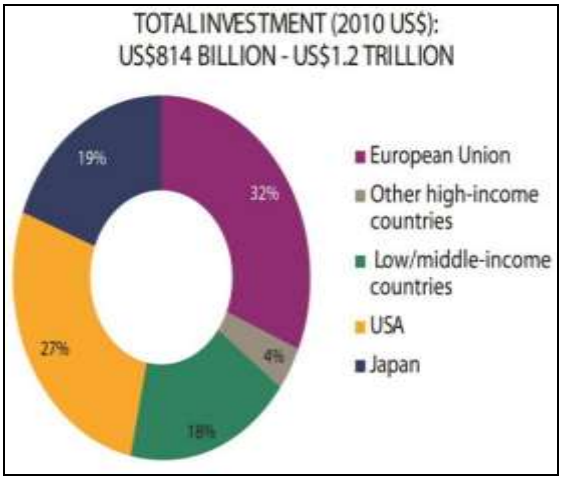

Figure 2

India's transport sector is widespread and diverse. It provides, to the needs of 1.21 billion (2013) people. In 2007, the sector contributed more than 5 percent to the nation's GDP, with road transportation contributing the lion's share. But railways and roads are the dominant means of transport having more than 85% of total traffic in the country. In present observation share of transport sector in Gross Domestic Product (GDP) of India has increased from 6.0% in 2001-02 to 6.5% in 2010-11. In particular, the contribution of road transport sector in GDP has increased from 3.9% in 2001-02 to 4.7% in 2010-11.

In 2011, air passenger-kilometers grew by 6.5% while the estimate for 2012 puts growth at 5.3%, reaching 5330 billion passenger-kilometers or 2.85 billion passengers. China, the second largest domestic passenger air transport market, recorded the strongest growth. Traffic expanded by 9.5% reaching 85.8 billion passenger-kilometers in 2012 according to IATA.

India has 125 airports, including 11 international airports. Indian airports handled 120 million passengers and 2.3 million tons of cargo in year 2012-13, an increase of 30.2% for passenger and 11.6% for cargo traffic over 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 150 million and cargo to cross 5.6 million tons by year 2020.

Country	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2006**	**2007**	**2008**	**2010**	**2012**
India	346	337	335	334	333	333	341	346	345	352	352

Table 1: No. of Various Airports in India

Airports contributing more than 55% of services to the air passengers, stating from booking tickets till boarding in aircraft and again deplaning of the passengers till travelling to passengers' destination will continue. Hence airport plays key role to add service value to air passengers.

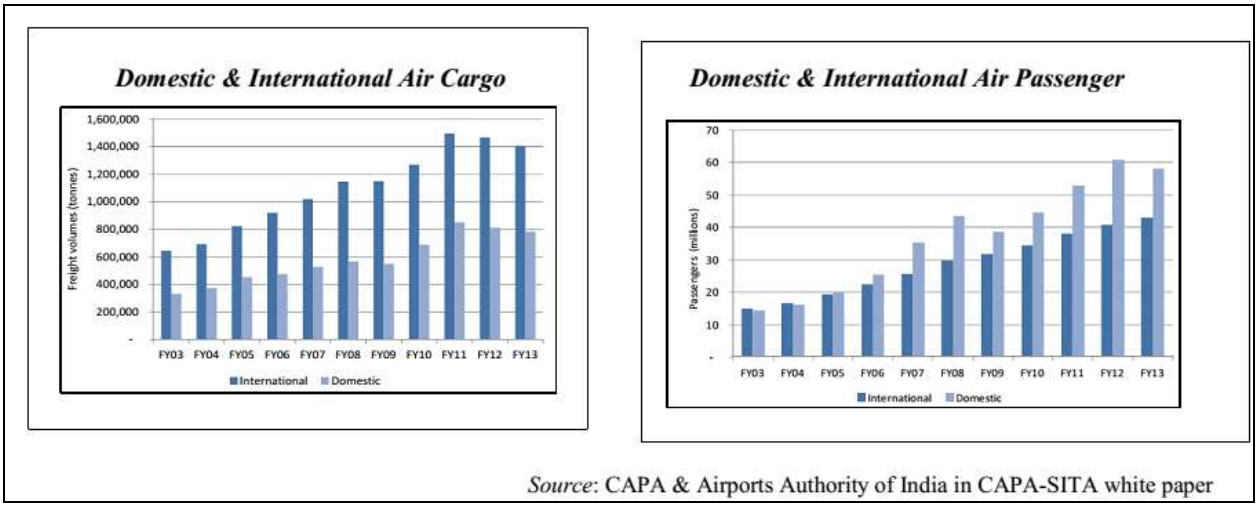

Figure 3

India has seen a transformation of its aviation landscape over the last decade, the sector is now more than three times larger than it was in 2002/03 and we expect traffic to almost triple again over the next decade to approximately 450 million passengers by 2022/23, by which time India will likely be the third largest aviation market in the world behind the USA and China.

2. Literature Review

Measuring and managing services is the major challenge in the management sphere because of its various uniqueness viz. intangibility, heterogeneity, perish ability, inseparability of services and massive human involvement in service delivery process. Delivering superior value and assuring customer satisfaction have had premeditated necessities for entity to survive and prosper (Lewis *et al* 1983; Parasuraman *et al* 1985-a & b; Sureshchandar *et al* 2001; Brady *et al* 2001; Athiyaman, 1997).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 (Trumble, et al 2002).Gronroos,explained 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. Service quality can be regarded as a composite of various attributes. It not only consists of tangible attributes, but also intangible/subjective attributes suchas safety, comfort, which are difficult to measure accurately (Tsaur*et al* 2002).

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. Airlines play key role in aviation industry. Airports which are act as door step to a country, played vital role to country's development. Brueckner & Girvin (2007) argument for airport-level regulation can further strengthened when it is recognized that noise damage varies across airports, mainly due to heterogeneity in local topography and airport heterogeneity raises the possibility to noise limits would be binding at some airports and not with others. According to Rendeiro and Cejas (2005) airport infrastructure is the first and lastpoint of tourists' contact in their holiday destination; thus, it constitutes the mobility axe of tourists. Correia, *et al*, (2008), and Yeh & Kuo, (2003) studied that service quality can be important influence to an airport's competitive advantage. Liou *et al (*2009) addressed how the passenger's perceptions of the airport's level of service have a significant impact on promoting or discouraging future tourism and business activities. Airport has a significant driver of air passengers' satisfaction and loyalty. So evaluating service qualityfor each service point in international airport services has become an important concern for airport management (Kuo and Liang, 2011).

Without considering this vagueness, the decision maker might have come across lot of difficulties in their final output at different level. After Zadeh(1965) proposed fuzzy set theory, and described decision making method in fuzzy environment, large number of intellects and scholars studies with imprecise fuzzy problems by applying this theory. Thus a fuzzy set defined by a function that maps objects in a domain of concern to their membership value in the set. This function is called the membership function (Yen and Langari, 2011).The membership function of a fuzzy set A is denoted as μ_A, and membership value of x in A is denoted as $\mu_{A(x)}$.By keeping in the mind, the study is applying fuzzy theory to measure the subjective judgments of human nature from its respondents. Hence the subjective airport service quality items become objective in quantitative numbers (Mohanty*et al* (2005), Nejati et al (2009), Lai *et al* (2010), Park and Kim, 1990). Defuzzification is a technique to convert the fuzzy number into crisp real numbers, a single representative value that captures the essential meaning of the distribution. There are several methods available to serve this process (Yen and Langari, 2011; Bojadziev and Bojadziev, 1995).

3. Research Gap and Research Question

From the above literature the study confirmed towards the few research gaps such as basically service quality depends upon human attitude. So various dimensions of overall service quality will be differ in respect to settings, time, sectors and medium etc**.**Hence it is

difficult to measure service quality with respect to preceding factors. No study has yet implicitly looked into the various level of service quality on airports in Indian context.
From the above research gaps few research questions can be framed like, what are various structure of airports services that perceived by air passengers. Is there any antecedent to measure airport services for air passengers'?

4. Research Objective
By considering the preceding research questions, the following objective is to be looked into further in this study.

- To **categorize** air passengers' service quality dimensions and its attributes to construct "FliQual" instrument for measuring airline passengers' perceived service quality;
- To **confirm** the identified air passenger perceived service quality variables and factors by developing FliQual measurement models;

5. Methodology
For the above objectives, the study is based on available secondary data some extent and major part is descriptive (Stern et al 2012) and conducted with primary data that were collected. Basic 24 items (with 5- point Likert Scaled) excluding 9- demographic variables (categorical) were considered. More than 280 questionnaires were sent to passengers, returned back 234 (83%).This study has followed purposive (Non- probability) sampling techniques, because the list of population cannot be available and it is also indefinite. Purposive sampling is an approach whereby the researcher selects a non-probability sample they believe is representative of the population as a whole (Zikmund, 1997). The sample were justified according to Hair et al., (2007);Cooper and Schindler (2000)also that means at most for all 24*10=240 should be consider as sufficient condition. The study has used different statistical techniques such as descriptive statistics, EFA and CFA etc. Again it confirmed by using Fuzzy approach with the help of various software package like SPSS-21, AMOS-20 and certainly MATLAB R2013 also. The proposed sample is based upon 95 percent confidence level and 5 percent sampling error.

Particulars ↱ Components↓	**Air passenger (**economy class only)			
Respondents/ Sample	Male (45.32%)-109s		Female (49.3%)-102s	
Sampling Method	Purposive (Non Probability) sampling			
Data collection method	Survey-Primary data			
Research instrument	Structured questionnaire (closed ended) [Variables+ Demographics]			
Instrument reliability	Cronbach's alpha- scaled data (.716)		Cohen's Kappa Coefficient-Categorical data (. 56)	
Instrument validation	Face (measured)	Predictive- (tested)	Content- (tested)	Constructive (tested)
Field of Study	Hyderabad city only (more than 3% of country's air passenger)			
Time period	June, 2014			

Table 2: Research Design at Glance

An Exploratory factor analysis (EFA) was used for data calibration and to explain the pattern of correlations within variables and to find five dimensions in our predictive model. Whereas CFA was then used to confirm the first and second-order dimensionality suggested model by the various literature review, that modified by the results of the exploratory factor analysis.
In EFA, KMO is .679, Chi-Square (514.519), df (105) at 5% significance level of KMO and Bartlett's Test. Here all variables having communalities are above .5 and total cumulative variance explained is 61% with significance correlation. Here the EFA is subjected to Principal Component Analysis and Varimax with Kaiser Normalization rotation. Again rotation converged in 10 iterations.

6. Discussion
From the factor analysis, we found five dimension using 14 variables. Each dimension are having reliability above .73. According to Churchill (1979), only that items loaded on single factor were selected for the final version of the dimension. And in all five factor solutions some items that failed to load on any one of dimension at the 0.4 level or higher and so they were removed. Items were reduced and sub-dimensions were modified for each scale in an iterative process. From the original 24. Again coefficient alphas, item-to-total correlations and normality were calculated for each item.

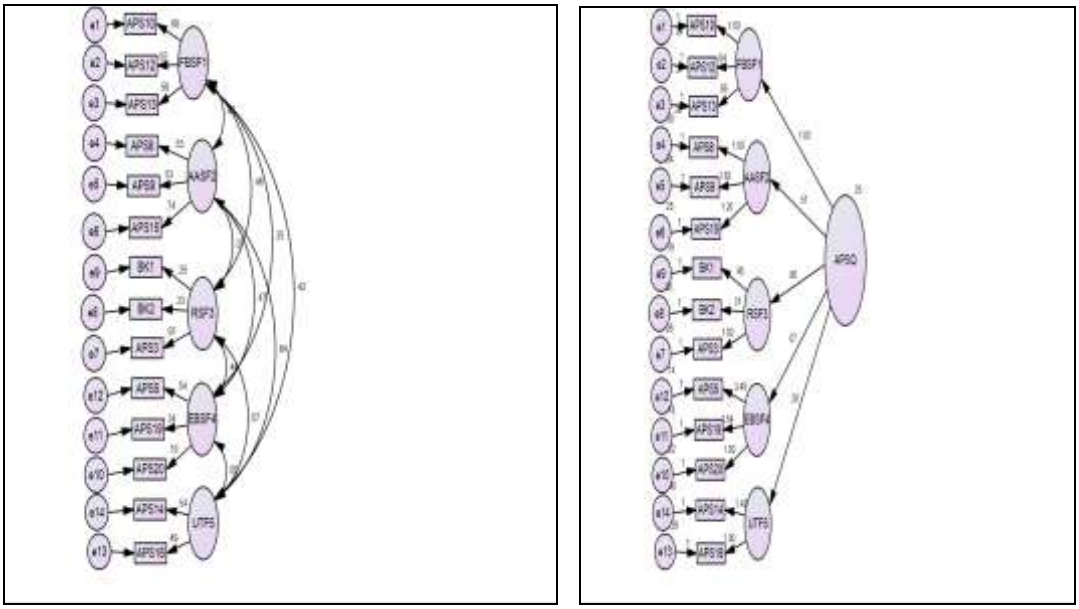

Figure 4 (a) Measurement Model of First Order (b) Measurement Model of second Order

Where normality values and coefficient alpha indicated that further deletion of some variable for further improvement, this was done. Computation of normality and item-to-total correlations and reexamination of the factor structures were repeated again and again. Finally we found five factors like Food and Beverages services (FBSF1), Available and Accessibility services (AASF2), Reservation system (RSF3), Employee Behaviors services (EBSF4) and Updated technology and good ambiance in every services (UTF5) etc. Based on the results of EFA (Exploratory Factor Analysis), the perceived preliminary airport service quality model were revised and specified as second and higher-order factor model (see in Fig 4).

The revised structure of the dimension in EFA was evaluated through a confirmatory factor analysis (CFA) using AMOS 20. The conceptual models from EFA are framed with first order, second order and also third order measurement model. Out of that the second order measurement model shown as final and best fit indices in every fit indicators. Though various fit indices increases and decreases as per the norms of various scholarly articles from first to second order, it was shown same towards the third order model. Hence the study reached for second order measurement model is the best model (Hair. *et al* 2007) for the airport service quality. Again most of the study are done till second order measurement model. The revised and best fit structure of the remaining items was then produced and acceptable fit was found such as $\chi 2/df = 4.68$, GFI=.937, AGFI=.901, CFI=.729, RMSEA=.051, PCLOSE=.440 for the figure 3(b). While fit indices for third order model are $\chi 2/df = 4.98$, GFI=.902, AGFI=.801, CFI=.705, RMSEA=.081, PCLOSE=.340 which is not recommended model by default. Here composite reliability (CR) is .703 that indicates good reliability and as it is above .6 hence it satisfy convergent validity (Hair *et al* 2007). Again in this study, unidimensionality and convergent validity of the scale is achieved as the AGFI is above 0.90, while the root meansquare of approximation (RMSEA) is less than 0.08.Further in the model, maximum shared variance (MSV) .591 and Average shared variance (ASV) .4 are less than Average variance extracted (AVE) .6 respectively for individual dimension wise. So that the model satisfy Discriminant as well as Nomo-logical validity.

Theone lambda value for each dimension and sub-dimension was set at 1.0. An examination of the modification indices (those are less lambda value) suggesting any changes in the model that to further specify the model But due to importance of the objective, it is recommended to delete these items which are less factor loadings or lambda value. Hence the results led us to conclude that the proposed factor structure for airport service quality is supported.

Here the study has converted all the scale point into its fuzzy form by using fuzzy method with the help of software MATLAB and then rank all the five dimensions. Here the Fuzzy Delphi method was adopted to evaluate service level in airport. For this, it has taken seven (three faculties and four scholars) experts, concerning their expertise and interest. The respondents were asked, to give their opinion in triangular format directly from range 0 to 1, in form of (Li, Mi ,Ui), i = 1… 7 and the study assumed $Li < Mi < U_i$. After that, deviations and the average of each deviation were founded and value is R_{ave} = (0.53, 0.76, 0.87).

Linguistic variables in triangular form	
Highly satisfied	(0.8, 0.9, 1.0)
Satisfied	(0.6, 0.8, 0.9)
Neither satisfied nor dissatisfied	(0.4, 0.6, 0.8)
Dissatisfied	(0.2, 0.4, 0.6)
Highly dissatisfied	(0.0, 0.2, 0.4)

Table 3

If the authorities are not satisfied with the average of service qualities level (0.53, 0.76, 0.87) to ascertain, then the deviation will be given to each seven expert/ respondents $R_i$for reconsideration. The respondent will suggest new triangular number Si in the following table 4. In the 2nd iteration, again using the same steps, experts are called to reconsider each factor, and suggested, new triangular number S_i in the following tables. Here final S_{ave} = (0.63, 0.82, 0.92), and deviation is in table-5. After authorities satisfy as R_{ave} and $S_{ave,}$ are very close, fuzzy Delphi process can be stopped. Then, accepts the triangular number Save as combined conclusion & acceptable service quality level is the interval [0.6, 0.9], as the supporting interval of as the supporting interval of the triangular number Save and the most likely level of acceptable service quality is 0.81.

Respondent (S_i)	L_i	M_i	U_i
S1	0.58	0.88	0.90
S2	0.61	0.89	0.93
S3	0.67	0.89	0.94
S4	0.65	0.83	0.97
S5	0.58	0.78	0.98
S6	0.71	0.83	0.99
S7	0.65	0.85	0.99

Table 4: Responses

S_i	S_{ave} - L_i	S_{ave} - M_i	S_{ave} - U_i
S1	0.05	-0.03	0.05
S2	**0.02**	**-0.04**	**0.02**
S3	-0.04	-0.04	0.01
S4	**-0.02**	**0.02**	**-0.02**
S5	0.05	0.07	-0.03
S6	-0.08	0.02	-0.04
S7	-0.02	-0.88	-0.04

Table 5: Deviations

7. Conclusion

The important findings of the study, passengers are more concerned with available and accessibility services then easy reservation and cancellation system and after that good food and beverages should be available with reasonable charge in various airports. So the authorities should be concerned more and more for internal marketing related to available, easy & hassle free solution for any kind of problem if any in airports faced by the passengers, and employees behavior in time etc. The same results were found from the earlier literature (Chen et al 2005, Fodness & Murray, 2007 etc.).Here the study has used with five points Likert scale and linguistic expressions as par, and the survey were in Hyderabad city with limited respondents. Again, this was only for economy class passengers, airport and others before boarding the aircraft. That can be extended further to other cities in India with number scale point and linguistic expression as scope of the study.

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