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Choice between Full-Service Carriers and Low-Cost Carriers – Assessment of Relative importance of Attributes using Analytic Hierarchy Process

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Abstract

US Congress was the first to deregulate and liberalize aviation sector way back in 1978. The concept spread to other countries soon after. This has changed outlook of aviation industry across the world. A by-product of these initiatives is the birth of Low-Cost Carriers (LCCs) pioneered by Southwest airways in USA. With innovative ideas and dynamic business practices, LCCs ushered an era of wider network, high competition, improved efficiencies, and affordable airfares. While the Low-Cost Carriers achieved a major market share across the world, India has the distinction of being among the top.

Studies have been carried out to identify factors which influence the passengers while choosing an air carrier. While numerous articles and research papers are published on this subject across the globe, unfortunately, there is hardly any comprehensive study carried out in Indian context.

To fill this gap, the authors have carried out a Pilot study to identify factors which influence passengers while choosing an air carrier and rank them in the order of importance. Analytic Hierarchy Process (AHP) has been chosen to analyse the data. The hierarchy consists of Goal i.e., choice between Full-Service Carriers & Low-Cost Carriers at level-1, five Dimensions at level-2, and 21 Attributes at level-3. The Pilot study revealed that, Safety Record followed by Brand image, Reliability, Response to Customer complaints, Schedule convenience, and Punctuality are the top five important attributes in that order.

Key Words:
Full-Service Carrier (FSC), Low-Cost Carrier (LCC), Analytic Hierarchy Process (AHP), Pairwise Comparison of alternatives, Eigen Value

1. Introduction

Market competition works as an incentive for organizations to improve performance by stimulating innovation. It facilitates improved services at attractive prices and generates wider choices to the customers.

The civil aviation industry in the past was a case of state sponsored monopoly and hence was riddled with many shortcomings. The countries across the world not only operated their respective flag carriers but also formulated policies concerning entry & exit of air carriers, allocation of routes, fixing airfares etc. This era of state interference burdened the airlines with large manpower base, inefficiency, lack of incentives to improve the performance - all leading to higher airfares affordable by elite class only.

USA was the first to realize the importance and advantages of fair competition and private participation in aviation industry. Through the historic Airline Deregulation Act in 1978, the US congress ushered an era of free market competition and liberalization of the sector (Severin Borenstein 1992). The liberalization and de-regulation policies soon spread not only to Europe but also to other parts of the world. This resulted in two important outcomes – i) entry of private operators in aviation sector, and ii) the emergence of a new business model called "Low-Cost Carriers (LCCs).

Pacific Southwest Airlines was the first to introduce the low-cost concept in US which was later adopted and popularized by Southwest Airlines in 1971. Slowly, it spread across the globe and today the LCCs are among the most sought-after mode of transport in the airline industry (Laura Diaconu, 2012)

India had to wait till early 1990s before introduction of liberalization and de-regulation policies. Air operators like Jet Airways (1992), Air Sahara (1993), Kingfisher Airlines (2005), Modiluft / Royal Airways Ltd (2005) etc started venturing into the Indian aviation market. These airlines adopted the hub-and-spoke model of legacy airlines. Air Deccan was the first Low-Cost carrier in India, and it commenced its operations only during 2003. Subsequently, a number of private operators entered aviation business. While some could sustain, many had to close down the operations.

2. Full-Service Carriers and Low-Cost Carriers

Besides Chartered carriers, civil aviation operators fall under two main categories namely, Full-Service Carriers (FSCs), and Low-Cost Carriers (LCCs).

Full-Service Carriers, as the name indicates, follow the business model where they offer full complement of services to the passengers. These services include number of classes in the cabin configuration, comfortable seating arrangement, adequate leg room, in-flight entertainment, food and beverages on-board, liberal baggage allowances, passenger lounges, frequent flyer programs etc. They follow hub-and-spoke network model by which they consolidate passengers at a major airport (hub) by bringing them from different airports (spokes) and fly them to different destinations (another hub or spokes). The hub-and-spoke network helps them to cover more destinations with lesser resources. The airfares are generally on the higher side as they factor cost of providing all these facilities.

International Civil Aviation Organization (ICAO) has defined Low-Cost Carrier as "an air carrier that has a relatively low-cost structure in comparison with other comparable carriers and offers low fares and rates (ICAO 2009). The Low-Cost Carriers strive to bring down the cost of operations to a bare minimum level so that they can offer airfares lower than their competitors. To achieve this, they follow innovative practices, efficient use of workforce, point-to-point operations, direct sales, single type of fleet, low turn-around time etc. Many services provided by the FSCs are not offered as a standard package. They are unbundled and, In some cases, they are offered on additional payment basis.

The entry of LCC have revolutionized aviation industry. The fleet sizes have increased substantially, more and more destinations have been added to the network, and frequency of operations have increased many folds. All these resulted in increased air traffic, fierce competition, and falling airfares. To cite an example, in the USA, the real cost of providing air transport had come down by more than 60% from 2.20 USD in 1970 to 0.60 USD in 2010 (IATA Vision 2050). Consequentially, the airfares had fallen down from 2.42 USD (1970) to 0.56 USD (2010) (IATA Vision 2050). The myth that the Air travel was for elite class was busted and common man started availing the services.

The emergence of LCCs has stimulated massive changes in the aviation industry (Bamberger & Carlton, 2006; Vidovic, Steiner, & Babic, 2006). LCCs not only caused migration of price sensitive passengers from the Full-Service carriers (Pels, 2008; Gábor, 2010; Westermann, 2012; Sarker et al.,2012) but they also created new breed of flyers especially from other modes of transport – railways in particular.

Across the world, the marker share of LCCs has gone up gradually from 20.3% in 2009 to 31% in 2018 (Source: Statista 2020). Interestingly, during the same period, the market share of LCCs in India had gone up from 30.2% to 69.8% ((Source: Wesley Charnock, Routesonline**,** 30 Apr 2019). As per the DGCA reports, the market share of LCCs has touched 82% in India during the year 2022 with GoAir alone contributing to 58.3% (Amazonaws.com).

Objective:

The objective of this article is to identify factors (attributes) that the passengers are likely to consider while selecting either a Full-Service carrier or a Low-Cost air carrier. The article will also rank these attributes based on their relative importance. For this purpose, 21 attributes were identified from extant literature and inputs from Indian context.

Past literature revealed that airfare is the most important factor while selecting a carrier. This is understandable since the air transport was beyond the reach of ordinary citizens. As inputs from any survey will not throw any further knowledge, this factor is not considered in the present study. Instead, an attempt has been made to carry out sensitive analysis of changes in the airfares

3. Review of Literature

3.1 Excerpts from past literature

Since its debut in 1970s, the topic of LCCs in the airline industry has been the focus of attention and study by many scholars, professionals and analysts alike. The emergence of LCCs has had a multidimensional impact, especially on the economy, the tourism industry, employment and aviation itself (Freiberg and Freiberg, 1998).

The authors have searched internet to find extent and coverage of the research carried out in the past. Reputed on-line platforms like EBSCO, EMBRY RIDDLE, EMERALD, SODHGANGA, RESEARCHGATE etc and Journals like Journal of Air Transport Management, American Journal of Tourism Research, Transportation Research to name a few, were assessed.

More than 2,000 publications could be located pertaining to the aviation industry. Out of this, 128 publications pertain to studies on Full-Service Carriers and/ or Low-Cost Carriers and 61 publications on the subject specific to the article. These 61 publications covered more than 50 attributes by nomenclature. There is a good amount of commonality in these attributes. After removing duplicates, rationalising overlapping attributes, 18 attributes from 36 publications have been shortlisted. A summary of the attributes, and the authors is compiled and the same is placed at Appendix-A. In addition, three more attributes have been added which are specific to the Indian context. These attributes pertain to the initiatives and involvement of Government of India (GOI) in promoting civil aviation

industry in India. The purpose is to ascertain how deep these initiatives have percolated down the passengers' community and what is their impact.

4. Pilot survey:

This article is based on the pilot study carried out to find the relative importance of these 21 attributes. 25 individuals who are knowledgeable on aviation industry have been selected to gather the data through a structured questionnaire. To get more realistic inputs, individuals with different backgrounds have been selected. The questionnaire consists of two parts. Part 1 covers demographic details of the participants and Part 2 questions covering these 21 attributes. Twenty individuals have given their responses.

4.1 Demographic analysis (Part 1)

The demographic details sought included *gender, age, education profile, income, occupation, place of domicile, purpose of last journey, the number of trips undertaken generally in a year, and general choice between FSCs and LCCs*. The data are summarised below:

Demographic Information

S/No.	Characteristics	Percentage
A)	Gender	
	Male	75.0%
	Female	75.0%
B)	Age Profile	
	< 15 years	0.0%
	16 to 34 years	40.0%
	35 to 49 years	20.0%
	50 to 64 years	15.0%
	65 years and above	25.0%
S/No.	Characteristics	Percentage
C)	Education Profile	
	Schooling-Primary	0.0%
	Schooling-Secondary	0.0%
	Graduate	15.0%
	Postgraduate	85.0%
	Ph D	0.0%
D)	Monthly Income (INR)	
	< 10,000/-	5.0%
	10,000 to 19,999/-	5.0%
	20,000 to 49,999/-	25.0%
	50,000 to 99,999/-	40.0%

	100,000 to 119,999/-	20.0%
	≥ 200,000/-	5.0%
E)	Occupation Profile	
	Govt. Sector	20.0%
	Private Sector	35.0%
	Business	20.0%
	Self-employed	15.0%
	Agriculture	0%
	Student	10.0%
F)	Travel Frequency	
	≤ 1	0%7
	2 to 6	95.0%
	7 to 11	0%
	12 to 15	0%
	16 to 20	0%
	> 20	5.0%
G)	Purpose of Journey	
	Official	15.0%
	Business	15.0%
	Education	10.0%
	Leisure	30.0%
	MF&R	30.0%
S/No.	Characteristics	Percentage
H)	Member of FFP	
	Yes	10.0%
	No	90.0%
I)	Domicile Status	
	Bengaluru	85.0%
	Other parts of Karnataka	5.0%
	Outside Karnataka	10.0%
J)	General Choice	
	FSC	55.0%
	LCC	45.0%

The above data is presented graphically in exhibits 1 to 10 placed at Appendix-B.

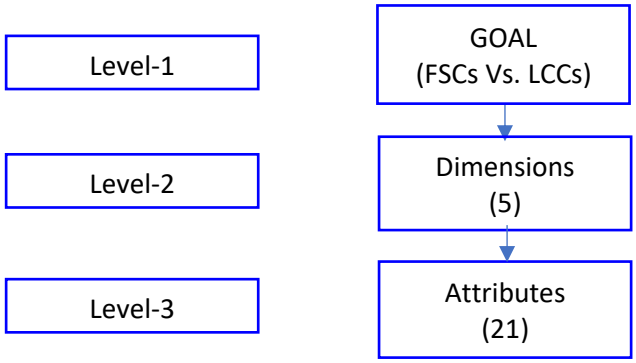
5 Questionnaire pertaining to Attributes (Part 2)

For data analysis, Analytic Hierarchy Process (AHP) has been chosen in this study. AHP is a structured technique of modelling the decision involving multiple variables. It consists of an overall goal, a group of options or dimensions for reaching the goal, and a group of factors or attributes that define the group of dimensions. (Meltingpointathens.com).

To reduce the complexity associated with bigger problems, AHP allows to split the main problem (goal) into smaller components arranged in a hierarchical order. Another uniqueness feature of AHP is that it prescribes pairwise comparison of alternatives chosen for analysis. This pairwise comparison allows for more focussed attention while choosing the preferred choice from each pair of alternatives.

5.1 Analytic Hierarchy Process

The 21 attributes shortlisted for study and analysis were grouped under five dimensions and three-level hierarchy has been constructed as shown in the schematic diagram given below:



A detailed Graphical view of the structure is shown at exhibit 11 in Appendix-B

The Part 2 of the questionnaire was structured to facilitate pairwise comparison of five dimensions at Level 2 with reference to the achievement of goal at level 1. Similarly, the structure facilitates pairwise comparison of the attributes (at level 3) within each dimension (at Level 2).

The participants were asked to identify their preferred choice from each of the pair of alternative dimensions with respect to meeting the goal (at level 1). Similarly, the participants were asked to identify their preferred choice from each of the pair of alternative attributes with respect to their contribution toward the dimension (at level 2). The relative importance of alternatives (dimensions / attributes) in each pair is measured numerically using ratio scale from 1 to 9 defined by R. W. Saaty (1987). The value indicates the relative strength i.e., how many times the selected alternative is preferred over the other one in the pair. A value of one (1) means that both the alternatives are of equal importance. The largest value nine (9) indicates extreme importance for the preferred alternative. Other values have significance as defined in Saaty scale (1987).

For the dimensions (level 2), the pair-wise comparison data is captured in a square matrix called pair-wise comparison matrix for dimensions. Similarly, for the attributes (level 3), a number of pair-wise comparison matrices are generated called pair-wise comparison matrices for attributes.

5.2 Analysis of pair-wise comparison matrices

The analysis includes tests for normality, reliability / consistency of data, generation of eigen matrix, eigen values, and local & global scores of the attributes.

5.2.1 Test for normality

Kolmogorov Smirnov Statistic (KS) test is used to ascertain if a sample comes from a population with a completely specified continuous distribution (Zvi Drezner, Ofir Turel, & Dawit Zerom

(2010). In the current analysis, KS test is used to check the normality condition of the distribution of pairwise responses. When the distribution is skewed, it points to a strong preference in favour of one of the alternatives in each pair. No such conclusions can be drawn when the distribution is normal. In this study, the sample size is 20. and accordingly, for Normality, the Critical Value "D" should be less than 0.265 at $\alpha = 0.05$ (two-tailed test) (Frank J. Massey, Jr, 1951)

5.2.2 Test for Reliability

Cronbach's alpha describes the extent to which all the items in a test measure the same concept or construct (Mohsen Tavakol, Reg Dennick, 2011). It is a way of assessing reliability by comparing the amount of shared variance, or covariance, among the variables in the questionnaire to the amount of total variance. The idea is that if the instrument is reliable, there should be a great deal of covariance among the items relative to the variance (L M Collins, 2007). It is expressed as a numerical value between 0 and 1; higher the value, better will be the consistency. Generally, for reliability, the value should be more than 0.7 while the data is questionable when the value lies between 0.6 and 0.7 (Stephanie Glen).

5.2.3 Eigen Vector and Eigen Values

Eigen vector of a square matrix A is a vector, denoted by X, such that when X is multiplied with matrix A, then the direction of the resultant matrix remains same as vector X. Mathematically, above statement is represented as (Erwin Kreyszig. 2011):

$AX = \lambda X$

where, A is any given matrix, λ is eigen value and X is an eigen vector corresponding to the eigen value. In general, there would be a number of eigen values and hence a series of eigen vectors. The one with the highest eigen (positive) value is of interest in the AHP analysis.

The calculation of the exact eigen vector and principal (maximum) eigen value involves elaborate mathematical calculations. However, for practical purposes, this can be exempted, and a simplified process can be adopted (Kostlan, 1991). In this study, the simplified method is used to calculate approximate eigen vector and maximum eigen value.

The elements in Eigen vector represent critical values and have a direct physical significance in AHP. They indicate the contribution / participation of that entity in the achievement of its respective parent (goal described at level 1 / dimensions at level 2).

5.2.4 Data consistency

In AHP, the data consistency is ascertained using two parameters namely, Consistency Index (CI) and Random Consistency Index (RI). CI is calculated using the critical values from the Eigen vector and the values for RI are adopted from the table created by R. W. Saaty (1987). The ratio of CI to RI indicates the extent of consistency in the responses. The data is considered consistent when the CI/CR ratio is less than 0.10 (R. W. Saaty, 1987).

5.3 Pairwise comparison matrix for Dimensions (Level 2)

The goal or objective at level 1 is to find the preference of air passengers between Full-Service Carriers and Low-Cost Carriers. This is ascertained based on pairwise comparison of five dimensions namely, A) *Corporate Initiatives*; B) *Pre-flight Experience*; C) *Staff Interaction*; D) *Flight Experience*; and E) *Government Initiatives*. Pairwise comparison of these dimensions translates into comparison of 10 pairs of alternatives. The pair-wise comparison data for these five dimensions is captured in a square matrix called pair-wise comparison matrix for dimensions.

5.3.1 Kolmogorov Smirnov Statistic (KS) test

It is revealed that, out of 10 pairs only three pairs exhibit near normal distribution. The skewed distribution of balance seven pairs indicates that the preferences are strong in favour of one of the alternative dimensions.

5.3.2 Cronbach's alpha (α)

Cronbach's alpha for the pairwise comparison matrix is found to be 0.836. This suggests that the reliability, or internal consistency of these five dimensions is very high and that they together are fairly adequate in achieving the goal at level 1.

5.3.3 Analysis of pair-wise comparison matrix

From the pair-wise comparison matrix for dimensions, eigen vector has been generated. Critical values in the eigen vector and their relative importance in terms of ranks are summarized in Table 1 given below:

Table 1

EIGEN VECTOR VALUES FOR DIMENSIONS (LEVEL 2)

Dimension	Critical values from Eigen vector	Critical values (in %)	Rank
(A) Corporate Initiatives	0.3344	33.44%	1
(B) Pre-Flight. Experience	0.2317	23.17%	2
(C) Staff Interaction	0.1939	19.39%	3
(D) Flight Experience	0.1383	13.83%	4
(E) Government Initiatives	0.1017	10.17%	5
	1.0000	100.00%	

5.3.4 Important derivatives and Data consistency

From the pair-wise comparison matrix for dimensions, important derivatives as required in AHP analysis have been calculated and the same are summarized in Table 2 given below:

Table 2

Important derivatives for Dimensions (Level 2)

Description		Value
Highest Eigen Value, $\lambda_{max.}$	:	5.4100 (approx..)
Consistency Index (CI)	:	0.1025
Random Consistency Index (RI) for m = 5	:	1.1200 (R. W. Saaty, 1987)
CI/RI ratio	:	0.0915
Conclusion	:	Data is consistent

The CI/RI ratio is less than 0.10 and hence the responses from the survey can be considered as consistent.

A graphical representation of the Table 3 is shown at exhibit 12 in Appendix-B

5.3.5 Discussion

Table 1 and chart 1 highlight the relative importance of the dimensions. It shows that *Corporate Initiatives* with a critical score of 33.44% is the most important dimension in achieving the goal followed by *Pre-Flight Experience* (23.17%), *Staff Interaction* (19.39%), *Flight Experience* (13.83%), and *Government Initiatives* (10.17%), in that order.

5.3.6 Observations and Suggestions

From the survey results, the following are highlighted:

a) To attract and to retain the customers, the Corporate Management should proactive and implement policy initiatives like creation of a good *Brand Image*, maintaining high *Safety Record*, ensuring *Reliability* in operations, reaching out to customers through well directed *Promotion & Advertisements*, and implementing *Frequent Flyer Program (FFP*). It is also important that these initiatives are sustained in the marketplace.

b) Very close to *Corporate Initiatives*, *Pre-Flight Experience* takes the position of the second most desired dimension. *Pre-flight Experience* covers the phase starting from the moment an individual decides to travel by air till he boards the flight. While booking the ticket, the passenger looks for choices in terms of number of flights being operated between the boarding and destination airports. The passenger also looks whether the schedule (timings) is convenient or not. The passenger is also obsessed with refund policies of the airline should he miss the flight for genuine reasons. The passenger is also concerned with safe handling of the baggage and their arrival in sound condition at the destination without delays and damages. To meet these requirements, the airline management should offer frequent flights and convenient times along with favourable refund policies in genuine cases. The management should also put in place a sound, and fool-proof system for baggage handling.

c) The third important dimension is *Staff interaction*. Staff are the face of the air-carrier and the passengers derive the feeling of happiness and sense of delight when they encounter staff who are very pleasant, friendly, hospitable, knowledgeable, and helpful. The empathy shown by them, the genuine concern for the problems faced by the passengers and their efforts to resolve them go a long way in gaining the goodwill. The airline management should pay special attention to these issues.

d) The next important dimension is *Flight experience*. The passengers look forward for a comfortable flight in good environment and treated well during the journey. The passengers expect that the seats are spacious and comfortable with adequate leg room. Cleanliness is very important, and the proper environmental conditions make passengers happy. On-board services like food and beverages is a welcome gesture and on-board entertainment will make the journey memorable for the passengers. The cabin crew should be efficient, friendly, approachable, and should be ready to meet the requirements of the passengers. The Corporate management should ensure that these requirements are met to the satisfaction of the passengers.

e) *Government initiatives* takes the position of the least important dimension. The tax structure on aviation fuel, spare parts etc and they do impact the airfares, but the passengers could be ignorant of their impact and implications. Similarly, general passengers may not be knowledgeable regarding de-regulation policies even though they are enjoying its fruits. One possible reason could be that these policies effect both FSCs and LCCs equally and hence the passengers do not give much importance to them The recent initiatives of the Government of India (GOI) to popularise aviation sector through UDAN schemes and regional connectivity plans seem to have very little impact in the selection the air carriers at the moment.. The other reason could be that these schemes are either not popular, or their existence and their advantages have not percolated down to the grass-root levels. GOI should enhance efforts to make these schemes visible to the public and popularise them by bringing out their attractive features to the knowledge of common man.

6 Analysis for Level 3

At level 3, important attributes through which these dimensions are realized are defined. Total 21 attributes have been identified and grouped into the five dimensions. The survey carried out also includes pair-wise comparison of these attributes under each dimension. From pair-wise, dimension wise comparisons, separate matrices have been created and their corresponding Eigen vectors giving critical weights for each attribute have been computed. The critical weights calculated under each dimension indicate the contribution of the attribute in supporting the parent dimension.

The data analysis for the attributes is similar to the one explained at para 5.2 for dimensions. This includes Kolmogorov Smirnov Statistic (KS) test for normality, Cronbach's alpha for reliability, generation of eigen vectors, eigen values, consistency checks, and relative importance of the attributes.

The analysis at this level gives local weights for fulfilling the corresponding dimensions. Global weights are computed by multiplying the local weights with the weights of corresponding dimension. The global weights indicate the importance of the attribute in achieving the ultimate goal as defined at level 1. These global weights are ranked based on their values. The ranking shows the relative importance of each attribute.

6.1 Pairwise Comparison Matrix for Dimension – *Corporate Initiatives*

The dimension *Corporate Initiatives* has been defined using five attributes namely, A1) *Brand image*, A2) *Safety record*, A3) *Reliability*, A4) *Promotion & advertising*, and A5) *Frequent flyer program*. Pair-wise comparison of these five attributes translates into comparison of ten pairs of alternatives and the same is captured in a square matrix.

6.1.1 Kolmogorov Smirnov Statistic (KS) test

It is revealed that, out of 10 pairs, five pairs exhibit near normal distribution. The actual distribution is skewed in respect of balance ten pairs. This does not indicates that the participants have a strong preference towards one of the attributes in each pair.

6.1.2 Cronbach's alpha

Cronbach's alpha for the pairwise comparison matrix is found to be 0.749. This shows that the reliability, or internal consistency of these five attributes is very high and that they together define the Dimension Corporate initiatives fully.

6.1.3 Analysis of pair-wise comparison matrix

From the pair-wise comparison matrix, eigen vector has been generated, Critical values from the eigen vector and their relative ranking are given in Table 3.

Table 3

EIGEN VECTOR VALUES FOR DIMENSIION - CORPORATE INITIATIVES

Determinant	Eigen vector values	Eigen vector values (in %)	Rank
A1) Brand Image	0.2487	24.87%	2
A2) Safety Record	0.3652	36.52%	1
A3) Reliability	0.2445	24.45%	3
A4) Promotion & Advertising	0.0633	6.33%	5

A5) Frequent Flyer Program	0.0782	7.82%	4
	1.0000	100.00%	

6.1.4 Important derivatives and Data consistency

From pair-wise comparison matrix, important derivatives as required in AHP analysis have been calculated and the same are summarised in table 4 given below:

Table 4

Important Derivatives

Description		Value
Maximum Eigen Value, $\lambda_{max.}$	:	5.5424 (approx..)
Consistency Index (CI)	:	0.1356
Random Consistency Index (RI) for m = 5	:	1.1200 (R. W. Saaty, 1987)
CI/RI ratio	:	0.1211
Conclusion	:	Data not consistent

The CI/RI ratio is marginally more than 0.1000 (i.e., 10%), and there appears minor inconsistency in the data collected, and the pair-wise matrix generated. This could be due to smaller size of the sample and is likely to improve when the sample size is more. A graphical representation of the values in Eigen vector is shown at exhibit 13 in Appendix-B

.6.1.5 Discussion

In this case, among the 6 attributes, *Safety Record* with a critical score of 36.46% has the highest influence on *Corporate Initiatives* followed by *Reliability* (25.09%), *Brand Image* (16.60%), *Promotion & Advertising* (5.83%), and *Frequent Flyer Program* (5.81%).

6.2 Pairwise Comparison for Dimension – *Pre-flight Experience*

The dimension *Pre-flight Experience* includes four attributes namely, B1) *Origin-destination (O-D) pair/ frequency*, B2) *Schedule convenience*, B3) *Booking convenience and Ticket flexibility*, and B4) *Check-in / baggage handling*. Pair-wise comparison of these four attributes translates to comparison of six pairs and the same is captured in a square matrix.

6.2.1 Kolmogorov Smirnov Statistic (KS) test KS test for normality of the distribution of pairwise responses reveals that out of six pairs, three pairs exhibit near normal distribution. The balance three pairs exhibit the skewness in distribution. This indicates that the participants do not exhibit a strong preference towards any one of the attributes in each pair.

6.2.2 Cronbach's alpha

Cronbach's alpha for the pairwise comparison matrix is found to be 0.763. Thus, the reliability, or internal consistency of these four attributes is high and they together define the dimension Pre-flight experience (parent) fairly well.

6.2.3 Analysis of pair-wise comparison matrix

From the pair-wise comparison matrix, eigen vector has been generated. The critical values from the eigen vector and their ranking are given in Table 5 given below:

Table 5

EIGEN VECTOR VALUES FOR DIMENSION - PRE-FLIGHT EXPERIENCE

Determinant	Eigen vector	Eigen vector (in %)	Rank
B1) Origin-Destination pair & Frequency	0.3001	30.01%	2
B2) Schedule Convenience	0.3198	31.98%	1
B3) Booking Convenience and Ticket Flexibility	0.2571	25.71%	3
B4) Check-in / Baggage Handling	0.1230	12.30%	4
	1.0000	100.00%	

6.2.4 Important derivatives and Data consistency

From Table 5, important derivatives as required in AHP analysis have been calculated and the same are summarized in table 6 given below:

Table 6

Important derivatives

Description		Value
Maximum Eigen Value, $\lambda_{max.}$	:	4.0835 (approx..)
Consistency Index (CI)	:	0.0278
Random Consistency Index (RI) for m = 4	:	0.9000 (R. W. Saaty, 1987)
CI/RI ratio	:	0.0309
Conclusion	:	Data are consistent

The above table shows that the responses from the survey can be considered as consistent as the CI-CR ratio is less than 10%.

Graphical representation of the date from Table 5 is shown at exhibit 14 in Appendix-B.

6.2.5 Discussion

In this case, among the four attributes, *Schedule Convenience* with a critical score of 31.98% has the highest influence in *Pre-Flight Experience* dimension (parent) followed by), (30.81%), *Origin-Destination pair & Frequency* (30.01%), *Booking Convenience / Ticket Flexibility* (25.71%), and *Check-in/ Baggage Handling* (12.30%)

6.3 Pairwise Comparison for Dimension – *Staff Interaction*

The dimension *Staff interaction* has four attributes namely, C1) *Response to customer complaints*; C2) *Assurance*; C3) *Courtesy of staff*; and C4) *Flight information / announcement*. Pair-wise comparison of these four attributes translates to six pairs of comparisons and the same are captured in a square matrix.

6.3.1 Kolmogorov Smirnov Statistic (KS) test

KS test for normality of the distribution of pairwise responses reveals that out of six pairs, three pairs correspond to near normal distribution. The balance three pairs exhibit the skewness either

to the right or to the left side of the distribution. This indicates that the participants do not exhibit a strong preference towards one of the attributes in each pair.

6.3.2 Cronbach's alpha

Cronbach's alpha for the pairwise comparison matrix is found to be 0.680. Thus, the reliability, or internal consistency of these four attributes is moderate and they together define the Staff interaction reasonably well.

6.3.3 Analysis of pair-wise comparison matrix

From the pair-wise comparison matrix, Eigen vector has been generated. Critical values from eigen vector and their ranking are shown in the Table 7 given below:

Table 7

EIGEN VECTOR FOR DIMENSION - STAFF INTERACTION

Dimension	Critical values from Eigen vector	Eigen vector (in %)	Rank
C1) Response to Customer complaints	0.4168	41.68%	1
C2) Assurance	0.2562	25.62%	2
C3) Courtesy of staff	0.2029	20.29%	3
C4) Flt information / announcement	0.1242	12.42%	4
	1.0000	100.00%	

6.3.4 Important derivatives and Data consistency

From pair-wise comparison matrix, important derivatives as required in AHP analysis have been calculated and the same are summarised in the Table 8 given below:

Table 8

Important derivatives

Description		Value
Maximum Eigen Value, $\lambda_{max.}$	:	4.1160 (approx..)
Consistency Index (CI)	:	0.0387
Random Consistency Index (RI) for m = 4	:	0.9000 (R. W. Saaty, 1987)
CI/RI ratio	:	0.0680
Conclusion	:	Data are consistent

The above table shows that the responses from the survey are consistent as the CI-CR ratio is less than 10%.

Graphical representation of the date from Table 7 is shown at exhibit 15 in Appendix-B.

6.3.5 Discussion

Among the four attributes, *Response to customer complaints* with a critical score of 41.68% has the highest impact on *Staff Interaction* dimension followed by *Assurance* (25.62%), *Courtesy of staff* (20.29%), and *Flight information / announcement* (12.42%)

6.4 Pairwise Comparison for Dimension – *Flight Experience*

The dimension *Flight Experience* has five attributes namely, D1) *Punctuality*; D2) *Inflight Service*; D3) *Inflight Entertainment*; D4) *Facilities*; and D5) *Comfort*. Pairwise comparison of the five attributes translates to ten pair-wise comparisons and the same have been captured into a square matrix.

6.4.1 Kolmogorov Smirnov Statistic (KS) test

KS test for normality of the distribution of pairwise responses reveals that out of ten pairs, five pairs exhibit near normal distribution. Balance five pairs exhibit the skewness. This indicates that the responses are not strong in favour of alternatives attributes i.e., the participants have divergent priorities.

5.4.2 Cronbach's alpha

Cronbach's alpha for the pairwise comparison matrix is found to be 0.693 which is marginally less than threshold value of 0.70. Hence, the reliability, or internal consistency of these attributes can be considered as reasonable high.

6.4.3 Analysis of pair-wise comparison matrix

From the pair-wise comparison matrix, Eigen vector has been generated. The critical values from the eigen vector and their rankings are given in Table 9.

Table 9

EIGEN VECTOR FOR DIMENSION – FLIGHT EXPERIENCE

Determinant	Eigen vector	Eigen vector (in %)	Rank
D1) Punctuality	0.5052	50.52%	1
D2) In-flight Service	0.1640	16.40%	2
D3) In-flight Entertainment	0.0771	7.71%	5
D4) Facilities	0.0956	9.56%	4
D5) Comfort	0.1582	15.82%	3
	1.0000	100.00%	

6.4.4 From pair-wise comparison matrix, important derivatives as required in AHP analysis have been calculated and the same are summarised in the table 10 given below:

Table 10

Important derivatives

Description		Value
Maximum Eigen Value, $\lambda_{max.}$	:	5.2480 (approx..)
Consistency Index (CI)	:	0.0620
Random Consistency Index (RI) for m = 5	:	1.1200 (R. W. Saaty, 1987)
CI/RI ratio	:	0.0554
Conclusion	:	Data are consistent

The above table shows that the responses from the survey are consistent as the CI-CR ratio is less than 10%.

Graphical representation of the date from Table 9 is shown at exhibit 16 in Appendix-B

6.4.5 Discussion

In this case, among the five attributes, *Punctuality* with a critical score of 50.52% is the dominant attribute contributing to the *Flight experience* dimension followed by *Inflight service* (16.40%), *Comfort* (15.82%), *Facilities* (9.56%, and *Inflight entertainment* (7.71%).

6.5 Pairwise Comparison for Dimension – *Government Initiatives*

The dimension *Government initiatives* has been identified using three attributes namely, E1) *UDAN scheme*; E2) *De-regulation policies*; and E3) *Tariff structure*. Pair-wise comparison of

these three attributes translates to three pair-wise comparisons and the same are captured into a square matrix.

6.5.1 Kolmogorov Smirnov Statistic (KS) test

KS test for normality of the distribution of pairwise responses shows that only one of them exhibit normal distribution. This indicates that the participants exhibit a strong preference towards one of the attributes in each pair.

6.5.2 Cronbach's alpha

Cronbach's alpha for the pairwise comparison matrix is found to be 0.636. Hence, the reliability, or internal consistency of these attributes is moderate.

6.5.3 Analysis of pair-wise comparison matrix

From the pair-wise comparison matrix, Eigen vector has been generated. The critical values from the eigen vector and their rankings are shown in Table 11.

Table 11

EIGEN VECTOR FOR DIMENSION - GOVERNMENT INITIATIVES

Determinant	Critical Values from Eigen vector	Critical Values from Eigen vector (in %)	Rank
E1) UDAN Scheme	0.5447	54.47%	1
E2) De-regulation Policies	0.2554	25.54%	2
E3) Tariff Structure	0.1998	19.98%	3
	1.0000	100.00%	

6.5.4 From the pair-wise comparison matrix, important derivatives as required in AHP analysis have been calculated and the same are summarized in table 12 given below:

Table 12

Important derivatives

Description		Value
Maximum Eigen Value, $\lambda_{max.}$	:	3.1244 (approx..)
Consistency Index (CI)	:	0.0622
Random Consistency Index (RI) for m = 3	:	0.5800 (R. W. Saaty, 1987)
CI/RI ratio	:	0.1072
Conclusion	:	Data not consistent

Here again, the CI-CR ratio is marginally more than 10% indicating that there is marginal inconsistency in the data. The position is likely to improve when the sample size is large

Graphical representation of the date from Table 11 is shown at exhibit 17 in Appendix-B.

6.5.5 Discussion

Among the three attributes, *UDAN scheme* with a critical score of 54.47% has the highest influence on *Government Initiatives* dimension followed by *Deregulation Policies* (25.54%), and *Tariff Structure* (19.98%).

7. Global Scores

7.1 Global scores for the attributes have been calculated taking the individual local scores of the attributes and the critical scores of the dimension under which they are defined. A summary of the global scores of top 10 attributes is tabulated in Table 13 given below:

Table 13
Local and Global Scores of top 10 Attributes

Attribute	Local		Global	
	Score	Rank-Local	Score	Rank-Global
A2) Safety Record	0.3652	1	0.1221	1
A1) Brand Image	0.2487	2	0.0832	2
A3) Reliability	0.2445	3	0.0818	3
C1) Response to Customer Complaints	0.4168	1	0.0808	4
B2) Schedule Convenience	0.3198	1	0.0741	5
D1) Punctuality	0.5052	1	0.0699	6
B1) Origin-Destination pair & Frequency	0.3001	2	0.0695	7
B3) Booking Convenience / Flexibility	0.2571	3	0.0596	8
E1) UDAN Scheme	0.5447	1	0.0554	9
C2) Assurance	0.2562	2	0.0497	10

The above data covering top 10 attributes is presented graphically at exhibit 18 in Appendix-B

7.2 <u>Observations / Recommendations.</u>

The Table 12 and its graphical presentation highlight the following:

- Top ten attributes together account for around 75% of the total score and top fifteen 90% of the total score; the remaining six attributes account for only 10%. Hence, the air carrier management should ensure that maximum efforts are devoted to address the top 10 attributes.
- *Safety record* is found to be the most influential attribute with a global score of 12.21%. This shows that passengers are conscious of the importance of *safety record* of the airline and that they tend to choose an air carrier which has the best record on this attribute. This finding should help the airline management to pay more attention to this attribute and instil confidence in the minds of the passengers that they are in safe hands. This can be achieved by ensuring highest safety record, dissemination of safety measures implemented and statistical data to prove their claim
- *Brand image* with a global score of 8.32% is the next most important attribute. It is obvious that passengers prefer an air carrier which has a high reputation and strong brand image in the market. They get the psychological feeling that the air carrier will take care of all their needs, both the stated and the latent ones.
- The next most important attribute is *Reliability* with a global score of 8.18%. While high performance is welcome, it should not be a one-time affair. Passengers expect such high performance consistently, each time and every time.
- *Response to Customer complaints* is the next most important attribute with a global score of 8.08%. Passengers tend to move away from an airline if they find that their grievances and complaints are not resolved in reasonable time and the best of their satisfaction. The

management should activate an effective customer complaints resolution cell and make its vibrant and efficient.

- *Schedule convenience* with a global score of 7.41% is the next most important attribute in the selection process. It is natural that the passengers want the schedules to meet their convenience. As an example, passengers may like to depart during morning hours and return back during evening/ night. This facilitates adequate time to carry out business as well as to be with the family. Very early morning or very late-night flights are generally not the favourite choices.
- *Punctuality / on-time performance* with a global score of 6.99% is the next important attribute. Its importance is understandable as delays/ cancellations cause inconvenience to the passengers. It affects more to business travellers as time is important to them and they would not like to encounter missed opportunities and disturbed plans.
- *Origin-destination pair and frequency* with a global score of 6.95% is the next most important attribute as the passengers want the air carriers to fly them to each and every location they want to travel and that too during times most convenient to them. This may not be practical to meet this demand in full, but airlines should carry out adequate market survey to identify the routes that are in high demand and optimize their frequencies
- *Booking convenience and Ticket Flexibility* with a global score of 5.96% is the next important attribute. Passengers want that they can book the air tickets in the comforts of home and with flexibility to change the plans to meet any unforeseen exigencies.
- *UDAN scheme* launched by the Government of India to promote the aviation industry and to make it affordable to common man comes next in the priority list with a global score of 5.54%. It is encouraging to note that the scheme has an impact on the passenger community. This shows that the respondents have become knowledgeable about the *UDAN scheme* and probably have enjoyed its benefits. However, much more is expected and the Government should continue to expand the scope of the scheme by covering more and more destinations under the scheme and commissioning more and more airports especially in remote locations.
- *Assurance* with a global score of 4.97% occupies the tenth position. Assurance brings confidence in the minds of the passengers. They will have confidence that their issues and grievances will be resolved in reasonable time.

The balance attributes in the order of their preference are: Courtesy of staff, Check-in / Baggage Handling, Frequent Flyer Program, De-regulation Policies, Flight announcement, In-flight Service, Comfort, Promotion & Advertising, Tariff Structure, Facilities, In-flight Entertainment. While concentrating the top ten attributes, the management should not neglect these attributes altogether as they have the potential to become a dominating factor. It is true that the *De-regulation Policies*, and *Tariff structure* on ATF and spare parts are not under the control of the airlines. The best they can do is to apprise the government on the need to rationalize the tariff rates and to continue privatisation policies which will promote a win-win situation for the entire aviation eco system.

7.3 Price sensitivity analysis

Since Airfare is not included in this study, price sensitivity has been included instead. Towards this, the participants were asked to indicate their choice under the current scenario and when FSCs or LCCs chose to tweak the airfares charged by them. Four hypothetical cases were presented to the participants for this purpose as described below:

(i) When FSCs alone bring down the fares by 10%

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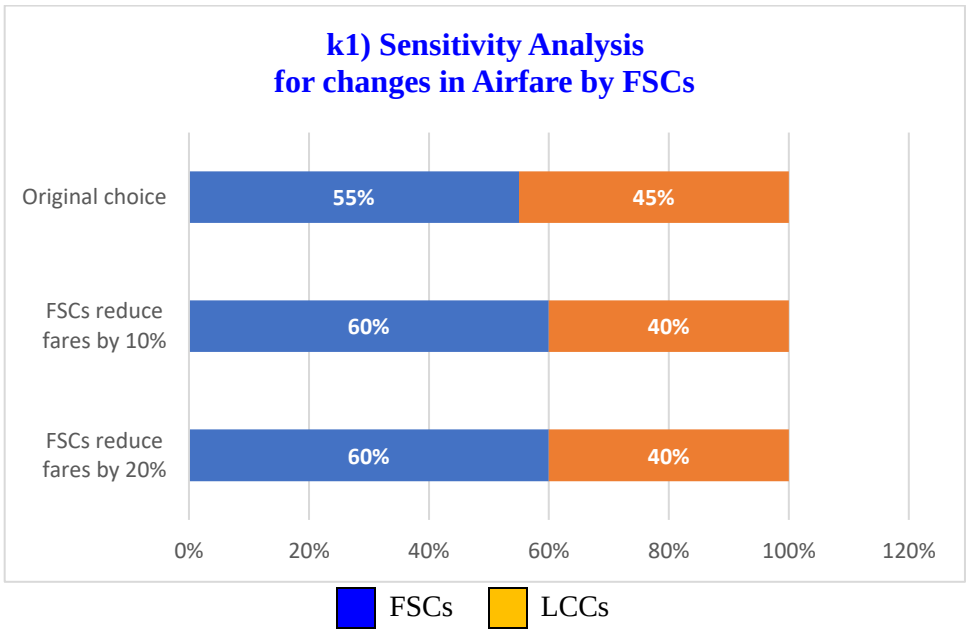
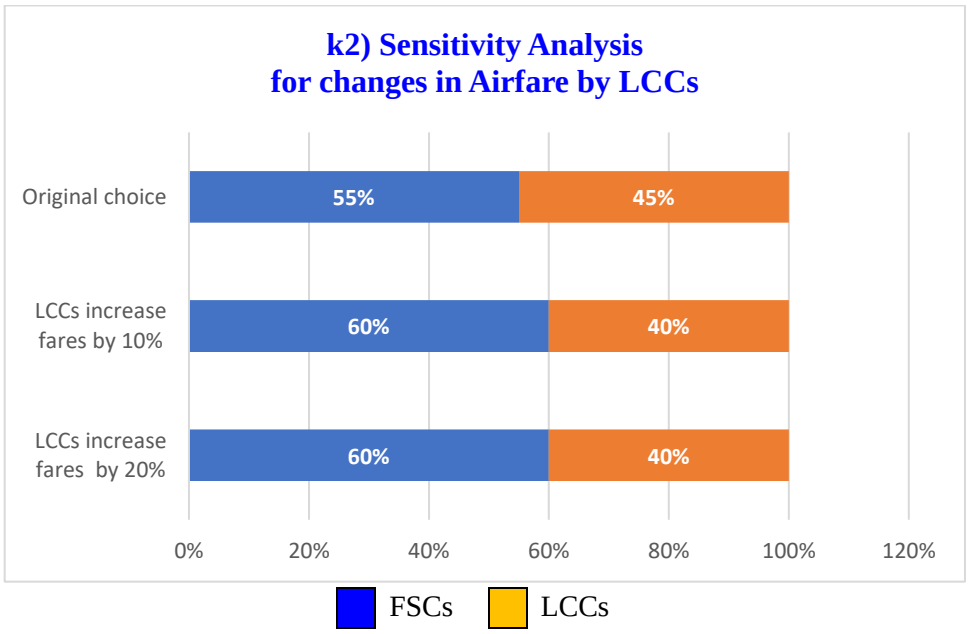
(ii) When FSCs alone bring down the fares by 20%
(iii) When LCCs alone increase the fares by 10%
(iv) When LCCs alone increase the fares by 20%

The analysis of the responses reveals the trends shown in the following exhibits:



Sensitivity Analysis for changes in Airfare by FSCs



Sensitivity Analysis for changes in Airfare by LCCs

In the original choice, 55% of the respondents have shown preference to FSCs and 45% to LCCs. In the hypothetical case where the FSCs reduce the airfares by 10%, 60% of participants have shown preference to FSCs and 40% to LCCs. It means that there is a migration to the tune of 5% from LCCs to FSCs. However, there is no further change in the preferences when the FSCs reduce the airfares by further 10% i.e., total 20%,

Similarly, in the hypothetical case where the LCCs decide to increase the fares by 10%, 60% of respondents have shown preference to FSCs and 40% for LCCs. This means that there is a migration from LCCs to FSCs is to the extent of 5%. However, when the LCCs increase the fares by further 10% i.e., total 20%. there is no further change in the preference pattern.

This shows that, FSCs gain when they decrease the airfares by 10% or LCCs increase the airfares by 10%. The preferences remain stable thereafter even when the FSCs reduce the airfares further or LCCs increase the airfares further.

8. Limitations

This is a pilot study with limited number of participants and hence the findings may not be applicable to the population at large. Further, the participants chosen are mostly from the city of Bengaluru and its adjoining areas. So, from this angle, the outcomes of the study may not be applicable pan India. To make the study holistic and universal, there is a need to include participants from all corners of the country.

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Graphical abstracts for article "**Choice between Full-Service Carriers and Low-Cost Carriers – Assessment of Relative importance of Attributes using Analytic Hierarchy Process**"

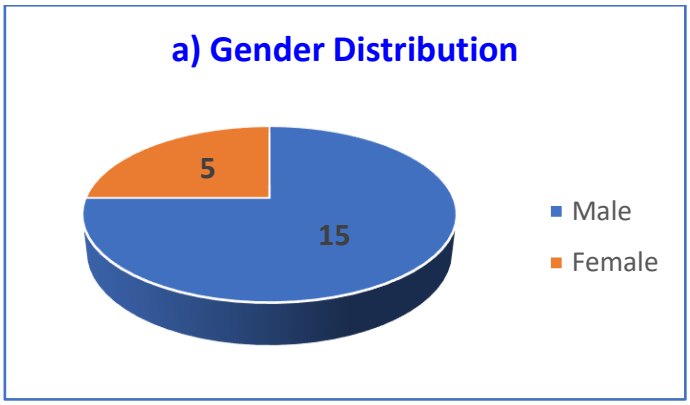

Exhibit 1: Gender Distribution

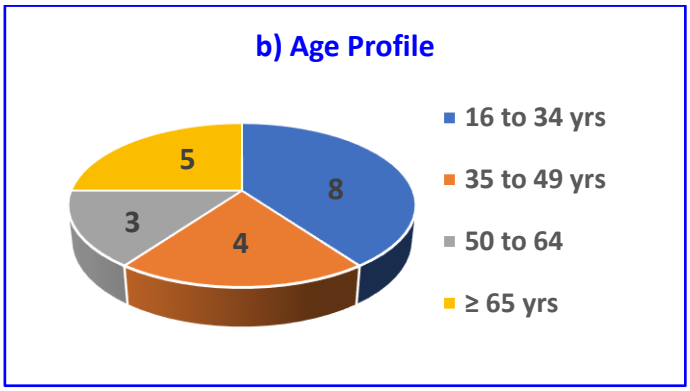

Exhibit 2: Age Profile

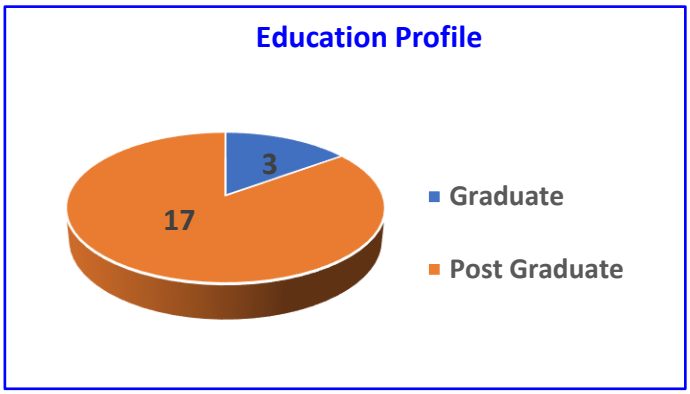

Exhibit 3: Education Profile

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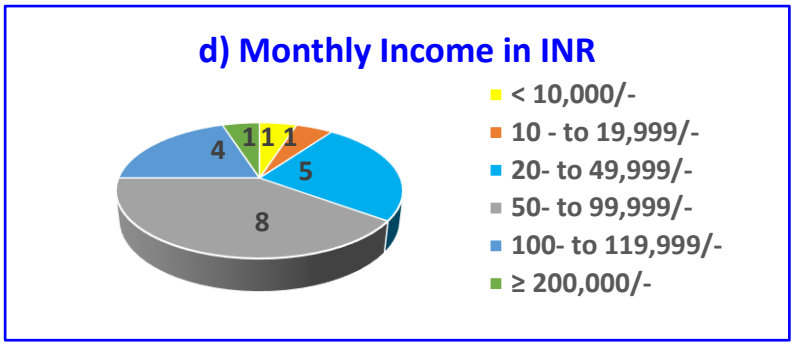

Exhibit 4: Monthly Income in INR

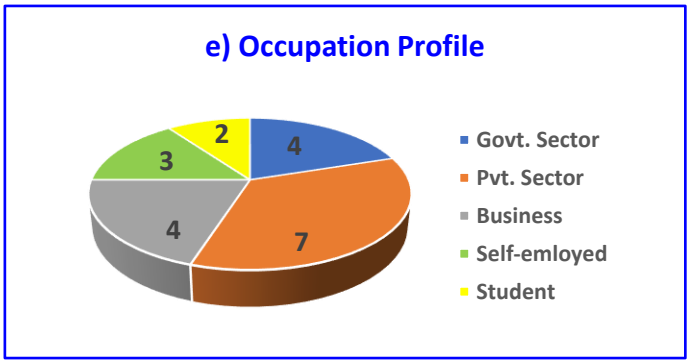

Exhibit 5: Occupation Profile

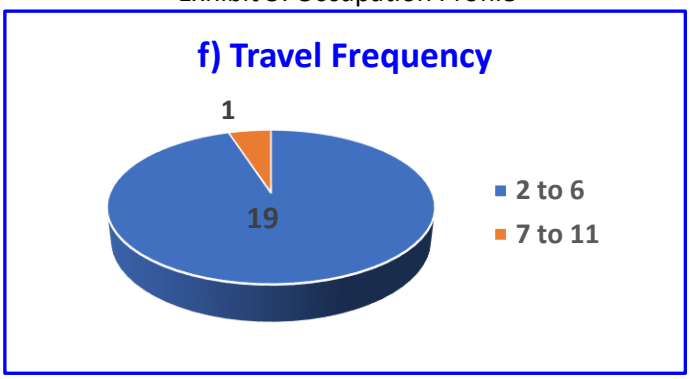

Exhibit 6: Travel Frequency

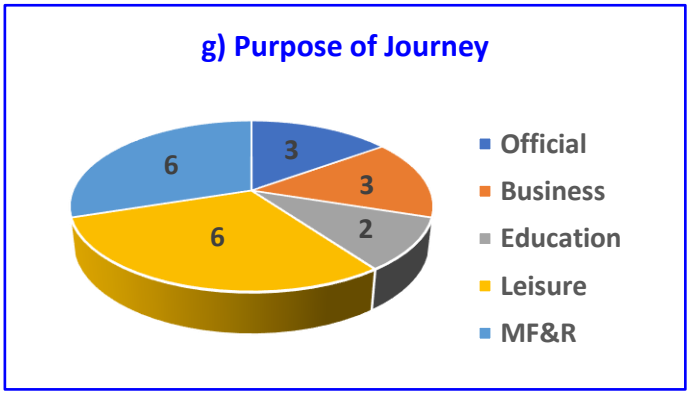

Exhibit 7: Purpose of Journey

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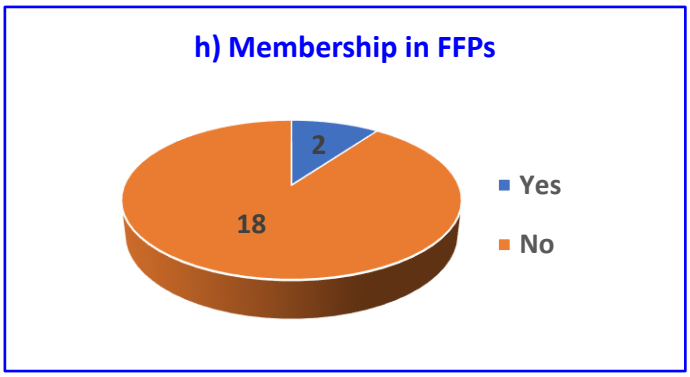

Exhibit 8: Membership in FFP

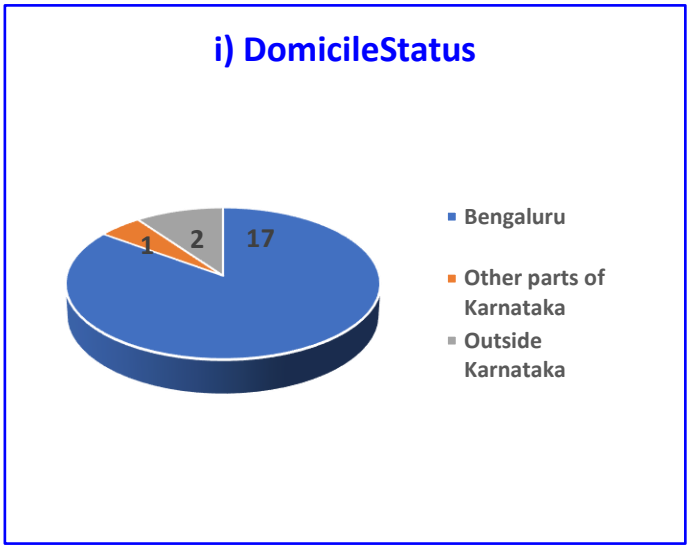

Exhibit 9: Domicile Status

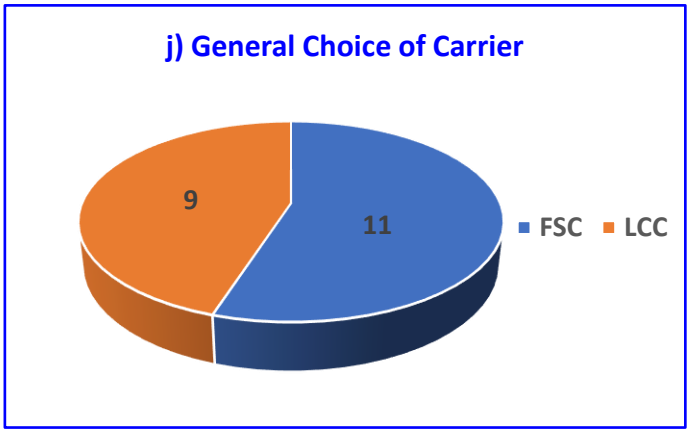

Exhibit 10: General Choice of Carrier

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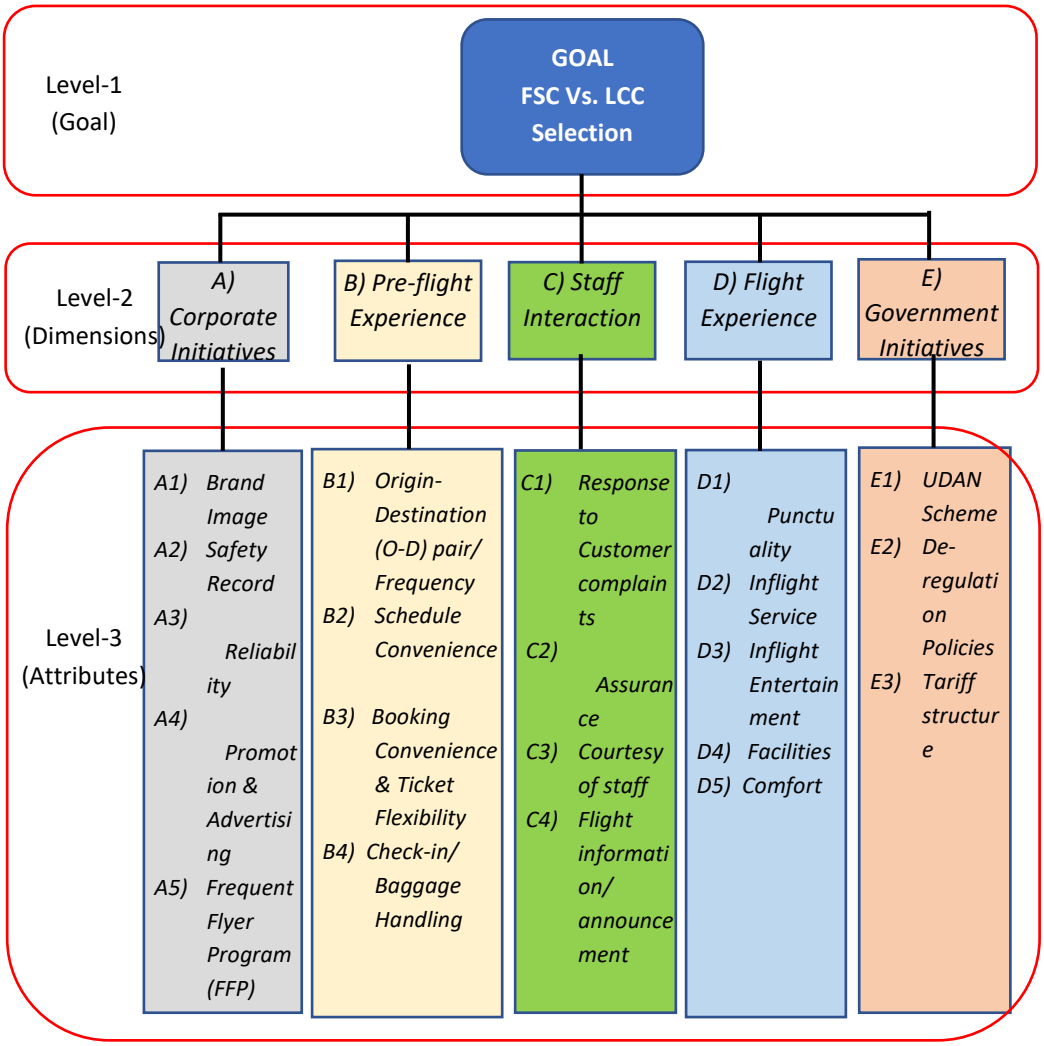

Exhibit 11: **Hierarchical Structure for Analytic Hierarchy Process**

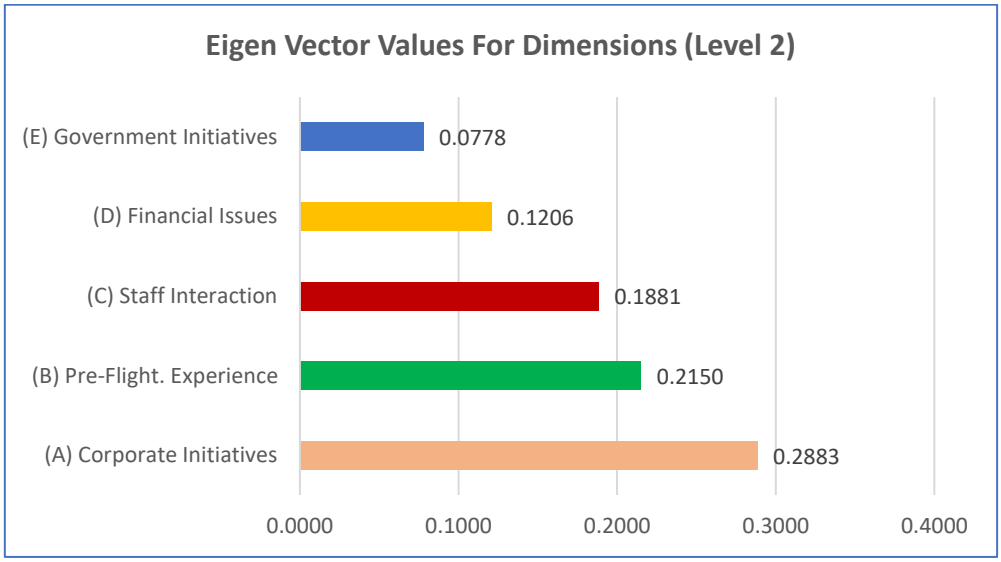

Exhibit 12 : **Results of the Comparison Matrix for Dimensions (Level 2)**

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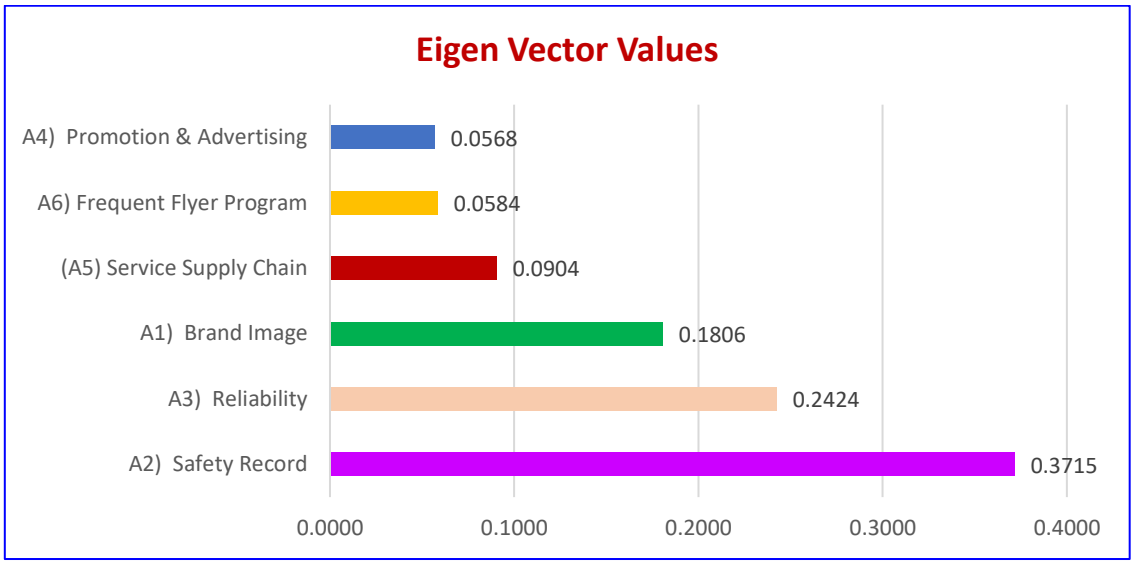

Exhibit 13 : **Results of the Comparison Matrix for A - Corporate Initiatives (Level 3)**

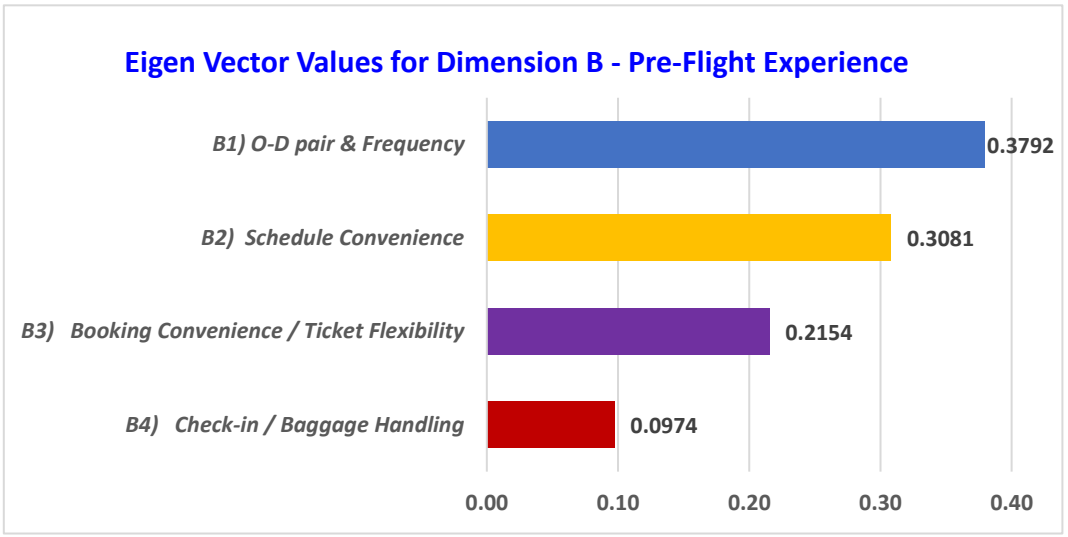

Exhibit 14 : **Results of the Comparison Matrix for B - Pre-Flight Experience (Level 3)**

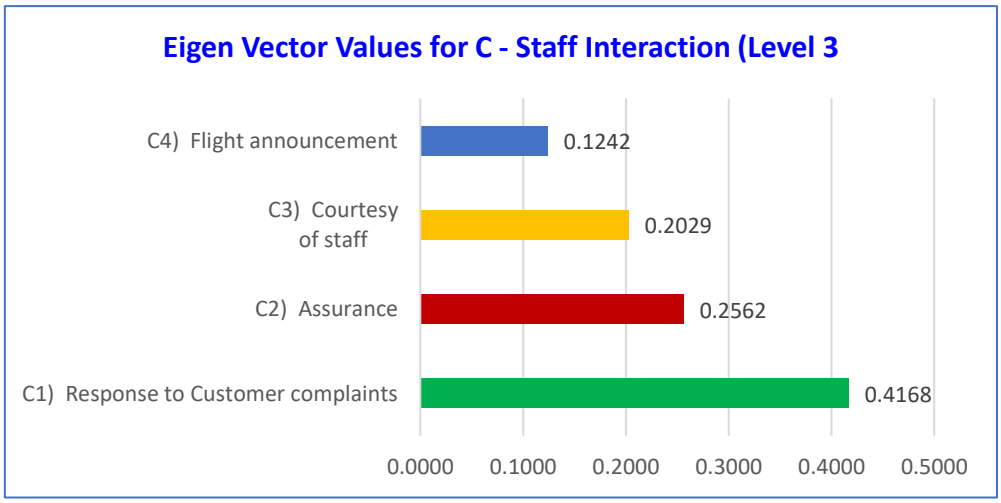

Exhibit 15 : **Results of the Comparison Matrix for C - Staff Interaction (Level 3)**

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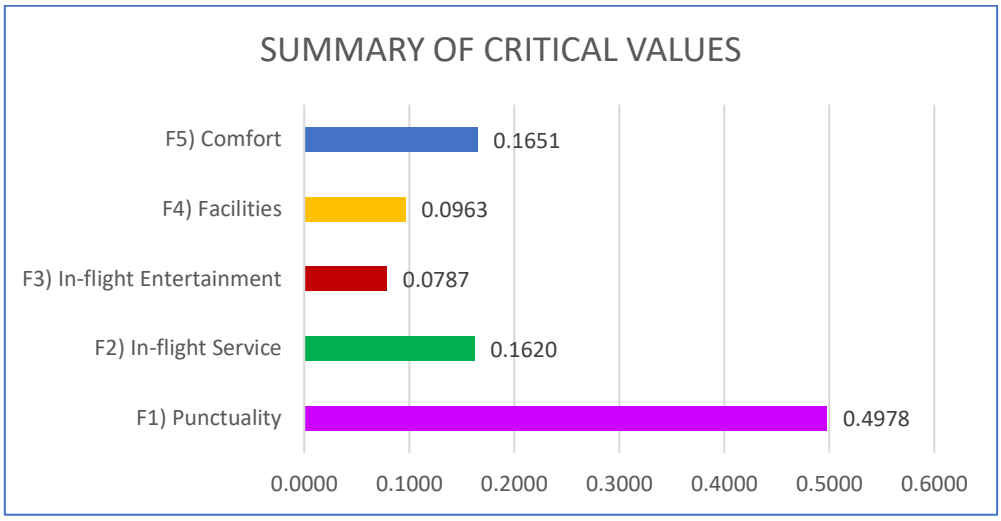

Exhibit 16 : **Results of the Comparison Matrix for D – Flight Experience (Level 3)**

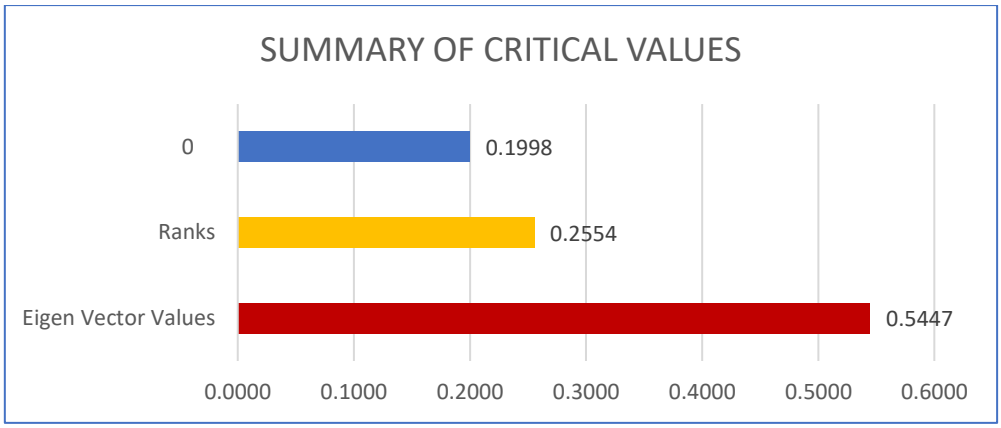

Exhibit 17 : **Results of the Comparison Matrix E - Government Initiatives (Level 3)**

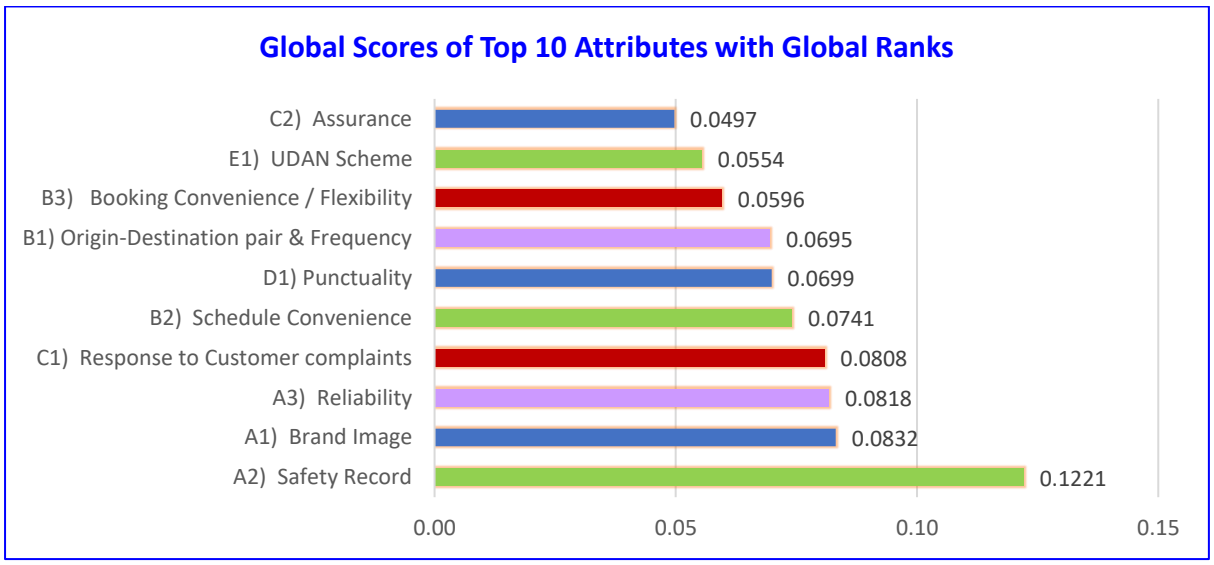

Exhibit 18 : **Global Scores of top fifteen Attributes**