AN INTEGRATED FRAMEWORK FOR DEVELOPMENT OF LOW COST REGIONAL AIRPORTS IN INDIA

By

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Mukesh Mohan Pandey

DECLARATION

"I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which has been accepted for the award of any other degree or diploma of the university or other institute of higher learning, except where due acknowledgment has been made in the text.

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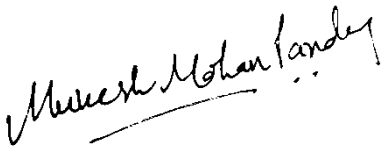

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January, 2019

THESIS COMPLETION CERTIFICATE

This is to certify that the thesis on "**AN INTEGRATED FRAMEWORK FO DEVELOPMENT OF LOW COST REGIONAL AIRPORTS IN INDIA**" by **MUKE MOHAN PANDEY** in Partial completion of the requirements for the award of the Degree Doctor of Philosophy (Management) is an original work carried out by him under our jo supervision and guidance.

It is certified that the work has not been submitted anywhere else for the award of any ot diploma or degree of this or any other University.

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Executive Summary

Indian aviation sector has seen phenomenal growth in last two decades. It is expected to grow rapidly in upcoming two decades. The advent of Low Cost Airlines (LCA) on Indian aviation market has polarised the price sensitive customer towards itself, resulting a spurt in their market share and generation of a new customer base. LCA have sustained a high growth trajectory completely dominating the legacy carriers since their inception. However, there is immense need of capacity enhancement of the airports to support the expected demand of air travel.

The Government of India has taken initiatives for development and modernization of the airports. Recently, the initiatives undertaken by government was to develop 160 non-functional airports. From the past evidences, it is observed that all the developed non-functional airports in India were not able to attract and retain airlines. Upon investigation, it is observed that non-integration of actual requirements of primary stakeholders in airport development has resulted in non attraction and non retention of primary stakeholders leading to opportunity loss and idle huge capital expenditure.

On the identified business problem, the review of literature has identified following research gaps. Firstly, there is lack of literature pertaining to studies on critical success factors for the development of low cost regional airports. Secondly, there has been absence of study pertaining to development of evaluation model for prioritization of key success factors of low cost regional airports. Thirdly, there has been dearth of research either in global or Indian context furnishing the framework for the development of low cost regional airports managing the diversified interests of primary stakeholders of the airports.

Based on above rationale and identified research gaps the current research aims to:

1. To explore and identify the success factors for the development of low cost regional airports in India.
2. To evaluate the success factors which help in development and operationalization of the low cost regional airport.
3. To devise an integrated framework for development of the low cost regional airports in India.

The 'integrated framework' in the third objective refers to the framework devised with an integrated approach, balancing the interests of key stakehoders of the regional airports. The third objective of the study also fulfills the existing theoretical gap in stakeholder's theory by providing a pragmatic heuristics of balancing the stakeholder's interests in context of low cost regional airport development.

The first objective of the study employs qualitative methods. The conceptual variables to the pertaining has been drawn from existing literature and verified for Indian context. Semi-structured interview of expert group was conducted to verify the relevance of identified conceptual variables and also explored the new related variables. Thematic Content Analysis was utilized on the obtained response of interview. The sample size of 10 respondents derived the saturation level of response.

To operationalize the second objective of the study, the existing evaluation models were analyzed. It was inferred that Fuzzy logic based evaluation models addresses the imprecision of human subjectivity inevitably present while measuring the human perception. Hence, Fuzzy logic based Graded Mean Integration Representation method has been utilized to develop an evaluation model to prioritize the success factors for development of low cost regional airports. The current objective employs the quantitative method. A questionnaire based sample survey was conducted to obtain response from 220 executives employed with key stakeholding organizations of the airports. These organizations lie within airport service boundary.

The third objective of study employs the qualitative method. It utilizes Fuzzy

logic based Analytical Hierarchical Process (AHP) method for framework development of low cost regional airport in India. Structured interview method was used to obtain response from expert group. The expert group comprised of senior executives working with primary stakeholders of the airport. On the obtained response Fuzzy-AHP method was utilized to devise the framework for development of low cost regional airport in India.

The finding of the first objective identifies 41 key success factors grouped in 8 dimensions. Conceptual lens drawn from literature resulted in identification of 32 success factors whose relevance was verified in Indian context. The analysis of interview transcript resulted in identification of 9 new success factors which were incorporated in the construct. The nine success factors identified were:

a. Catchment area
b. Market Factors
c. Technical criteria for airport development
d. Support hub and spoke and regional connectivity
e. Flexible Planning & Risk Management
f. New generation human capital
g. Government financing and assistance
h. Subsidized air fare to end users
i. Innovative sources of non-aeronautical revenue
j. Government model for development operations and maintenance

The second objective of the study develops an evaluation model which can be utilized for prioritization of success factors for the development low cost regional airport in India. The evaluation model is based on Fuzzy logic measuring accurate opinion of expert group.

The evaluation of the success factors has identified that the dimension of financial viability has highest weightage across all dimensions. The success factors Government financing and assistance, Governing model for development, operation and maintenance, innovative sources of non-aeronautical revenue and subsidized air fare to end users have gained very high importance score emphasizing them to be prominent success factors in

development of low cost regional airport in India.

The 'Physical infrastructure' is the second highest weighted dimension. All the criteria of the dimension physical infrastructure points towards need of minimizing the fixed cost by provisioning limited check-in facilities, conveyor belt, seating capacity and retail and catering.

The third ranked dimension in the construct is 'Airport authority's promotion policy'. The criteria under the dimension 'level of airport tariff', 'airport authority support attitude', and 'Support hub and spoke and regional connectivity' have attained high weightage emphasizing the need to keep low level of levies and render the support to all prime customers of airport.

The dimension Airport Strategy has achieved fourth rank with high importance score for criteria 'Low levy to users/service providers' and 'efficient airport operation'.

The fifth rank has been obtained by dimension 'Landside connection & development conditions' with high importance score obtained by success factors viz. market factor, technical criteria for airport development and catchment area. The high importance score of these criteria are indicating towards the need of stimulating demand by enhancing the catchment area and enabling the market factors.

The dimension 'airside infrastructure' has been ranked at sixth position. Prominent success factors under the dimensions are 'compatibility of runway characteristics with existing aircraft of prime LCA' and 'ability of air traffic control'. The dimension 'Passenger traffic handling conditions' has achieved seventh rank with high importance score of the criteria, efficiency in baggage handling, limited check-in and flight information system and convenience and efficiency of CIQ procedure which again indicates towards keeping low capital investment with maintaining high efficiency of the resources deployed.

The last and eighth ranked dimension is 'Ramp operation & conditions' have low weightage with two criteria of high importance, 'Operational efficiency of ramp services' and supply convenience of aircraft fueling' indicating towards maintaining fast turnaround time of LCA.

The third objective of the study has furnished an integrated framework for low

cost regional airport development in India. Fuzzy logic based AHP method was employed to obtain the prioritized hierarchy framework for the development of low cost regional airport in India.

The finding points that the 'Airport Strategy' is the most important dimension with weight of 33.4%. The high weightage obtained by airport strategy due to prominence of success factors such as 'low levy to users', 'efficient airport operations' and 'quick airport operations'. They point the need towards keeping airport strategy in mirror with the low cost airline strategy with low levy to all users and efficient operation through-out the value chain.

The dimension 'Financial Viability' has attained second rank with weight 27.4%. The high importance of the dimension is attributed to the prominent contribution from success factors 'government financing and assistance', 'subsidized air fare to end users' and 'governing model for development, operations and maintenance'. The findings have emphasized that there is immense need of obtaining government support to kick-start and develop the sustainable regional air transport market. The financial viability dimension indicates towards the need of government support to develop the regional aviation market and deploy appropriate regulatory economic model for its sustenance.

'Airport authority's promotion policy' is the third ranked dimension with weight 10.1%. The key success criteria of the current dimension are 'The level of airport tariff', Airport authority support attitude and Support hub and spoke. The findings points towards need of keeping low levies and support the airlines to make their business viable.

The dimension 'Physical infrastructure' has obtained fourth rank with the weight 10%. The prominent success factors of the dimensions consist of all seven criteria. The finding is indicating towards the need of keeping the low capital expenditures in airport development.

Fifth rank has been obtained by Landside connection and development condition with weight 7.9%. The key success factors for the current dimension include market factors, technical criteria for airport development, catchment area and population of service cities. The findings of the current dimension are

pointing towards the need of assessing the market factors, technical criteria and catchment area prior to opening of airport.

The top five ranked dimensions have aggregate weightage of 88.8%. The remaining three dimensions Passenger traffic handling conditions, Airside Infrastructure & flight management and Ramp operations and conditions have weight of 5.8%, 2.8% and 2.6% respectively.

The dimension Passenger traffic handling conditions, Airside Infrastructure & flight management and Ramp operations and conditions are also signifying the need to keep the low investment cost and efficient operations meanwhile maximizing the return on Investment in airport development.

Based on the findings of the study the current study furnishes the suggestions and recommendation for development of low cost regional airport in India.

The study is the pioneer to furnish the framework for development of low cost regional-airport in India by integrating the interest of primary stakeholders of airport lying within the airport service boundary. The study identifies and evaluates the success factors for development of low cost regional airport in India.

It has furnished a Fuzzy logic based MCDM evaluation model for prioritization of success factors for low cost regional airport development. It furnishes the framework for development of low cost regional airports in India integrating the interest of primary stakeholders of the airport. Theoretically, the study contributes to stakeholder's theory by furnishing a pragmatic analytical heuristics to balance the interest of stakeholder. It has developed a method based on integrated approach, which balance the interest of multiple stakeholders. It has also checked the efficacy of analytical heuristics on stakeholders' interests and overall outcome.

The outcome of the current study would directly be fruitful to airport planner, low cost airlines, aviation policy makers, other aviation stakeholders, academician and society at large.

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Chapter 1: Introduction

1.1. Growth of Aviation

Indian aviation has been growing at a phenomenal rate. The number of domestic passengers grew at a CAGR of 12.4% from 1990-91 to 2017-18 while international grew at a CAGR of 8.71% during same period (AAI, 2018). The number of passengers at the Indian airports is expected to grow at CAGR of 10.3% from 2018-19 to 2031-2032 (AAI, 2018). The number of aircraft Indian aviation sector has also observed high growth from 106 in 1997-98 to 555 in 2017. It is expected to reach the level of 1019 aircraft by 2030 (AAI, 2018). The drivers for the growth of aviation industry in India are the rising national income of the country

The Indian aviation has been growing at phenomenal rate. It is observed that the current growth in aviation Industry is in tandem with the growth in national income of the country. The national income of the country is expected to grow in upcoming two decade which indicates parallel growth in aviation sector in India.

1.2. Evolution of Commercial Airlines in Post Liberalised Era

There were only four Indian airlines operating namely- State owned enterprises Air India and then Indian Airlines, now together as NACIL, privately owned enterprises Jet Airways and Air Sahara. In 2003, Air India group had 47%, Jet Airways had 41% and Air Sahara had 12% of domestic aviation market share (AAI, 2017). India enacted a new civil aviation policy which deregulated the industry resulting in spurt of airlines namely Air Deccan in 2003, Spicejet, Kingfisher, Paramount, Go Air in 2005 and Indigo in 2006 (AAI, 2017). The rapid entry of new players into the domestic market has changed the landscape of competition phenomenally. The low cost airlines not only posed a threat to existing full service carrier but also challenged the

surface transport, creating a new customer base to aviation sector. The CAGR of domestic passenger during the period 2005-07, had been 35.7% (AAI, 2017). The above scenario on one hand gave significant stimulus to domestic passenger growth in Indian aviation. The service price fit of LCA dented the market share of existing full service carriers resulting dominance of LCA in domestic market which attained the market share of 38.5% in 2007 to 67.5% by 2017 (Refer Appendix 1 Figure 2) (AAI, 2017).

However, the Indian airlines have witnessed the rapid increase in costs from 2009 to 2012 due to high rise of fuel price. At the same time the fare war between airlines posed threat to the existence of less responsive airlines. To counter the intense competition from LCA, many of the full service carriers underwent consolidation namely Air Sahara was acquired by Jet Airways rebranded as Jetlite, which has been serving as the low cost subsidiary of Jet airways. Air India and Indian Airlines merged to become NACIL. And Kingfisher airlines acquired Air Deccan which had been rebranded as 'Simply fly Deccan'- as its low cost subsidiary. However due structural issue of Indian aviation industry such as non-conducive policy mechanism, high fuel cost and absence of secondary airports have led the airlines to run in losses for many years. Due to heavy loss airlines such as Kingfisher became defunct, Spicejet had to sell its stake.

The advent of Low Cost Airlines (LCA) in Indian domestic route, has polarised the price sensitive customer towards itself, resulting a spurt in their market share since their inception and has sustained on high growth trajectory completely dominating the legacy carriers. However the structural issues of the industry such as counter productive competition, archaical policies, Inadequate airport infrastructure, absence of low cost airport, high fluctuation of ATF price has challenged the sustainability of few players.

1.3. Airport Development and Indian Policy

The unprecedented growth of Indian aviation has mandated for the capacity addition in airport infrastructure. Based on Naresh Chandra policy framework GOI introduced PPP model to modernise, develop and operate the Brownfield

Delhi and Mumbai airport in 2006 (ICAO , 2017). Two greenfield airports of Bangalore and Hyderabad has also been operationalized since 2008 (ICAO, 2017). While the Cochin International Airport has been the first greenfield airport under PPP mode which has been founded in 1994 and operational since 1999 (ICAO, 2017). The five major airports under PPP mode are catering to the need of 60% of the country's air traffic (Nayar, 2013). The Airport Authority of India has modernized and expanded Kolkata and Chennai airport (Nayar, 2013). Also 35 non metro airports have been modernized with capacity enhancement under 11th Five year plan (Nayar, 2013). In May 2015, GOI has further approved 15 greenfield airports under PPP mode.

There are 464 airstrips in India of which only 116 are operational (AAI, 2017). The Government of India (GOI) has announced to develop 160 non-operational airports (Civil Aviation Policy 2016). Each regional airport is to be developed within budget of INR 100 crore. The integration of need and requirements of stakeholders is key for the success of the airports.

The growth of LCA has provided a good opportunity for the development of underused airports to attract LCA and travelers. It is expected that low cost airports shall emerge to satisfy the need of simple, affordable and uncongested facilities for LCA and their travelers.

1.3.1. Regional Connectivity Scheme and Low Cost Airport Development

GOI has announced the revival of 160 non-operational airstrips. These airstrips will be developed as 'no-frill' regional airport. The estimated budget for development of these airports is in between INR 50 crore to INR 100 crore. The core philosophy of developing these airports is to promote growth and connectivity of regional aviation. The government is considering the governing model in which state governments, private airport operators and AAI together can develop and run such airport.

a) The regional airports will only be built in the states which agrees to reduce VAT on ATF to 1% or less for period of 10 years.

b) The RCS policy states that state government will provide land for airport development with multimodal connectivity.

c) The RCS policy states that till 10 years from start of flight operations from the low cost airports:

1. Only 10% service tax will be charged on passenger tickets.
2. No airport charges will be levied under RCS.
3. The police and fire services shall be provided by state government free of cost. The state government shall also provide water, power and other utilities at nominal rates. The airlines shall be allowed to do ground handling by self at the RCS airports.
4. Till three years from commencement of operation from regional airports the Excise duty shall be charged at a rate of 2% for Aviation Turbine Fuel.
5. The state government and ministry of civil aviation will share the Viability Gap Fund in the ratio of 80 to 20 for any viability constraint to operationalize the regional airports.

The growth of LCA has provided a good opportunity for the development of underused airports to attract LCA and travellers. It is expected that low cost airports shall emerge to satisfy the need of simple, affordable and uncongested facilities for LCA and their travellers.

1.4. Evidences on Failure of Operationalizing the Regional Airports in India.

1. The eight no frill airports developed with fund of USD 50 million has not attracted and retained any airline operator. (The Telegraph, 2015).

2. **Jaisalmer airport** was developed at an expense of INR 80 crore, with three parking bays and two conveyor belts. The airport has not been utilized single operator since its launch in 2013 (The Reuter, 2015).

3. GoI has spent INR 34.43 crore on maintenance and development of **Sahnewal airport** in Ludhiana but it remains non-functional. (The Hindu, 2015).

4. Rs. 10 crore has been invested for development of **Gondia** airport but still not able lure any carrier (AAI, 2017).

5. Other non-operational but developed airport include **Jalgaon, Warangal, Mysore, Pondicherry, Kanpur, Cooch Behar, Juhu, Kolhapur, Pathankot, Sholapur, Akola , Bhatinda, Malda & Cuddupa** have similar context to narrate (AAI, 2017).

6. To upkeep the 30 non-operational airport AAI has spent Rs. 13 crore in the last financial year (AAI, 2018).

The development of low cost regional airport is a good initiative by government to develop aviation at regional level and bringing the development to regional economy. However, thoughtful considerations need to be made on the framework to operationalize the policy.

1.5. Investment appraisal mechanism undertaken for the regional airports by AAI

All the developed regional airports so far were constructed during the second world-war period. The technical feasibility of the airports has been conducted by M/S RITES. The projects have been developed after meeting all technical compliance. Also the traffic forecast and estimated revenue for each airport is done prior to development. As the traffic forecast has been done just on basis of population and economic potential of the catchment area, ignoring the key factors of the other primary stakeholders' interests, it has led to inaccurate estimate.

It has been observed that not addressing the requirements of stakeholders in the development of regional airport has led to failure of the airports. It is

evident from the reasons of failure of Ludhiana and Jaisalmer airport stated below.

Mr. V.P. Jain, airport director, Airports Authority of India (AAI), Ludhiana states

"Because of non-conducive weather for landing and shortage of small aircraft the airlines stop the operations at Sahnewal airport Ludhiana. Most airlines don't hve enough narrow-bodied aircraft to fly to Sahnewal. So we need to either expand the runway or encourage private carriers to opt for smaller aircraft". (The Telegraph, 2015)

At Jaiselmer airport, airlines are skeptical to fly because it has a seasonal demand of just four winter months of the year. Airlines have to look into the viability of the route and airports need to have either a year-long demand or very high seasonal demand says a senior official at GoAir (The Hindu, 2015).

Therefore there is immense need to integrate the key stakeholder's interest in the regional airport project appraisal mechanism and at project planning stage.

1.6 Industry Leaders opinion on failure

The union minister for civil aviation Mr. Ashok Gajapati Raju states

"A little over Rs. 600 crore had been spent over the last two years on 25 airports that were technically operational but in reality had not handled a single, scheduled flight" (PIB, 2016).

The CEO-South Asia of CAPA consulting Mr. Kapil Kaul states

"Unless a well-structured, demand driven and airline oriented plan for airport infrastructure development at Tier 2/ Tier 3 cities is developed, we may see more ghost airports" (CAPA, 2016).

Mr. Saniv Kapoor Chief commercial officer of Vistara Airlines states

“Government need to realise it's not a case of 'build the airport and we will come‘. The built airport should meet the need of the airlines” (The Telegraph, 2015).

Mr. V.P. Jain, airport director, Airports Authority of India (AAI), Ludhiana states

“Because of non-conducive weather for landing and shortage of small aircraft the airlines stop the operations at Sahnewal airport Ludhiana. Most airlines don't have enough narrow-bodied aircraft to fly to Sahnewal. So we need to either expand the runway or encourage private carriers to opt for smaller aircraft." (The Telegraph, 2015)

“Airlines are skeptical to fly at Jaisalmer airport because it has a seasonal demand of just four winter months of the year. Airlines have to look into the viability of the route and airports need to have either a year-long demand or very high seasonal demand” says a senior official of GoAir (The Telegraph, 2015).

It has been evident from above industry opinions that the interests of primary stakeholders of the airport are not met at the non-operational airports.

1.7 Some International Evidences where Inconsideration to Key Stakeholders is Leading to Loss

From past it has been evident that by not understanding the real requirement of LCA, airports while designing the low cost airport/terminal often outlay the unnecessary cost. The KLIA started its low cost terminal at Kuala Lumpur provisioned with the aerobridges and complex baggage system. The aerobridges and complex baggage system was not appreciated by LCA as it enhanced their turnaround time. As per opinion of Air Asia CEO Tony Fernandez provisioning of above facility not only resulted in dissatisfaction among LCA but also led the project over-budgeted and delayed (CAPA Low Cost airport summit, 2016).

Similarly Shanghai airport built gleaming low cost terminal in-order to compete with airports of other states in China, resulting dissatisfaction from its prime LCA customer Spring Airlines.

Hence understanding the needs and requirement of stakeholders is the first step towards realizing the low cost airport's operational excellence which has been missing in Indian Low Cost regional airport development so far resulting huge capital outlay and opportunity loss to all stakeholders.

1.8. Business Problem

Non- integration of the actual requirements of key stakeholders in development of the low cost regional airports, is resulting in non-retention and non-attraction of stakeholders leading to opportunity loss and consequences of idle huge Capital expenditure.

1.9. Objective of the study

The current study would attempt to identify, evaluate key success factor and develop an integrated framework for development of Low Cost Regional airport in India.

1.10. Motivation and need of the study

The current study would be addressing the gap of integrating the stakeholders view in low cost regional airport development in India. There is immense need of investigation with systems based thinking that aligns the airport strategies with its key stakeholders. There is earnest need to understand the key success factors required to attract and retain the key stakeholders of the non-operational regional airports in India.

1.11 The stakeholders of the airport and their goal:

The airport system entails multiple stakeholders making it complex to develop and operate. Being the airport infrastructure in hub, the airport organizations need to fulfill the interests of all stakeholders. Airport stakeholders refers to "Any group or individual who can affect or is affected by the achievement of the organization's objectives" (Mitchell et al.,1997). Table 1.3. depicts all stakeholder group involved in airport system with their respective interest (Schaar, D. & Sherry L., 2010).

1.11.1 Passenger:

Passenger is the ultimate customer of the airport system. The airport renders a connection between the ground and air transportation modes (Neufville & Odoni 2003). The airport includes varied type of passengers such as transfer, international, domestic, originating, arriving, charter, low cost airlines and shuttle passengers (Neufville & Odoni 2003). The primary objective of the stakeholder group from airport is to facilitate quick associated services, ensure on time performance with low fares.

1.11.2 Air Carrier

Air carriers renders the air transportation service to and from the airports. Air carriers include the transportation services to both passenger and cargo. The air carriers are further classified as scheduled and non-scheduled carriers. The key goals of air carriers from airport includes facilitation for on-time performance, low cost of operations, ensure safety of operations and provide access to high yields.

1.11.3 Airport Organizations

The airport organization refers to the stakeholders responsible for the operations and development of the airport. The goals of airport organization includes: facilitate the air transportation, connects surface and air transport, grow passenger numbers, achieve high security and safety, ensure sufficient infrastructure capacity, grow revenue and manage costs, find opportunities for new destinations and increase service frequency, drive economic growth,

maximize non-aeronautical revenues, maximize customer satisfaction, minimize noise, enhance competitive advantage and achieve environmental sustainability.

1.11.4 Investors/bond holders

The investors and bond holders refer to those stakeholders who are related with financing the airport projects. The prime interest of the stakeholder is the high financial performance from the airport operations, efficient and effective utilization of resources and ultimately high return on investment.

1.11.5 Concessionaires

The passenger services are offered by concessionaires in the terminal building of airport including food and beverage services, retail services, and hotels. Concessionaires are levied fixed annual rental or revenue sharing for usages of terminal space (Wells & Young 2003). The objective of concessionaires is to maximize profits. They expect from the airport to maximize number of passengers and minimize the rental paid to the airport.

1.11.6 Service providers

The service providers refer to parties who provide services including fuel oil supplier, baggage handling and sorting, toilet and water services, loading and unloading of aircraft.

1.11.7. Employees

These stakeholders refer to people working with respective organization within the airport setting.

1.11.8 Government

The government is one of the most important stakeholder of the airport system which helps to proliferate civil aviation.

1.11.9 Local government

The local government is part of airport advisory panel so as to maximize the positive impact and minimize the negative impact to local resident being occurred by development of airport.

1.11.10 NGO

Non-governmental organizations are the organizations developed with intent to do welfare of the individual and communities of aviation industry.

1.11.11 Parking & transport operators

These stakeholders refer to service provided by parties for surface transportation to customer which includes taxi service, mass rapid transit services, buses, shuttles, and limousines.

1.11.12 Airport Suppliers

These stakeholders provide supplies to airport organizations. It includes various contractors of the airport.

Table 1: Stakeholders of airport and their goal

Stakeholder Entity	Sub Types	The Stakeholder ‘s goals from the Airport
Passengers	Arriving, Departing & transferring Passengers	- Efficient flow of passengers through airport - Confirm the on-time performance - Facilitates low levies
Airlines	Passenger, freight and general aviation carriers	- Confirm timely performance - Ensure efficient cost of operations - Confirm safety in

		operations - Facilitate high Yields
Airports	Individual airports or multi-airport systems,	-Ensure high safety & security in operations - Enhance revenue and minimize the costs - Propel economic growth - Enhance the growth in number of passenger - Explore new destination with business potential - Maximize ancillary revenues - Enhance customer satisfaction - Ensure environmental sustainability
Financial Investors	Individuals/organizations who finance the project and the credit ratings agencies	- Maximize the returns on capital
Concessionaires	Provides services such as food and beverage and retail	- Enhance the number of passengers - Minimize levies
Service Providers	Facilitators of the services such as fuel ground handling at the airport	- Enhance the traffic volumes - Minimize the levies

Employees	Employees of the airport organization	-Offer secure jobs, wages, and benefits
Government	Bill-payer and regulator	- Keep up the airport service quality and standards - Ensure the safety, security and efficiency of operations
Local Government	Local elected entities such as Municipality	- Maximize economic welfare - Enhance the connectivity of the region - Reduce the noise and Emissions
Communities affected by airport operations	Residents in the vicinity of the airport region	- Maximize the economic Welfare of the region - Enhance the connectivity of the airport - Reduce noise and Emissions
NGOs, such as environmental bodies	Airport interest groups	- It is established based on the goal of interest group
ground transportation and parking service	MRT, taxi, buses, shuttles, rental cars, limousines, and	-Maximize the number passenger at the airport

providers	airport parking services	- Minimize the levies
Airport Suppliers	consulting services and equipment suppliers to airport	- Maximize the number of passengers

1.12. Scope of the study

To operationalize the objectives, the current study would attempt to undertake primary stakeholders related to airport development lying within purview of airport service boundary namely airport organizations related to management and operations, air carriers, government, regulators, service providers including ground handler, air traffic control, fuel operator, concessionaires, and consultancies.

1.13. Definitions

Integrated Framework: The integrated framework refers to developing the common goal of airport development and operation by integrating the interests of the key stakeholders.

Airport Stakeholder: Any group or individual who participate directly and indirectly the achievement of the airport objective.

Low Cost Airport: It refers to secondary or no frill airports developed with purpose to foster the specific requirement of low cost airlines.

Regional Airport: Regional airport refers to airport developed with purpose to foster the air connectivity of regional/small town and boost regional economic development.

Chapter 2: Literature Review

The current chapter discusses the existing literature related to success factors and framework for low cost airport development. For this purpose extensive search of literature was conducted on renowned databases such as science direct, web of science, scopus, ABI/inform, JSTOR, PsycINFO, google scholar and LEXISNEXIS Academic with the following keywords:

1. Success factors for low cost airport development
2. Success factors for Low Cost/regional airport development in India
3. Low cost airport strategy
4. Low cost airline and airport strategy
5. Framework for low cost airport development
6. Regional airport development
7. Integrated framework for low Cost/regional Airport development
8. Strategy for low cost/regional airport sustainability
9. Viability of low cost/regional airport
10. Evaluation model for low cost airport development success factors
11. Framework for Low cost/regional airport development in India

2.0 Themes of Literature Review: The literature obtained from the search has been clubbed into following three broad themes:

2.1. Critical success factor for development of low cost regional airport

2.2. Evaluation model of success factors for low cost regional airport development

2.3. Framework for low cost airport development

2.1. Critical success factor for development of low cost regional airport

Upon the search of literature for the current theme, following four sub themes have emerged which are summarized below: rise of low cost airline and its impact on airport, airport usages strategy of LCA, low cost airlines choice factors of airport, tenets and characteristics of the low cost airport and success factors for development of low cost regional airports in India.

2.1.1. Rise of LCA and their impact on airport

Before understanding of factors influencing the success of low cost airport it is important to make note of the sea change with dominance of LCA at all airports across globe. There has been plenty of research showcasing how the growth of LCA has been phenomenal enabler for high aviation growth rate. The literatures have evidenced that LCA with the reduced air fares have been able to propel the growth of air traffic. Dennis (2007) has reported that passenger number had increased at LCA dominated airports for Liverpool, London Stansted and Prestwick rapidly, while other airports in UK have grown by 59 % only in the same period of time. Another notable example was given by Barrett (2004b) showcasing the enhancement in the passenger traffic at both airports Chaleroi Brussels and Frankfurt Hahn.

There has been phenomenal growth of LCA in Indian aviation context as well. In 2003, Air India group had 47%, Jet Airways had 41% and Air Sahara had 12% of domestic aviation market share (AAI, 2017). India enacted a new civil aviation policy which deregulated the industry resulting in spurt of airlines namely Air Deccan in 2003, Spicejet, Kingfisher, Paramount, Go Air in 2005 and Indigo in 2006 (AAI, 2017). The swift entry of new players into the domestic market has changed the landscape of competition phenomenally. On one hand, the low ticket-prices of the "low-cost" players attracted the new customers using other mode of transportation, increasing the customer base domestic aviation. On the other the LCA dented the market share of existing Full service carrier exponentially increasing their customer base. The CAGR of domestic airline passenger during the period 2005-07, had been 35.7% and LCA attained the market share of 38.5% in 2007 which has now increased to 67.5% by 2017 (AAI, 2017).

For the purpose to offer customer oriented services at airport, the burgeoning traffic of LCA has necessitated for change in the service offering of airports across the globe. The airports have been strategizing to offer LCA centric services and facilities with primal objective of efficient and low cost of operations.

The subsequent section of the literature review highlights the shifting patterns of airport usages by the airlines.

2.1.2. Airport Usages strategy of LCA

A decade earlier, Pit and Brown (2001) contended that it is difficult to establish the the differentiation within the airport. However, now the growth of LCA have necessitated the industry for such differentiation. The airports are challenged to address the conflict of interest between the LCA and FSC. The low cost airports should focus to provide the commercial facilities which shall offset the aeronautical charges. It will help to maintain high passenger satisfaction even with relatively low standards of service (Graham A., 2013).

Barrett (2004a, 2004b) states that the airline deregulation was the prime reason for spread of LCA model eventually enhancing the usages of European secondary airports with limited role of the airport operator. The secondary airports utilized the innovation by renginnerring the airport organizational structure which help in reducing cost of LCA.

The businees model of LCA is dynamic and has changed overtimes. It has been observed that there is a deviation in LCA over usages strategy of secondary airport. Klophaus, Conrady, and Fichert (2012) has observed the changes in the business model of European LCA and found that LCA developed hybrid strategy with some features mixed of Full service Carriers. The study has developed a composite index of change in strategy based on the sub-indices such as network strategy, sevice offering, fleet structure and pricing policy.

LCA model emphasized on the usages of the secondary airports so as to minimize the tuenaround time and enhance efficiency in operations. In line with study of Klophaus et al. (2012), Alamdari and Fagan (2005) also established that there had been major deviation in the business model of LCA from the unique LCA model of Southwest Airlines except Ryan Air in Europe.

Wit and Zuidberg (2012) observed that LCAs were increasingly operating from major hub airports rather regional airports. EasyJet in US operates mostly from the major international airports while the other LCAs had adopted a mixed airport strategy (Gaham A. 2009).

Graham, A. (2009) has investigated the relationship between network and concentration of LCA. She has found that LCA have departed from their strategy of operating only piont to point network. The LCA also use the hub and spoke system to enhance their load factor while operating from maor airports.

However there are exception to above contention for examples carriers such as Ryanair still not use the hub and spoke system. The point-to-point strategy of LCA leads to enhance the concentration leading an efficient operations. Starkie (2012) conducted the study on Ryan air and Easy Jet to identify the above proposition.

As there are few conviniently located secondary airports in Australia, hence most LCA's in the continent utilize primary airport for operations with exception of sydney airport (Forsyth, 2003). There is lack of secondary airports in Asia which has been reported as challenge for implementing the LCA business model. De Neufville (2008) had identified limited secondary airport such as Manila, Zhang and Hanaoka. The secondary airport in Asia were found to be illequipped and expensive for LCA to operate (Inamura and Ishikura, 2008). In absence of efficient secondary airports in the region, the LCA use primary airport for their operation. Keeping in view, the customer oriented approach few primary airports such as KLIA and Changi had developed low cost terminal (LCT) more suitable for LCA. However the stakeholder's interest are not properly integrated in most of the developed LCT.

Most of the study related to LCA's airport usages strategy are limited to North America and Europe. There is derath of literature pertaining to asian context. It has been observed that airport usages strategy of LCA varies across globe and it significantly dependent on geographical context (Graham, A., 2013).

The LCA in US and Europe are currently adopting a mixed strategy and deviating from prior strategy of operating from secondary airport and offering point to point connections which is leading them to prevalently use the primary airports. However there is lack of academic research pertaining to airport usages of LCA in India. In the Asian contexts few studies have been conducted indicating the lack of secondary airports in this region has been posing a major problem for the growth of LCA model. A few literatures in asian contexts have identified the existence of secondary airports. However observed them to be expensive, illequipped and inconvinient for LCA operations. There is complete dearth of research pertaining to strategy to be adopted by airports targeting the LCA.

2.1.3. **Low cost airlines choice factors of airport**

Prior to liberalization the differention between the models of LCA and FSC was not observed. Initially, Berechman & de Wit (1996) observed that LCA's choice of airport varies with FSC on the criteria airport charges, demand and airport capacity.

Further the service quality offered by airport was noted to have strong influence on the LCA's choice of airport (Adler & Berechman, 2001). Seven criteria such as low airport charges, single and simple terminal building, facilitation of prompt check-in, high connectivit with surrounding cities, provison of shopping and catering and non-provisoning of executive and business lounges were identified as key features of low cost airport (Barrett, 2004). Gardiner, Ison, & Humphreys (2005) identified that criteria such as night flight restriction and airport charges were impacting the decision making of airport for LCA. Warnock-Smith & Potter (2005) exhibited that LCA differ on airport usages policy. However, the core requirement has been emphasized on low cost services for all facilitations. Accordingly, Gillen & Morrison (2003) also endorsed the existence of differentiation between LCA and FSC on the basis of airport choice factors. In further study, it was advised that airport need tailor their startegy to offer more LCA oriented services (Gillen & Lall, 2004).

The facilitation of efficient operations to LCA is most important expectation of LCA from airport (Lawton & Solomko, 2005). The efficient operations results in fast turnaround time for aircraft bring efficiency. Warnock & Smith (2005) explored 15 criteria on basis of which LCA's choos an airport of opertation. All the criteria leads to efficient airport operations, fast turnaround time for aircraft, reduced airport charges and flexibility in slot time.

Francis, Fidato, & Humphreys (2003) states that airports attract LCA on basis of offerings of network connectivity and utilize it for leveraging the aeronautical revenues. However, Barret (2004) contends that as the secondary airport are located away from urban area, the increased car rentals helps to enhance the non-aeronautical revenue generation which is utilized to offset the aeronautical charges levied to LCA.

Pitt and Brown (2001) contends that the low cost airport must be designed so that the airport fit in with the operating model of LCA. In line with above philosohy, Warnock-Smith & Potter (2005, 2015) has identified the detailed five and fifteeen airport choice factors of LCA. Francis, Fidato and Humphrey (2003) emphasized on the need to decrease aeronautical charges of LCA. As LCA operate on short- medium haul routes they tend to visit airport frequently hence airport cost for LCA turn out to be relatively more significant than traditional airlines.

Operational efficiency of LCA should be met by ensuring that there is sufficient demand at the origin and destination so that LCA can have regular frequencies with high load factor. To meet the above need the traditional airline practice to operate

from airport with a capturing large catchment area. But LCA are able to expand the catchment area and lure the passenger from wide spread region on the basis of low ticket price Dennis (2007). He established the above contention by exemplifying the Charleroi airport in Belgium with a meager natural catchment area. However as the airport was located near more populous airport with affulent catchment area, the airport attracted the passengers lying in the catchment area of other airports. Only 18 percent came from natural catchment area of Charleroi airport rest passenger came from Brussels, Luxembourg or Amsterdam (Dennis 2007). The passenger in Hanover area of Germany are observed to come from further afield leading to development of more heterogenous catchment area overlapping the spatial structure and leading to airport competition. The degree of airport competition plays an important role for LCA to negotiate for better rate with the airports (Gillen & Lall, 2004). At the same time the choice of airport is also influenced to grab the market share of rival airlines (Dennis, 2007). Dennis (2007) evidenced it with illustrating the situation of East midland airport however the enhanced operation of LCA from neighbouring airports resulted in contraction of the catchment area. The air services to common destination from neighbouring airport causes cannibalization among air carriers (De Wit & Zuidberg, 2012).

Barrett (2004a) obtained the preferences of Ryan air from airport such as single storey airport terminal, presence of catering and shopping at the airport, reduced airport charges, fast turnaround time, , prompt check-in, , provision for ground transport and absence of luxurious lounges. Warnock-Smith & Potter (2005) surveyed eight LCA in Europe observing that catchment area, convinient slot availability and fast turnaround time were the most important factor. The fourth ranked factor was low aeronautical charges as it is small portion of airlines operating cost. It was also contended by them that one size fit all strategy is inappropiate for LCA. Hence the customized services to LCA should be rendered. The airport attrativeness index was developed by Mason and Morrison (2008) based on the four primal variable such as, the average annual passenger at the airport, the average number of Full service carriers at the airport, average airport cost per passenger and the city pair routes with monopolies.

Chang, Hsu, Williams, & Pan (2008) modeled a framework listing airport choice factors including “airport charges, operations hours, surface transport, terminal floor area, navigational aid and estimated demand for the destination were pertinent factors for LCA choice of airport”. The existing studies are inconclusive about factors that

influence LCA for airport usages. Few studies have also emphasized that the low cost airport startegy should be aligned with the business strategy of LCA prevalent in the market. There is acute shortage of studies related to current theme in Indian context.

Despite the increasing dominance of LCA in the domestic Indian aviation market, there is dearth of research pertaining to understanding of expectations of LCA from airport. As the most of the literature reviewed, observed that the strategy of low cost airport should be aligned with the LCA and the primary stakeholders of airport market. There is absence of research identifying the requirements of LCA from the airport.

2.1.4. Tenets and characteristics of the low cost airport

Airport business has been experiencing a paradigm shift because of economic deregulation and rise of low cost airlines. The airports are experiencing the challenges pertaining to long term planning, meeting expectations and certainty of clients. The LCAs' are going to become center-stage in airport development. LCAs' have catalyzed the development of 'low-cost airports/terminal'.

De Neufville et al. (2008) have identified the features of Low Cost Airports which rely on business motto of deriving economy through operational efficiency and minimum frill corollary to LCA. Low cost airports have simple design, avoiding the grandiose building; the passenger building has less space per person emphasizing on higher utilization and productivity for every resources deployed in the airport; Retail and commercial space is limited in low cost airport as building and operating retail area is expensive and cumbersome (De Neufville, 2008).

Low cost airport entails terminal developed with low capital investment cost offering limited facilities due to space restriction, favoring simplified and efficient services (Sabar, 2009). Sabar (2009) identifies two types of terminal, converted and newly-built; and enumerate some typical characteristics as basic terminal facilities, avoidance of jet bridges, limited retail and catering, single story terminal, no executive or business lounges, only road services and coach services to nearest cities and short taxiing distances to and from terminal building.

The terminal of low cost airport provides an opportunity to target the LCA segment. However, in the context of Multi Airport System it has been criticized for duplicating the resources which are mandatory irrespective of the market focus (Njoya & Niemeier, 2011). Also it cannibalizes the traffic from other terminals and lacks ability

to expand (Blackman, 2011; Toh, 2013). Recently, Hanaoka & Saraswati (2011) contend that the efficiency of low cost terminal is more dependent on its location rather than its configuration. The Low cost airports are characterized by simplified terminal building, limited and needful check-in facilities, extensive use of self-service check-in kiosks, expensive business lounges are eliminated, limited seat at the departure gate and the arrival area with one or two conveyor belt (Hanaoka & Saraswati, 2011).

Kalakou & Macario (2013) analyzed the business model of different airport categories and contended that low cost airport do not hold a unique feature; however it was identified that they do not emphasize much on retail activities. Conversely, European Low Fare Airline Association (2004) contended that Low Cost Airport emphasizes more on non-aeronautical revenue by increasing the terminal shopping area. The volume and type of traffic has strong influence on airport business model. The growth of LCA resulted in development of secondary airport providing 'low cost efficient facilities' catalyzing competition between airports with focus on requirement of LCA (ELFAA, 2004). However the feature of the low cost facilities of secondary airports has not been elaborated in the study leading towards the scope of future investigation.

De Neufville (2008) states that the use of secondary airport was previously confined as part of multi-airport systems but now it is expanding to regional level as well. He observed that half of the observed secondary airport were underutilised with low traffic. These airports act as feeder to main airport. This has resulted in development of the routes facilitating the hub and spoke system and also point to point network releshing the air traffic potential of the regional areas(Barrett, 2004b).

Borbot (2006) contends that with the purpose to obtain the benefits of quick turnarounds, uncongested facilities and lower charges, the LCAs have desire to choose sendary airport. The exact features and characteristics of these airports varies. However the are consider to faciltate efficient operations acting as reliever and feeder to main airports.

There are five classifications airports used by LCAs (Dobruszkes, 2006). "These were medium or large traditional airports; secondary urban airports of large cities; regional airports serving a large city fairly close; remotely located regional airports that airlines use either as access to tourist areas or points of departure for tours; and traditional airports of beach tourism" (Dobruszkes, 2006).

Abda, Belobaba, & Swelbar (2012) contends that in the US LCA dominates the usages of primary airports. The study was inferred from the observation drawn from 200 airports in US between 1990 and 2008. Hence it is evident that concept of Multi airport system is more prevalent in USA market.

With regard to changing business model of airlines De Neufville (2008) suggested that parallel change is noticed in the airport planning as well. He contends that in the new situations with higher uncertainty looming in the environment the airport planning incorprates wide variety of services and flexibility to tailor the service offering as per specific needs of customer. He utilized the Portuguese case study to illustrate the flexible design process in the airport strategic planning.

Hanaoka and Sarawati (2011) highlighted that airports in North America were changing their services to fulfill the need of LCA. The airports have inititated the strategy of facility sharing and minor alterations in terminal to facilitate the LCA operations.

However, in the case of Dublin airport, on the basis of differing needs of FSC and dominant LCA customer, Ryan Air, the airline emphasized on the need of dedicated airport or at least terminal for themselves (Pit and Brown, 2001; McLay and Reynolds-Feighan, 2006).

Graham, A. (2013) contends that building or developing the basic low cost terminal to specifically meet the requirement of LCA at the existing airport can be a radical solution. Hanoaka and Sarawati (2011) and Price and Hermans (2008) states that refurbishment options of the cargo or maintenance terminal can be a pragmatic solution which is popular in Europe. There are also few example in USA and Asia. JFK Newyork is example of LCT in USA while Singapore, Kuala Lumpur and Zhengzhou in Asia.

The construction cost of low cost airport is quarter the cost of normal price and reduction in operating cost 30-40 percent (Njoya and Niemeier, 2011). For Singapore Low cost airport terminal the cost per passenger is a tenth of old terminal (De Neufville, 2008). De Neufville (2008) further states that cost reduction is reflected in reduction in levies on passengers.

Francis,Dennis, Ison, & Humphreys (2007) states that low cost airports have limited and necessary facilities. Moreover Pels (2008) contends that for full service carriers which serve for long haul market have higher aircraft turnarounds due to volume of

loading and off-loading luggage, catering items and number of passengers. The airport charges contributes approximatel five percent of airlines cost (Morrell, 2008). Hence reduction of airport cost is not much bigger incentive for LCA to use secondar airports where the will get less number of passengers and number of routes (Daft & Albers, 2012; Wensveen & Lieck, 2009).

For planning the low cost airport the airport standard planning should focus on keeping the investment cost low. In this context Sabar and Fewings (2008) furnishes the example of Kuala Lumpur airport have single terminal with same level for departure and arrival reducing the capital investment and increasing efficiencies. The single pier terminal is the preferable configuration for LCA, although the location becomes more important to drive the time saving and terminal efficiency rather than configuration (Hanoka and Sarawati). The same proposition has been exemplified by Zhang et al. (2008) mentioning that Kuala Lumpur LCT has been located far away from the main terminal resulting in non usages. Zhang et al. (2008) states that Jet star and Air Asia did not use the LCT at Singapore cumbersome for passenger flows.

A significant contribution to define the features low cost airports comes from Graham (2013) contending that Low cost airport facilitates for fast turnaround time, convenient slot time, lack of congestion, low aeronautical charges and other user cost, small airport size and encompasses larger catchment area. Dziedzic & Warnock-Smith (2016) defines that the characteristics of low cost airport as an airport levying low cost to its users, expansion of catchment area, efficient airport operations, near to primary city and convenient slot availability.

The development of secondary airports acted as enabler for growth of LCA in US and European market (ELFAA , 2004). The extensive review of academic literature on the relationship between airports and LCA was conducted by Graham, A. (2013) and it was acknowledged that the literature is inconclusive about overall impact of LCA on airports. However, Graham (2013) has observed that the selection decision of airport by LCA airport is determined by its business model. The traditional airports with the grandiose infrastructure are more suitable for full service carriers. High capital expenditure airports increase per unit cost of the low cost users hence resulting dissatisfaction.

There is absence of research defining the exact physical tenets and characteristics of Low Cost Airports. The feature of the low cost airports varies geographically depending upon the market situation. In context of Indian aviation, there is dearth of research defining the physical characteristics and tenets of the low cost airports.

2.1.5 Success factors for development of low cost regional airport in India

There is very limited literature pertaining to success factors for development of low cost airport. As the concept of low cost airport is flegling in Indian context hence very few study has been conducted so far. With regard to features of low cost airport in Indian context, Singh, Dalei, & Raju (2015) have contended that Low cost airport which focused on efficiency and quality of services. The features of airport facilitates 25-30 minutes turnaround time for LCA. The low cost airport requires half space per passenger when compared to traditional airports. The low cost airport is developed to cater the need of smaller aircraft. These airports should be provisioned with minimum airside such as VOR without Night Operations facilities. The runway of these airports should not be beyond 1700m equipped with 2 parking bays. ***However the above characteristics need to be verified that how far these will keep the Low cost airport model sustainable.***

2.1.6 Definitions of Success Factors for low cost regional airports development in India

The critical success factor (CSF) is most prevalently used in management literature. The word CSF was initially defined in 1961 in management literature furnishing the CSF for industry (Daniel, 1961). While further enhancing the usages Anthony et al. (1972) applied the CSF to the company's objectives level.

Rockart (1979) defined CSF as "the limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance for the organization".

Rockart (1979) stressed on the need of continuously monitoring and managing the activities of the company. Bruno and Leidecker (1984) defined CSF as

"those characteristics, conditions or variables that, when properly sustained, maintained, or managed, can have a significant impact on the success of a firm competing in particular industry", while Pinto and Slevin (1987) contended the CSF as "factors which, if addressed, significantly improve project implementation chances".

In the context of the current study, success factor is defined as all those characteristics, conditions or variable, lying within scope of airport service boundary when effectively managed, results in the success of a low cost regional airport development in India.

2.2 Evaluation model of success factors for low cost regional airport development

Harris (1998) defines Decision Making (DM) as such:

"Decision making (DM) is the study of identifying and choosing alternatives based on the values and preferences of the decision maker(s). Making a decision implies that there are alternative choices to be considered, and in such a case we want to identify as many of these alternatives as possible but the idea is to choose the one that best fit with our objectives and values".

The ideal decision making should include the decision makers and stakeholders in the process minimizing the possible conflict about problem definition, goals and criteria (Baker et al. 2002). Further he contended that decision criteria should be:

- Able to differentiate the possible outcomes comparing the options.
- Comprehensive
- practical and important
- Non-redundant
- limited in numbers

Baker et al. (2002) also furnished the steps of ideal decision making process which is depicted in Figure 1 below

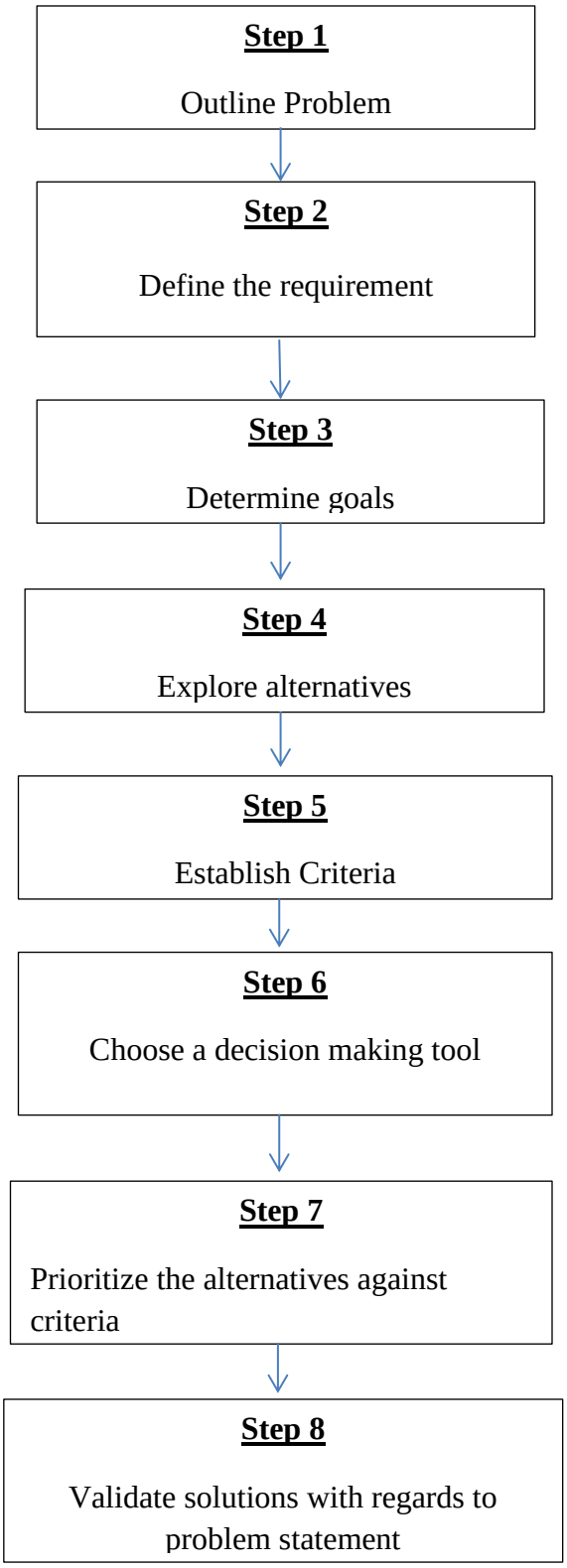

Figure 2: Steps of decision making process

Baker et al. (2002) contended that to set a clear and precise problem statement describing actual and ideal situation.

The second step of determining the requirement specifies the mandatory condition which the possible solution to the defined problem should comply with. Goals are established in the third step which specifies the desirable outcome of the possible solution. The fourth step in the decision process is to identify the alternative which represents the choices of possible solutions. The fifth step of defining criteria indicates towards establishing decision criteria which will be utilized to assess the alternatives on the basis of their goal achievement. The step 6 requires choosing of an appropriate tool which is exclusively based on nature of decision problem. Generally simpler method is prioritized; however, complex decision problem may require complex method as well. The decision making process requires the evaluation of alternatives on the basis of respective scores of criteria which is conducted as step 7. After the selection of alternative by utilization of decision making tool, the result requires validation against the requirements and goals of the decision problem which is conducted as step 8.

The evaluation and selection of the critical success factor may include conflicting quantitative and qualitative criteria and multiple decision makers within the airport service boundary. Hence the selection and evaluation of Success Factor for Low Cost Regional Airport development could be classified as a Multi-Criteria Decision Making (MCDM) problem.

The classification of MCDM problem could be classified on the basis of data utilized there in. It can be deterministic, stochastic, or fuzzy MCDM methods (Triantaphyllou, 2000). Goicoechea et al. (1982) have classified MCDM into three categories:

1. Outranking techniques,
2. Multi attribute decision making techniques, and
3. Mathematical programming techniques

Ching-Lai and Yoon (1981) suggested that the MCDM problems could be classified into two main groups:

1. Multi objective decision making (MODM), and
2. Multi attribute decision-making (MADM)

The MODM method has continuous decision space and decision options are not pre-identified while MADM method has discrete decision space with possibility for assessment of each option using a combination of analytical tool.

Zhou et al. (2006) have classified decision analysis methods into three main categories:

1. Single objective decision making method
2. Decision support system
3. Multi criteria decision making method (MCDM)

The above study also established that Analytical Hierarchy Process (AHP) most popular MCDM with score of 18% followed by Multi Attribute Utility Theory (MAUT) with 17%, Multi Objective Decision Making (MODM) with 14% and Decision Tree (DT) with 14%.

2.2.1 Multi Criteria Decision Making

Multi-criteria decision-making (MCDM) techniques has often been utilized in the field of airline safety, airline service quality, airport service quality, Logistics, third party reverse logistics, third party logistics

Overtime varied methodologies has been developed to measure and evaluate human subjectivity issue encountered while measuring the perceptions. Broadly these methodologies can be segregated in three categories: Stated Importance Methods (SIMs); Derived Importance Method (DIMs) and Multi-Criteria Decision-Making Method (MCDM). In SIMs the perception and expectation of human is measured on liguistic-numerical likert type scales, which is simple to apply however it can be time consumng to apply (LUPO,

T., 2015). Because of these reason DIMs is widely applied in recent past where expectation rating on service dimensions are statistically derived keeping in view the relationships among performance on service and quality aspects (HUMPHREYS, I. and Francis, G., 2000; ADLER, N. and Berechman, I., 2001; LUPO, T., 2015).

Both SIMs and DIMs are based on liguistic numerical likert type scale rating which can give imprecise result as judgement provided by linguistic numerical evaluation scales are subject to uncertainties and vagueness (LUPO, T., 2015; CHOU, C.C. et al., 2011). To overcome the stated weakness, MCDM method was later utilized by many researcher to measure the human subjective items.

Simonovic (2002) has established the basic tenets of the MCDM problem which includes:

1. "A set of alternatives
2. A set of criteria
3. A number of decision makers
4. A preference weight
5. A set of performance evaluation of alternatives for each criterion".

The subsequent section of literature review detail for two main decision making branches MODM and MADM.

2.2.2 Multi Objective Decision Making

The MODM renders the optimal solutions to problem in which contradictory objectives are solved simultaneously. The MODM results in choosing of best alternatives among potentially infinite set of alternatives. Mathematical programming is utilized for obtaining the final solution. The MODM problems are solved utilizing several optimization models such as goal programming,

compromising programming, constraint method and fuzzy multi-objective programming.

2.2.3 Goal Programming

Goal Programming (GP) was propounded by Charnes and Cooper (1961) in which the decision makers determine goal for each objective. The potential solution to problem minimizes the deviations from goal (Lu et al., 2007). The GP method facilitates the incorporation of multiple criteria using single criterion optimization software. The GP method limit ate to collect the respondents preferences pertaining to priority level, importance weight and objective target value.

2.2.4 Compromise Programming

Compromise Programming (CP) is a mathematical programming utilized in continuous context (Zeleny, 1973). CP method utilizes the concept of minimum distance in which the composite distance from ideal point is measured. The optimization problem consists of various combinations of weight or direction creating various efficient solutions. The best compromising solution is identified from various efficient solutions.

2.2.5Constraint Programming

The constraint programming method calculate main performance index based on the essential criteria or attribute while other criteria are considered as constraint by allocating proper tolerance level to each of them. A set of optimal solution is identified by varying the tolerance level as compromising method. The optimal solution fulfils all constraints maximizing the main performance index and is considered as most efficient solution.

2.2.6Fuzzy Multi Objective Programming

The Fuzzy Multi Objective Programming method is developed to solve multi-objective optimization with fuzzy logic theory (Zhu & Chow, 1997). The problem objectives and constraints are represented by membership function and their shapes are evaluated reducing the decision space relatively with other method.

2.2.7 Multi Attribute Decision Making

Multi Attribute Decision Making (MADM) refers to evaluating the finite set of known alternatives using decision constraints. MADM method has been popular and promising tool in selection of best strategy (Ching-Lai and Yoon, 1981).

2.2.8 Multi Attribute Utility Theory

Keeney and Raiffa (1976) propounded Multi Attribute Utility Theory which is based on maximization of aggregated criteria. The MAUT is based on offset or compensation principle in which the gain of one criterion can compensate the loss of other. The MAUT problem can be expressed as single objective function and also ensures the achievement of best compromise solutions,

2.2.9 Outranking method

The outranking method is one of the MADM which assists for dealing with complex problem having multiple criteria and group participant (Roger & Bruen, 1998). Figueira et al. (2004) conducted survey for MCDM including outranking methods and has obtained the ELECTRE and PROMETHEE to be most popular methods.

2.2.10 The ELECTRE Method.

The Elimination and Choice Translating Reality (ELECTRE) method was propounded by Roy (1968). The ELECTRE method selects the alternative that is preferred over most of the criteria. It makes pairwise comparison of alternatives for each criterion. The method can be applied to both quantitative

and qualitative data set with discrete criteria. The ELECTRE method is suitable when there is less number of criteria and large number of alternatives. By application of ELECTRE method the less preferred alternatives are eliminated with most preferred one.

2.2.11 The PROMETHEE Method

Preference Ranking Method for Enrichment Evaluations (PROMETHEE) is one of the most prevalent outranking methods utilizing the six preference types to measure the decision making priorities. PROMETHEE renders a robust results as able to accommodate the threshold modifications (Brans et al., 1986)

2.2.12 The Analytical Hierarchy Process

The AHP was propounded by Thomas L. Saaty in 1980. The primal principle of AHP emphasized of utilization of actual data, knowledge and experience in the decision making process. The AHP decision making involves the two steps:

1. Hierarchy Design: The hierarchy design refers to breaking the decision problem into a hierarchy of decision criteria which includes goal, criteria and alternatives.
2. Hierarchy Evaluation: It refers to the evaluation of hierarchy which involves establishing the weightage of respective criteria and determining the alternative preference as per stakeholders priorities.

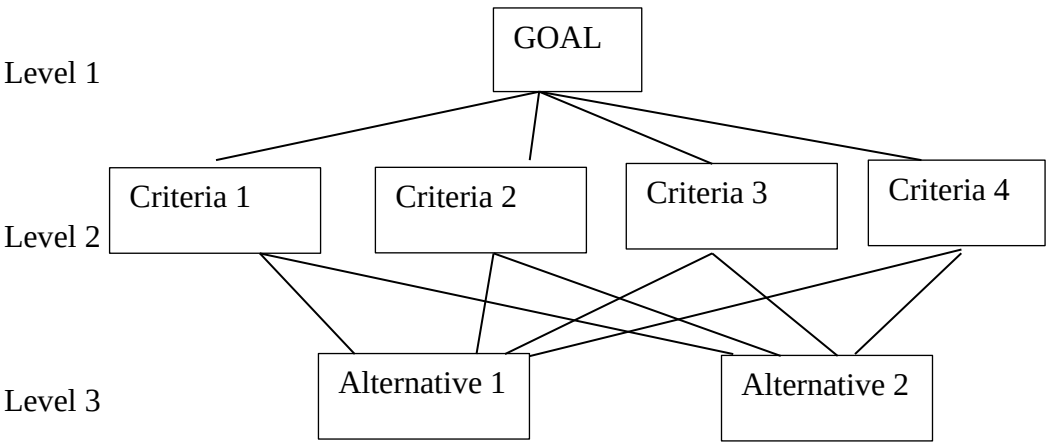

Figure 2: The hierarchy structure of the AHP

Figure 2 describe the three level AHP hierarchy for selecting an appropriate alternative. The goal is top level of hierarchy decomposed into various quantitative and qualitative criteria at level 2. The level three represent the possible alternatives to the problem. The AHP helps in arranging the goal, criteria and alternatives and render a framework as output which supports the decision makers to understand relationships between decision elements and assess their respective importance in decision problem. Thomas Saaty (2005) a highlighted the unique strength of AHP method is that it emphasizes to include the intangible criteria, which are hard to capture by human understanding and also derives the relative importance of criteria in decision process. Figure 3 shows the flowchart of AHP methodology in which the pairwise comparison of criteria is done based on Eigen value to generate the relative importance of criteria and best possible alternative for the goal.

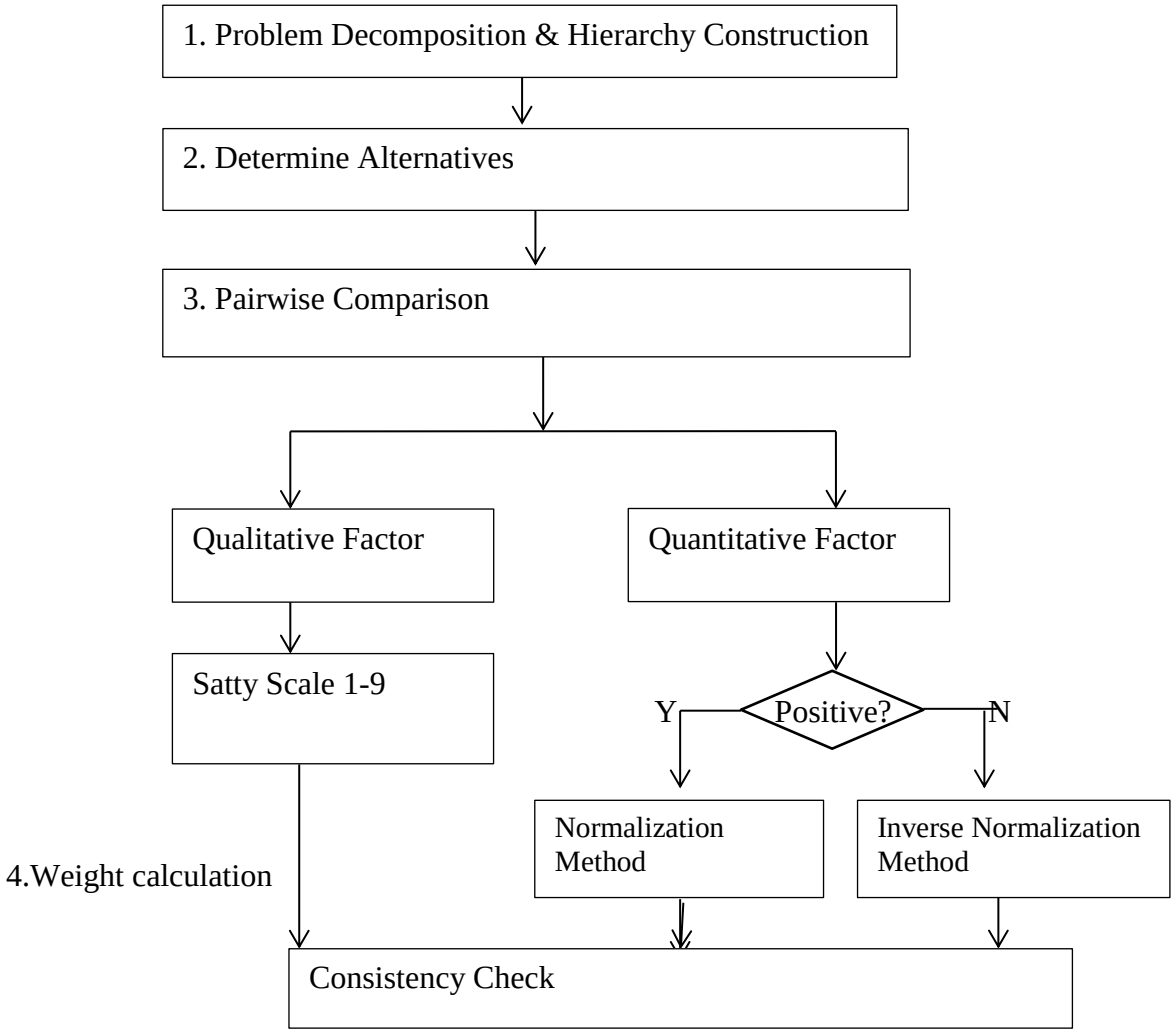

Figure 3: Flow diagram of AHP method

2.2.13 Fuzzy Logic Based MCDM Models:

The point estimate based rating methods brought imprecision is gauging the human subjectivity issue (Pandey, 2016; Zadeh,1973). With the advent of Fuzzy logic method where rating is done by the overlapping intervals brought precision. The overlapping intervals are measured by linguistic scales capturing precision in study of the human subective issues(Zadeh, 1973).

2.2.14 Fuzzy GMIR based Evaluation model:

Graded mean Integration Representation is the simplest Fuzzy based MCDM model which was developed by Chen and Hesih (1998). It was further improved by Chou (2003) by multiplying two triangular fuzzy numbers. Further Chou (2006) developed the model for aggregating the results. The model was verified in for MCDM application and framework development (Chou, 2007). Chien-Chang (2012) applied the developed model of Chou (2007) for evaluation the service quality of the airports using triangular fuy number.

The two triangular fuzzy number Y_1= (c_1,a_1,b_1) & Y_2= (c_2,a_2,b_2) will be represented by graded mean integration method by equation 4.

$$P(Y1) = \frac{1}{6}(c1 + 4a1 + b1) \qquad \text{Equation 4.}$$

Later both the triangular fuzzy number were defuzzied by employing the inverse function arithmetic presentation (CHIEN-CHANG, C., 2012)

2.2.15 Why Evaluation model based on Fuzzy GMIR?

Since the subjective evaluation is difficult to be expressed in number, as there is existence of uncertainty (fuzziness) (CHIEN-CHANG, C., 2012). Hence the

use of Fuzzy MCDM model can be more realistic in evaluating the critical success factor of experts by utilizing the linguistic term. FERNANDES, E. and Pacheco, R. R. (2010) evaluated the Airport Service Quality using alpha cut concept in Fuzzy multi-criteria analysis. The author applied these methods on six airports in Brazil and rendered strategic framework for management of airport. LUPO, T. (2015) utilized ELECTRE III method to comparatively evaluate quality of airport service alternative, however the outranking approach of ELECTRE method is not able to directly gauge and verify the strength and weaknesses of alternatives (VELASQUEZ, Mark and Hester, Patrick T., 2013; KONIDARI, P. and Mavrakis, D., 2007). Also the process and outcomes of ELECTRE method is complex to employ (VELASQUEZ, Mark and Hester, Patrick T., 2013).

CHIEN-CHANG, C. (2012) also employed Fuzzy MCDM based on graded mean integration representation (GMIR) method to gauge the service quality of two airports in Taiwan and gave strategic solution to improve the service quality performance of airport by employing fuzzy expert system in which the service quality performance is fuzzified using graded mean integration approach and defuzzified using Inverse Arithmetic representation method**.** As Evaluation Model based on Fuzzy GMIR is relatively easy and reliable to gauge subjective perception hence Chien-Chang, C. (2012) preferred it over other methods.

2.2.16 Evaluation Model on Fuzzy MCDM Application

Fuzzy logic method was founded with intent to remove inherent error while doing the subjective evaluation of criteria. It helped to make the subjective evaluation more accurate than the measurement earlier done under the probability distribution framework. The concept of fuzzy logic has been widely applied for MCDM in varied context.

Kannan, G. Pokharel, S. and Kumar, P.S. (2009) utilized AHP and TOPSIS method in reverse logistics decision making. Liou, James J.H. et al. (2007) utilized Fuzzy based MCDM evaluation model to establish the relationship between the airline safety and other criteria. He utilized Fuzzy logic based

DEMANEAL and AHP method to the pertaining. Fuzzy logic based AHP and TOPSIS evaluation model was utilized for selection of strategic alliance in logistics value chain by Büyük€ozkan, G.et. al. (2008).

Shaw, K., Shankar, R., Yadav, S.S. and Thakur, L.S. (2012) developed an evaluation model for selecting the appropriate supplier in supply chain based on integrated approach utilizing fuzzy based AHP and multi-objective linear programming. Ho, W., He, T., Lee, C.K.M. and Emrouznejad, A. (2012) develops evaluation model for selecting optimal third party logistics service provider utilizing Fuzzy based QFD and AHP method. Bai, C. and Sarkis, J. (2013) exemplified the practical utility of fuzzy MCDM based evaluation model for selection of third party logistics partner. Liou, James J.H. (2013) developed the evaluation model for selection of strategic alliance partner in airline industry using Fuzzy based DEMATEAL and ANP method.

Akman, G. (2014) developed the evaluation model for green supplier development programs utilizing Fuzzy C-means and VIKOR for automobile industry in Turkey. Rezaei, J., Fahim, P.B.M. and Tavasszy, L. (2014) investigated the practicality of Fuzzy AHP and conjunctive screening evaluation model for supplier selection in European airline retail industry. Senthil, S., Srirangacharyulu, B. and Ramesh, A. (2014) developed evaluation model based on Fuzzy AHP and TOPSIS for contractors evaluation and selection in third party reverse logistics. Ayhan, M.B. and Kilic, H.S. (2015) developed an evaluation model based on Fuzzy AHP and MILP method to decide weight and select partner respectively of gear motor company in Turkey.

Prakash, C. and Barua, M.K. (2015) develop the evaluation model for gauging the airport service quality and ranking based on Fuzzy TOPSIS and AHP method. Lupo, T. (2015) utilized Fuzzy based ELECTRE III method to comparatively evaluate the airport quality and service alternatives. Pandey,M.M. (2016) demonstrated the practicality of Fuzzy based GMIR method for evaluation of service quality of airports in Thailand.

There are many studies carried out using the Fuzzy logic based evaluation models to precisely evaluate the factors which have been utilized by global authors in varied industry and contexts. However, there is absence of study furnishing the evaluation models for prioritization of success factors of Indian low cost regional airports. The application of Fuzzy based evaluation model for ranking of success factors has not been explored yet.

2.3 Framework development for Indian Low Cost Regional Airport

2.3.1 Framework for development of regional airport & airport

USA was the first country to initiate liberalization of air transport market in 1978 and experience the airport spatial pattern development. During 1978-1993 the operations at smaller airport decreased and number of enplanement at the airport has nominal increase reflecting operational inefficiency prevailing at the regional airport.

Likewise in European context it was noticed that competition between airports resulted to reduction of traffic at regional airport (Lian and Roenvick, 2011). Merkert and Mangia (2014) contend that efficiency of airport plays an important role in airport development and sustenance. Ingledew (2010) contends that regional airport should focus on changes and improvement to ensure sustainable future. Pao-Yen Wu and Mengerson (2013) has reviewed the models for airport terminal development contending that existing models are not comprehensive in capabilities and requirement. However many research has stressed on importance of growth of regional airport and economy (Button et al. 2010; Halpern and Brathen, 2012).

But it has been observed that smaller airport has been challenged by problem of cost benefit experiencing less volume and limited non-aeronautical income (Antonin Kazda, Martin Hromadka & Boris Mrekaj, 2017). They contend further that development of regional airport have indirect, induced and catalytic economic impact which collectively should outweigh the cost regional airport subsidy. They also emphasized on need of developing appropriate method to measure the economic impact of regional airport development. An economic analysis is necessary before subsidizing the small regional airport assessing the extent to which airport development meets its social and macroeconomics objectives quantifying the contribution of public welfare (Antonin Kada, 2017).

1.

Peneda, Reis & Macario (2011) explored the framework for development of the airport. The critical factors of the framework included Connectivity, Economic Potential, sustainable development and commercial attitude. The connectivity refers to facilities (rail and road) providing seamless approach to the airport. The second factor the economic potential refers to the high per capita income of people residing in catchment area. The per capita income is strongly correlated with propensity of air travel. The third factor commercial attitude of the airport operator refers to aggressive customer oriented marketing strategies of the airport operator. Political prioritization, minimization of externalities and the capture of spin-off economic benefits includes the dimension sustainable development.

There is acute shortage of literature pertaining to framework for low cost airport development. The existing studies have identified few critical factor of framework for airport development but it needs to be verified in Indian low cost airport context. The nature of airport business mandates to integrate the interests of all stakeholders. Hence the critical factors of airport development framework should be look upon with integrated approach which has not been incorporated in any of the study.

1.3.2. Low Cost Airport Planning

Prior to liberalization, there was absence of competition among airports (Barret, 2000). The advent of deregulation catalyzed the competitiveness of the airports. As airlines are free to choose their destination and hub airports, hence the airports design their strategy to lure them, resulting increasing competitiveness among airports. The changes in the organizational structure are also contributing in increasing competitiveness of airports (Starkie, 2002). Earlier the airport competitions emphasized on catchment area of city as more than one airport were planned in the metropolitan area (Lian & Rønnevik, 2011). In the liberalized market the competition between airports has been

intensified and evidences of competition has been identified in few studies (Starkie, 2008; Forsyth, Gillen, Müller, & Niemeier, 2010; Copenhagen Economics, 2012). However to devise an effective strategy of an airport it is necessary for an airport to understand their competitive environment and the way airport relate to their multiple stakeholders to align their strategies. To fulfill the above gap, Schaar & Sherry (2010) presented a model that attempts to describe the interrelationship between highly diverse entities of airports in terms of their responsibilities and needs for United States. Jarach (2001) develop the air transport pipeline model to analyze the business relations among all entities of the airports. Tretheway & Kincaid (2010) utilized 'four Ps of marketing' to develop the strategy to cater the specific need of the airport customer. The four P's model developed by Graham (2010) has not been effective in airport context as airport involves multiple buyers and suppliers interacting simultaneously.

Frank, (2011) analyzed the business model of airports and concluded that the business model of airports is highly dependent on the context in which they operate. Kalakou & Macário (2013) evidenced the existence of diversity in the business model of 20 low cost airports.

The aviation industry is under rapid flux of change. The deregulation of air transport industry has brought a sea change exemplified by the rise of airlines alliance and low cost airlines, in USA since 1978, in Europe since 1990's and in India since 2003. Parallel to this, the technological advancements, increasing environmental awareness and increasing competitions has catalyzed the rate of change. The pace of change in the industry has dwelled an uncertainty in airport strategic planning. The AMP describes the strategy of airport operator encompassing the aeronautical development (runways, taxiways, gates etc.) and non-aeronautical development (real estate, commercial activities, retail development etc.). It depicts the development of physical facilities in the airport, land use for areas surrounding the airport, environmental impact assessment of airport and airport access through surface transport (Ashford, Mumayiz, & Wright, 2011). The AMP mandated by ICAO is a full description of very likely future and prepare the airport to deal with

that future. However, it prepares a little to accommodate a different scenario. The current practice of AMP has structural weakness that they do not recognize uncertainty of future or prepare with the possibility that airport managers could shape the future by defining the features of their product and target customers (De Neufville & Odoni, 2003). To solve this issue De Neufville et al. (2003) suggests the need of Proactive planning in the airport planners. ***However there is absence of standard framework to develop proactive airport plan.***

The Terminal 5 in JFK airport is managed by Jet Blue Airways, Changi airport has designed Low cost terminal for Tiger, Kualalumpur International Airport has developed it for Air Asia, Dallas Love airport for Southwest and Hamilton Ontario Airport for West Jet airlines indicating that airlines driven airports are need of hour (Hanaoka & Saraswati, 2011).

The development of low cost facilities for the greenfield airport is airport-driven where the airport stakeholders build the facilities targeting LCA. In the same line Bordeaux airport has successfully attracted six LCA to operate (Hanaoka & Saraswati, 2011).

Other solution rendered by De Neufville et al. (2003) to overcome the flaws of the current AMP without major change in current process is dynamic strategic planning. It refers to long term plan in which airport operators must adjust their plans and designs dynamically overtime to accommodate the variety of future that unfolds (De Neufville, 2003). In the same line, Kwakkel, Walker, & Marchau, (2010) proposed an adaptive airport strategic planning which is iterative, flexible and over due course of time can adapt to changing conditions. ***However the applicability of the Adaptive strategic airport planning and dynamic strategic airport planning models need to be checked in varied airport developments and specific environmental contexts.***

2.4 Theoretical Premises: Stakeholder Theory

The 'integrated approach' of developing framework for low cost regional airport in India is driven by the philosophy of stakeholder theory. The 'integrated approach' points towards fulfilling the need of balancing and integrating the interests of primary stakeholders for the success of low cost airport development in India. As evident from the business problem that the lack of integration of stakeholder's interest has resulted in non-operational low cost regional airport in India. Hence, the 'integrated approach' is the need of hour for low cost regional airport planning in India. The 'integrated approach' emanates from the theme of balancing of interests of stakeholder's theory. But before exploring the specific theme of theory the short evolution and briefing of stakeholder theory is furnished below.

2.4.1 Stakeholder Theory: An Overview

The concept of stakeholder emanates from the works of Rhenman and Stymne (1965) and Ansoff (1965). Later it again appeared in study of Stanford Research Institute (1982). The framework for Stakeholder management was comprehensively presented by Freeman (1984) in his book, *Stakeholder Management: A Stakeholder Approach*. He developed the framework using the literatures of corporate planning, systems theory, and corporate social responsibility. Freeman (1984) contended that "the quantity and kinds of change which are occurring in the business environment". Freeman (1984) stated that managers should "take into account all of those groups and individuals that can affect, or are affected by, the accomplishment of the business enterprise".

Freeman (1984) suggested that managers should utilize the segmentation of marketing for effective stakeholder management. Freeman (1984) propounded the four generic strategies for stakeholder management which were exploit, defend, swing, reinforce.

Based on Freeman's (1984) work plethora of studies has been conducted resulting evolution of stakeholder theory . Broadly we can classify four major broad themes of stakeholder theory:

1. Description and importance
2. Stakeholder actions and responses

3. Firm actions and responses

4. Firm Performance

2.4.1.1. Definition and salience

The literature in this theme have tried to define the stakeholders. Initially Freeman (1984) gave definition of stakeholder as "any group or individual who can affect or is affected by the achievement of the organization's objectives". Freeman further contended that "To be effective strategist you must deal with those groups that can affect you, while to be responsive (and effective in the long run) you must deal with those groups that you can affect" (Freeman,1984). The inclusion of word 'can' led to many works to know the priority of stakeholders and then managing their interests.

The normative perspective of stakeholder theory is pretty pervasive, from restrictive view that yields power over firm to broad view which include powerless (Frooman, 1999; Pajunen, 2006; Clarkson, 1995; Cragg & Greenbaum, 2002; Starik, 1995 and Schwartz, 2006).

Regarding stakeholder identification, it was observed managers prioritize on stakeholders with power over firm (Winn 2001). These stakeholders have legitimate power (Knox and Gruar 2007). Power is most significant attribute in stakeholder management followed by urgency and legitimacy (Parent & Deephouse, 2007). Power is "inadequate for incorporating the near and the far, the short- and the long-term, and the actual and the potential" (Driscoll and Starik, 2004).

2.4.1.2 Stakeholder actions and responses

The current theme of studies not only develops the understanding of stakeholders but also should predict their possible strategies. The current themes addresses following issues influence of stakeholder on firm, mobilization of stakeholders, stakeholders support to firms.

Frooman (1999) utilized the resource dependence theory to predict the strategy of stakeholders. Frooman (1999) states that stakeholders use the direct strategy if the firm is dependent on stakeholder for resource else they form ally for their salience. O'Connell, Stephens, Betz, Shepard, and Hendry contended that stakeholders use both direct and indirect mechanisms for rationalizing stakeholder's relations with

firms, including "internal subunits, legislated stakeholder participation, legislated access to information, and direct stakeholder activism".

As the dominance of stakeholder is based on power and legitimacy indirect strategy like allies and consortium enhances their bargaining power. (Eesley & Lenox, 2006; Welcomer, 2002).

With regard to second question on the mobilization of stakeholder groups, Wolfe and Putler (2002) observed that stakeholders have varied interests, obstructing their ability to determine clear choices and strategies. There is requirement of carefully observing the stakeholders with regard to their interest towards mobility in line with the firm's strategy.

Rowley and Moldoveanu (2003) suggests that stakeholders most likely to act together if it has (a) historical relationship, (b)internal cohesiveness among group member , (c) members with common value and (d) few members with conflicting interests.
The question has been answered by Choi and Shepard (2005) who demonstrated that stakeholders supports firms with old origin, legitimate, well reputed, reliable, accountable and flexible.
Hendry (2006) contends that stakeholders support the firm making significant impact in environment.

2.4.1.3. Firm actions and responses

The stakeholder's framework given by Freeman (1984) has strongly emphasized on the firm action and response. Freeman (1984) has furnished the four generic strategies for stakeholder management and pointed that the stakeholder can be cooperative or competitive for the firms. In the same line many other research was conducted and have furnished the answers to concerns, firms obtaining stakeholder support, stakeholder management, balance stakeholder interests

Addressing the first question several researches has suggested that stakeholder can help the firm through charity (Godfrey, 1995; Haley, 1991). Jones (1995) contended that trust and absence of opportunistic approach can enhance the stakeholder support. Although many studies has been conducted in the current area still the validation of various instrumental efficacy remains unverified.

Many studies have been conducted addressing the second question on stakeholders management. Brickson (2007) contended that the identity orientation is influential on stakeholder relationship. Rowley (1997) observed that the position of stakeholder determines the engagement of stakeholder. The central player are more engaged than less interconnected stakeholders. The life-cycle stage has significant impact on the stakeholder management strategies.

The last sub theme addresses the concern with respect to balancing of interests of stakeholders. Freeman (1984) contended that the role of management is to balance the interests of stakeholders. However Kaler (2006) found that the theory does not provide the basis for conflicting interests. Jensen proposes that managers should focus on "maximization of the long-run value of the firm as the criterion for making the requisite tradeoffs among its stakeholders" (2002).

2.4.1.4. Firm Performance

The research conducted for the current theme has provided solution to following inquiries:

(a) Is there any association between stakeholder management and financial performance of the firm?

(b) Is there any association between corporate social performance and stakeholder management? and

(c) Does the stakeholder management affects the organizational outcomes?

Answering the first inquiry the study points out that the firm's prospects can be improved utilizing stakeholder analysis and by anticipating and avoiding the unforeseen problems (Freeman, 1984). Freeman, 1984 states that stakeholders have concern for business processes rather corporate social responsibility.

Addressing the third inquiry, Roome & Wijen, 2005 have examined the organizational learning, innovation and the leadership with respect to stakeholder management. Another remakable study conducted in the area contributed from Schneper and Guillen (2004) have compared hostile takeover incidences in 37 countries, demonstrating an "increase in frequency with the extent to which shareholder rights are protected and decrease with the degree to which workers' and banks' rights are protected". The purview of stakeholder theory is vast. The

'Integrated Approach' indicates towards the theme of stakeholder thoery answering the on how to balance the interests of stakeholder which has been detailed in next section.

2.4.2 Stakeholder Theory: Methodology to Balance the interests of stakeholders

To manage the multiple stakeholders simultaneously in business, Freeman (1984) proposed the strategies of effective management of stakeholders. Stakeholder theory has evolved a lot in the line with management of stakeholders.

Rowley (1997) a firm is competent to stakeholder pressure when it is central player of business and association is weakly interconnected. The identity orientaion of firm determines the strength among stakeholders (Brickson, 2007). Freeman (1984) proposed that role of manager is to balance the interests of stakeholders. However the thoery do not provide the basis for deciding in case of conflicting interest (Kaler,2006). To overcome this flaw Jenson (2002) contended maximiation of firm value can be the basis to balance the stakeholder's interest. However the proposed hypothesis was contradicted by Schwartz (2006) and Beekun and Badawi (2005) contending it to be impragmatic and turn out to be utopian method. Hosseini & Brenner (1992) proposed use of analytical techniques to calculate a consistant weighing framework to balance these interest. The stakeholder analysis can be done bias free utiliing the anlytical approach (Reed et al., 2009).

Reed et al. (2009) contended that the stakeholder analysis method may have a specific purpose and may be insufficient to draw comprehensive view of stakeholder interests. Stakeholder analyses should be undertaken carefully and skillfully (Lynn, 1996; Bardach, 1998). Less attention has been given to examining the appropriate heuristics to balance the interests of stakeholders within the stakeholder literature.
The existing methods of balancing the interests of stakeholders can be classified into two broad class:

i) 'analytical categorizations' and
ii) 'reconstructive methods'

2.4.2.1 Analytical categorization

The observations of the phenomenon is conducted by others with their own perspective are termed as Analytical categorizations. Hence in such observations

Hare & Pahl-Wostl (2002) contends that firms are "embedded in some theoretical perspective on how a system functions". The analytical categorization has been very widely utilized for studies on cooperation, competition, threat, predictability, power, interests, power, urgency, legitimacy, outcome and relationships (Freeman, 1984;; Mendelow, 1991; Reed, 2009; Bryson, 2011). The analytical approach can be a valuable contribution to analysis of stakeholder provided it addresses the biasness.

2.4.2.2 Reconstructive categorization

Reconstructive method refers to observation of phenomenon by the firm on their own hence the analysis reflects the concern of the performing firm more closely (Reed, 2009). Contrary to above method the interviews or workshop is done to analyse the strategic perspectives to align the (Dale & Lane, 1994). "Policy discourse analysis" is the other way to identify the opinion discourse between the groups (de Bruijn & ten Heuvelhof, 2004). "Factor analysis" is also popularly utilized for analyzing of discourses (Barry & Proops, 1999). Reed (2009) contends that these methods are promising still needs to be tested and validated with regard to stakeholder management.

2.4.3 Gaps emerged from Stakeholder theory

The stakeholder theory has evolved into robust theory. However the theory has still failed to answer the question of how to balance the interests of stakeholders using the analytical techniques on the model stakeholders' interest and overall outcome.

In line with literature on stakeholder and communicative planning, it is important to understand the stakeholder. The integrated approach furnishing a holistic view of stakeholders interest involving multiple stakeholder interest are sparse (Key, 1999).

Stakeholder theory is perceived to handle the aspirations of all participants fairly (Phillips, 1997; Gioia, 1999; Trevino & Weaver, 1999). However, Mainardes et al. (2011) observes that stakeholder's contribution to firm varies making it tough to treat equally.

Hence the current tools developed for balancing the interests of stakeholders does not furnish the generic model but the available tools are made for specific purpose. For this reason, an integrated framework for stakeholders' balancing of interest has been developed in current study. The integrated framework will have both quantitative and qualitative approaches which may be tailored as per contextual utilizations.

The question of balancing stakeholder interests has been addressed by many research still the practical heuristics remain inconclusive and varied across the industry (Kaler, 2006). There is need to validate the efficacy of practical heuristics in managing stakeholders interest pertaining to specific industry. "An analytical approach can be a valuable addition to a stakeholder analysis, provided it eliminates the inherent biasness" (Reed et al., 2009). The theory has still failed to answer sufficiently on the question of how to balance the interests of stakeholders using the analytical techniques on the model stakeholders' interest and overall outcome. Also the processes that can balance the interests of stakeholders with an integrated approach handling multiple stakeholders on varied issues are sparse in literature, which has been contributed by the current study.

Addressing all gaps in stakeholder's theory discussed above, the current study contributes to the theory on three fold:

1. It furnishes a pragmatic analytical heuristics to balance the interest of stakeholders

The current research will be primarily investigating whether analytical heuristics is pragmatic tool to balance the interests of stakeholders. Earlier this tool was utilized by Hosseni & Bremer (1992) assessing the weight of stakeholder's on the basis of their value. However in current study the weight of prime stakeholder's interest will be determined in relation to overall goal of the phenomenon.

2. It is developing a method based on integrated approach which balance the interest of multiple stakeholders

   The integrated approaches designed for handling multiple stakeholders on varied issues are scanty which necessitates developing a method which balances the interests of stakeholders with holistic view (Key, 1999).

Hence the current study will be addressing the above gap by developing a model based on integrated approach for development of low cost regional airport in India. The proposed model will integrate the interests of external and internal stakeholders group to achieve overall goal. As the model represents the interests of primary stakeholders of the organization, it also contributes by developing an integrated approach for meeting of the overall goal of low cost airport development.

3. The efficacy of analytical heuristics has been checked on original model based on stakeholders' interests and overall outcome.

The current research contributes to the theme of how to balance the interests of stakeholders utilizing the Hosseni & Bremer (1992) approach of utilizing the analytical technique. Hosseni & Bremer (1992) utilized Analytical Hierarchy Process, an analytical heuristics, to generate value weight and matrix of stakeholders. The current research on same approach of utilizing AHP, will generate the weight of respective stakeholders interest in achieving overall goal of phenomenon.

2.5 Summary of Literature Review and Research Gaps

a. It has been observed that acute dearth of literature exists pertaining to studies on critical success factors with regard to low cost airport development. The related literature reviewed on the above topic has been sub themed as proliferation of low cost airlines, airport usages strategy of LCA, design characteristics of low cost airports, airport choice factors by LCA and success factors for the development of Indian low cost airport. There has been lack of literature on the current theme in both global and Indian context. There have been many studies signifying the growth of low cost airlines in air transport across globe and in Indian context. It is evident from literature that the LCA model is phenomenally growing across the world and especially in India. The impact of LCA growth on airline competition has been explored in literature but their impact on airport development and airport facilitations for LCA has not been explored.

There have been studies conducted on changing airport usages strategy of low cost airlines. In global context a lot of studies have been conducted in USA and Europe, facilitating the findings that the LCA have started utilizing mixed model therefore

started using primary airport rather secondary airport. The changing pattern of airport usages by LCA in these countries necessitates for dynamic airport planning. However in Asian contexts a few literatures points that the lack of secondary airports was the major challenge for LCA. A few literatures have identified the existence of secondary airports however observed them to be expensive, ill-equipped and inconvenient for LCA operations. It is observed that there is complete dearth of research pertaining to strategy being adopted by airports targeting the LCA in Asian and Indian context.

The third sub theme identified in literature is related to tenets and characteristics of low cost airport. In global context there have been studies conducted to identify the characteristics of secondary and low cost airports. The studies have identified the typical physical characteristics and configurations of low cost airports however it has been found that these characteristics varies geographically and is moreover situation driven. As the development of low cost airport is new in India there is no study conducted on the above theme which need to be explored and identified.

Due to lack of study in the current area, the literature pertaining to the sub theme 'airport choice factor by LCA' has been utilized to identify the success factor for development of low cost airport. There have been many studies conducted in the current sub-theme in global context giving the requirement of LCA from the airport. It is observed that the airport choice factor is market driven and varies geographically. In Indian context no study has been conducted to identify the requirement of LCA from the airports.

There is acute lack of study identifying the key success factors for the development of low cost airport in India. However, the review of literatures have identified few articles and reports in which the opinion of experts on characteristics and physical configuration suitable for development of Indian low cost airports have furnished. However it is observed that the findings of the studies are not 'comprehensive' and 'integrative'. The existing literatures on the study are particular stakeholder oriented. They lack the integrated approach of developing the pool of factors which is win-win for all primary stakeholders. Also the study has identified few factors related to airport strategy and physical character. Many important factors have not been identified in the study.

b. There are plenty of studies furnishing evaluation model for prioritizing of the key success factors. The most recent evaluation models incorporate the mechanism of

addressing the limitation of gauging human subjectivity in the prioritization process. The Fuzzy logic based method has been adopted to address the limitations. There are many studies using the Fuzzy logic based models to precisely evaluate the factors which have been utilized by global authors in varied industry. Fuzzy logic based MCDM evaluation model such as AHP, GMIR, ANP, ANN, DEMANEAL, DEMATEL, VIKOR, TOPSIS, MILP, ISM methods has been utilized to evaluate models related airline safety, airline service quality, airport service quality, Logistics, third party reverse logistics, third party logistics. However the evaluation models are not modified for the utilization in development of low cost regional airport context.

In Indian context various evaluation Fuzzy logic based MCDM model such as AHP, VIKOR, TOPSIS, MILP, ISM methods has been utilized for prioritization of third party reverse logistics, ranking of airports, battery manufacturing, garment and outsourcing industry. However, there is absence of evaluation model to prioritize the key success factors of low cost regional airport. Since the prioritization of factors is moreover based on human subjectivity necessitating the removal of imprecision caused due to human subjectivity involved in the process. There has been absence of study pertaining to development of evaluation model for key success factors of Low cost regional airport addressing the imprecision involved due to human subjectivity.

c. There has been no research either in global or Indian context furnishing the framework for the development of low cost regional airport by managing the diversified interests of primary stakeholders of the airport. The review of literature has identified few studies furnishing the success factors for the development of regional airport and aerotropolis in global context. However, no study has been found in the literature survey related to Indian context.

The studies reviewed in the current theme have identified the success factors for the development of regional airport which includes the rapid expansion of routes, strong growth in demand, and the recognition of the airport's quality by its users. Some of the studies reviewed have identified the critical factors for the development of an airport city. However there is complete lack of study furnishing a comprehensive framework for low cost regional airport development. From theoretical view point there is lack of literature pertaining to pragmatic heuristics for balancing of stakeholder's interests. The study develops the framework for the development of low cost regional airport based on 'integrated-approach', balancing the interests of primary stakeholders.

Chapter 3: Research Method

After identification of research gaps from literature and theory, the current chapter has established the objectives of the study and details the methods adopted for each objective.

3.1 Research Questions

Based on the identified gaps in review of literature, the current study aims to address following questions:

1. What are the success factors which help in development of the Low Cost regional airports in India?
2. How to evaluate the key success factors for the development of Low Cost regional airports?
3. What should be the integrated framework for development of Low Cost regional airports?

3.2 Research Objective

Based on research questions, the objectives of the current study are:

1. To explore and identify the success factors which help in development of an Low Cost regional airports in India.
2. To identify the evaluation model for prioritization of the success factors which help in development of the Low Cost regional airports.
3. To devise an integrated framework for development of the Low Cost regional airports in India.

3.3 Research Problem

As the developed low cost regional airports have become non-operational in India, there is immense need to understand the key success factors for development of Low Cost regional airport integrating the interests of all stakeholders. The study would also attempt to devise a framework for development of the Integrated Low Cost regional airports in India.

3.4 Research Design

3.4.1 Research Design for Objective 1:

"To explore and identify the success factors which help in development of an Low Cost regional airports in India"

The above objective demands to employ qualitative and exploratory research method. As the low cost airports are not operational in India, hence we utilize the opinion of expert member who are senior executives working with primary stakeholders of airport through semi structured interview. The interview shall cover the questions pertaining to the characteristics, strategy and factors considering other stakeholders interests for the development Low Cost Regional Airports and shall discuss their suitability in Indian context. The discussion shall include the conceptual lens depicted in Figure 4 the analytical hierarchy structure for low cost regional airport. The discussion will remain open ended and will not be only limited to the items given in Analytical Hierarchical structure below.

The number of experts to be interviewed depends on saturation level. Purposive sampling method shall be utilized. Thematic content analysis will be used on transcript obtained from group discussion to explore the success factors for development of Indian low cost regional airports.

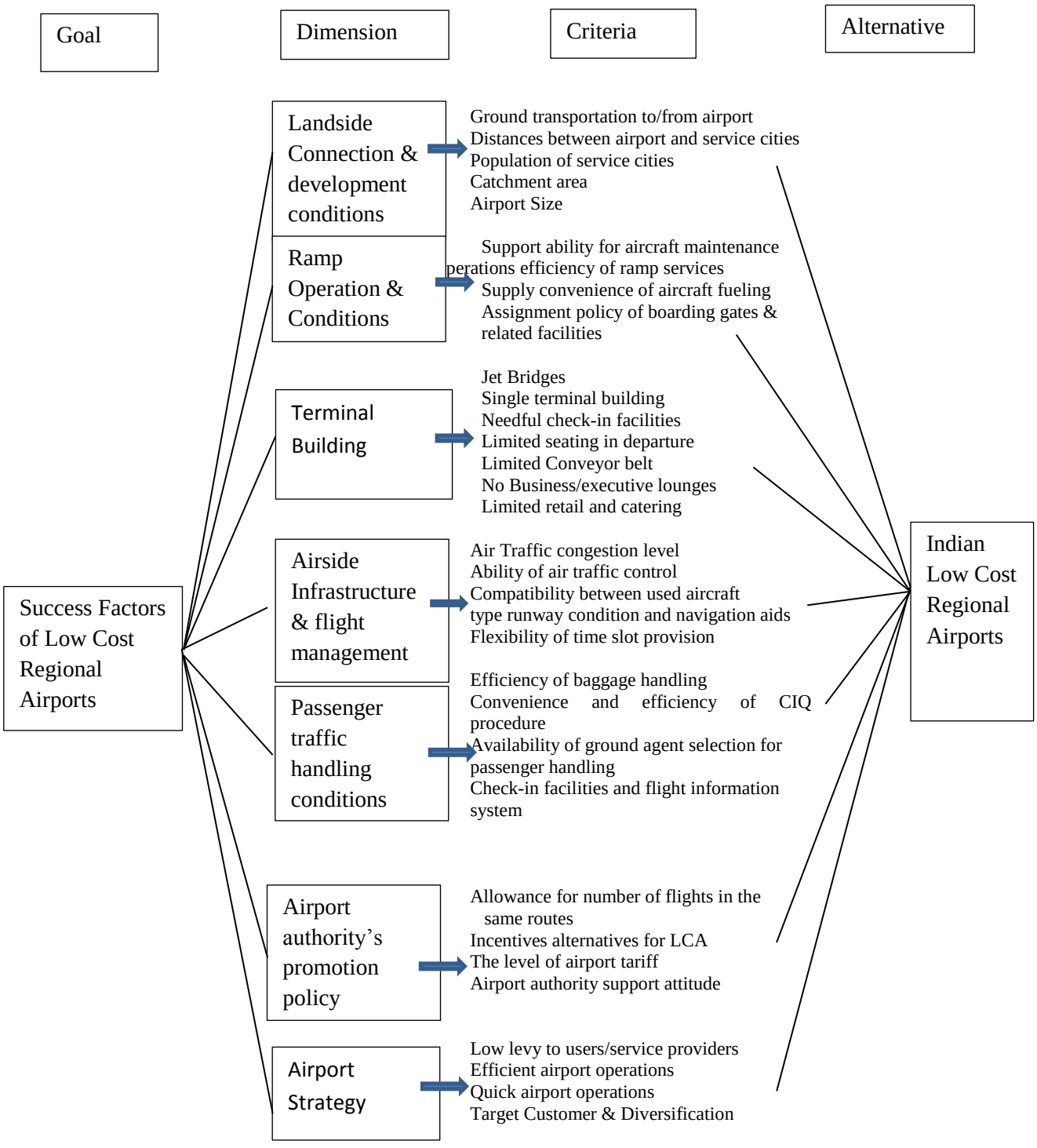

Figure 4: Hierarchical analysis structure for evaluation of the success factor Low Cost Regional Airports

Research Design for Objective 2:

To identify the evaluation model for prioritization of the success factors which help in development of the Low Cost regional airports.

To operationalize the above objective the quantitative research methods will be employed. On the basis of identified success factors an analytical hierarchy structure shall be framed which shall be utilized to develop the questionnaire for survey with airport executives. This research employs Purposive sampling method. It utilizes both judgments sampling and quota sampling. Cooper & Schindler (2003) stated that "Judgment sampling is fruitful to find the right respondents to provide advantageous information". Sekaran (2003) contends "Quota sampling is appropriate to ensure the adequacy of respondent groups".

The sample size would be 5-8 times the number of variables (Hair et al, 2009). Hence the minimum sample size for above analysis should be at least of 200. For which 240 respondents were approached out of 220 have responded with response rate success of 91.66%. The number of respondents to approach would be in deviation of 20% of sample size. The data would be collected by mailing the questionnaire or One to one interaction and filling up the questionnaire. The collected data will be analyzed utilizing Fuzzy based MCDM method to evaluate and rank the respective item as per their respective importance. Fuzzy MCDM has been utilized as it helps to measure the subjective judgments with precision by utilizing the overlapping boundaries of rating rather than crisp numbers.

A fuzzy set is interval based overlapping boundaries based linguistic scale of membership function. Mathworks (2012) defines a "membership function (MF) as a curve that explains how each point in the input space is mapped to a membership value (or degree of membership) between 0 and 1".

The importance of success factors has been measured using the linguistic variables. The linguistic variables are represented in form of triangular fuzzy numbers as indicated in Table 2.

Table 2: Importance Scores of Success factors

Not at all important	(0.0, 1.0, 2.0)
Slightly Important	(1.0, 2.0, 3.0)
Moderately Important	(2.0, 3.0, 4.0)
Very Important	(3.0, 4.0, 5.0)
Extremely Important	(4.5, 5.0, 5.0)

The multiplication of the two triangular fuzzy numbers is done utilizing the operation indicated in equation (Pandey, M., 2016).

$$A1 \otimes A2 = (l1, m1, u1) \otimes (l2, m2, u2) = (l1l2, m1m2, u1u2)$$

Equation 5.

In line with the study of Chien-Chang (2012) the importance score of criteria has been fuzzified utilizing equation 6 using graded mean integration representation.

$$P(Y1) = \frac{1}{6}(c1 + 4a1 + b1) \qquad \text{Equation 6.}$$

Further the triangular fuzzy number were defuzzified by employing the inverse function arithmetic presentation as indicated in equation 7.

$$AWi = \frac{\sum_{n=1}^{N} win}{\sum_{i=1}^{I}\sum_{n=1}^{N} win} \qquad \text{Equation 7.}$$

Research Design for Objective 3:

"To devise an integrated framework for development of the Low Cost regional airports in India."

The integrated framework refers to developing the common goal of airport development and operation by integrating the interests of the key/primary stakeholders namely airport organizations related to management and operations, air carriers, government, regulators, service providers including ground handler, air traffic control, fuel operator, concessionaires, consultancy and catering.

Qualitative research method will be employed for the above objective. On the key success factor evaluated from objective 2, Fuzzy AHP method will be employed to obtain the framework for the development of the integrated low cost regional airport

Purposive sampling, a nonprobability sampling method encompassing both Judgement sampling and quota sampling will be utilized for data collection. Cooper & Schindler (2003) stated "Judgment sampling is fruitful to find the right respondents to provide advantageous information". Sekaran (2003) stated "Quota sampling is appropriate to ensure the adequacy of respondent groups".

The data collection for the current objective will be done through structured interview of expert group comprising senior executives working with primary stakeholder of the airport. The sample size for interview depends on the saturation level of the response obtained. The response sheet obtained from interview consist of pairwise comparison of success factors utilizing the linguistic variable defined in table 3.

The five steps implemented for Fuzzy AHP analysis is depicted below.

Step 1: Measuring the importance of the factors and dimensions

The respondent compares the criteria utilizing the linguistic variables depicted in Table 3.

Table 3: Linguistic variables used for pairwise comparison

Linguistic Variables	Assigned TFN
Equally Important	(1,1,1)
Weakly Important	(2,3,4)
Fairly Important	(4,5,6)
Strongly Important	(6,7,8)
Absolutely Important	(9,9,9)
Intermittent Values between two adjacent scales	(1, 2, 3) (3, 4, 5) (5, 6, 7) (7, 8, 9)

A transcript obtained from structured interview is represented in form of a pair-wise comparison. The scale depicted in table 3 is used to indicate the relative importance of each attributes. 10 senior executives from aviation industry working within the airport service boundary with organization such as airport, airline, consultancy, regulators, government and concessionaires in India has been interviewed for their rating.

Step 2: Average the response obtained from all respondents

The preferences of all respondents are averaged and (d_{ij}) is calculated utilizing the equation 8 below.

$$\text{dij} = \sum_{k=1}^{K} \text{dij} / K \qquad \text{Equation 8}$$

Step 3: The Averaged preferences are depicted in single pairwise comparison matrix and TFN values are de-fuzzified using centre of area method.

$$P(Y1) = \frac{1}{6}(c1 + 4a1 + b1)$$ Equation 9

Step 4: The geometric mean of each row is calculated using the equation 10 and normalized to obtain the weight of each criteria.

$$\tilde{r}_i = \left(\prod_{j=1}^{n} \tilde{d}_{ij}\right)^{1/n}, \quad i=1, 2,....,n$$ Equation 10

Step 5 The consistency check has been done in the last step. Utilizing the equation AW=λmax W largest eigen value is calculated.

The consistency index is calculated by equation and consistency ratio (CR) is calculated by equation where RI stands for random index. As thumb rule the consistency ratio of less than 10% indicates consistent matrices.

$$\boldsymbol{CI = \frac{\lambda max - n}{n-1}}$$ Equation 11

$$\boldsymbol{CR = CI/RI}$$ Equation 12

Rationale of Using Fuzzy AHP based Evaluation Model:

The reasons of utilizing the Fuzzy AHP based method for the current objective is summarized below:

1. The AHP model decomposes the problem into a hierarchical structure which enables the decision makers/stakeholders to have holistic view of problem encompassing dimensions, criteria and alternatives (Darvish et al., 2009).

2. **Q**uantifying the qualitative variables enables AHP to remove biasness in decision making (Partovi, 2001).

3. By using pairwise comparison features, the AHP allows for many objectives to be simplified to individual choices. Pairwise comparison will make assigning weights much easier for participants because only two objectives are being compared at any one time.

4. The pairwise comparison makes it easy to identify the elements of a problem.

5. AHP provides an inconsistency check test that enables the elimination of illogic or rush answers (Coyle, 2004).

6. AHP method represents a consensus of experts. Lee et al. (2007)

7. Availability of support commercial AHP software makes the calculation easy and provides many show tools for quick viewing of the results.

8. Gass & Rapcsák (2004) stated "AHP method has been accepted as a leading multi-attribute decision model both by practitioners and academics". Pohekar & Ramachandran (2004) contended "AHP method in the rank-order weighting method is more and more prevalent because of its understandability in theory and the simplicity in application". Many researcher concluded AHP as a better decision-making method.

The AHP method seems attractive because the pairwise comparison form of data input is straightforward and adequate. However, the rank reversal problems have caused some limitation, where rank reversal refers to the fact that when new additional alternative added to the candidates alternatives which does not change the range of outcomes of any criteria may lead to a change in the ranking of the other alternatives (Belton and Stewart, 2002). AHP is considered among a wide range of application areas in being an excellent research method tool.

Table 4: Objective wise research methods

Objectives	Research Method	Population	Sample Size	Sampling Technique	Data Collection Tools	Data Analysis
To explore and identify the success factors which help in development of an Integrated Low Cost regional airports in India.	Qualitative	All Primary stakeholders of airport excluding passengers	10	Purposive	Semi Structure Interview	Thematic Content Analysis
To evaluate the success factors which help in development and operationalization of the Low Cost regional airports.	Quantitative & Qualitative	All Primary stakeholders of airport excluding passengers	220	Purposive	Questionnaire	Fuzzy MCDM (GMIR)
To devise an integrated framework for development of the Low Cost regional airports in India.	Quantitative & Qualitative	All Primary stakeholders of airport excluding passengers	10	Purposive	Structured interview	Fuzzy AHP

Chapter 4: Success Factors for Low-Cost Regional Airport Development

The current chapter presents the findings pertaining to first and second laid down objective of the study. It identifies the success factors governing low cost regional airport development in India and furnishes the evaluation model to prioritize the identified factors utilizing Fuzzy based MCDM method.

With respect to first objective of the study the conceptual lens has been explored from literature depicted in Figure 1. The variables shown in the figure has been identified as the key success factors governing the low cost regional airport development in India. These variables need to be verified for its relevancy in Indian context. The inductive and deductive analysis of interview transcripts received from the expert group has also resulted in incorporation new conceptual variables in the construct. The variables identified are further evaluated utilizing the Fuzzy based MCDM model to render the prioritized variable for the development of low cost regional airport in India. The chapter further discusses the implications of the findings.

The first objective of the study is to explore and identify the success factors which help in the development of integrated low-cost regional airports in India. For the above pertaining as indicated in the methodology, 15 senior executives have been approached; but only 10 senior executive participated in the interview. The executives interviewed were working at leadership position in airport service organizations which are considered to be primary

stakeholders of the airports. The interviewed executives' details are depicted in the table below.

Table 5: Profile of Interview respondents

Organization	Position	Number of respondent
Ministry of Civil Aviation India	Advisor	1
Airport Authority of India	Executive Director (Planning) General Manager Airport Manager	4
Indigo airlines	Vice President	1
Spicejet Airlines	Vice President	1
NACIL	Vice President	1
Delhi International Airport Pvt. Ltd.	Vice President	1
CAPA India	CEO	1

The above respondents were interviewed by online mode via skype and personal meeting. Recruitment of respondent consisted of a purposive sampling strategy. Biernacki & Waldorf (1981) contends that "Snowballing", in which the selection of participants was done through peer referral. The respondents' working at leadership and senior executive positions was individually judged before approaching them for response which ensures the credibility of information furnished. At every stage extreme care was employed to ensure confidentiality. In the course of analyzing transcript and data alphanumerical codes were used ensuring anonymity. Prior consent from each respondent was undertaken with right to withdraw at any point of data collection.

Measures: Data collection utilized semi-structured interviews of respondents. The interview consisted of 13 questions indicated in the Appendix,

incorporated through deductive analysis of literature indicated in Figure 1 as conceptual lens for objective 1. The interview also consisted of open ended questions which further help to explore new variables through inductive analysis.

Transcript Analysis: On the transcript recorded from interview we utilized the thematic content analysis using Atlas ti version 8. The definition for each code was clearly depicted initially in hierarchical structure. The codes were revised during analysis. The finalized codebook consisted of 41 codes classified in 8 groups (Appendix B).

Semantically similar codes revolving around same facet were aggregated in same theme. Thematic formation was done on basis of frequency counts, pre-grouping into sub-themes, reorganizing of overarching themes (Braun & Clarke, 2006). Throughout the process has maintained the flexibility revising the codes where it was necessary. Checking over data, recoding and rechecking was utilized to enhance the reliability of codebook.

The result of thematic content analysis is reported in figure 5. The italicized variables has been incorporated through inductive approach of analysis while the variable indicated in normal font are incorporated on the basis of deductive analysis of literature and verified through interview.

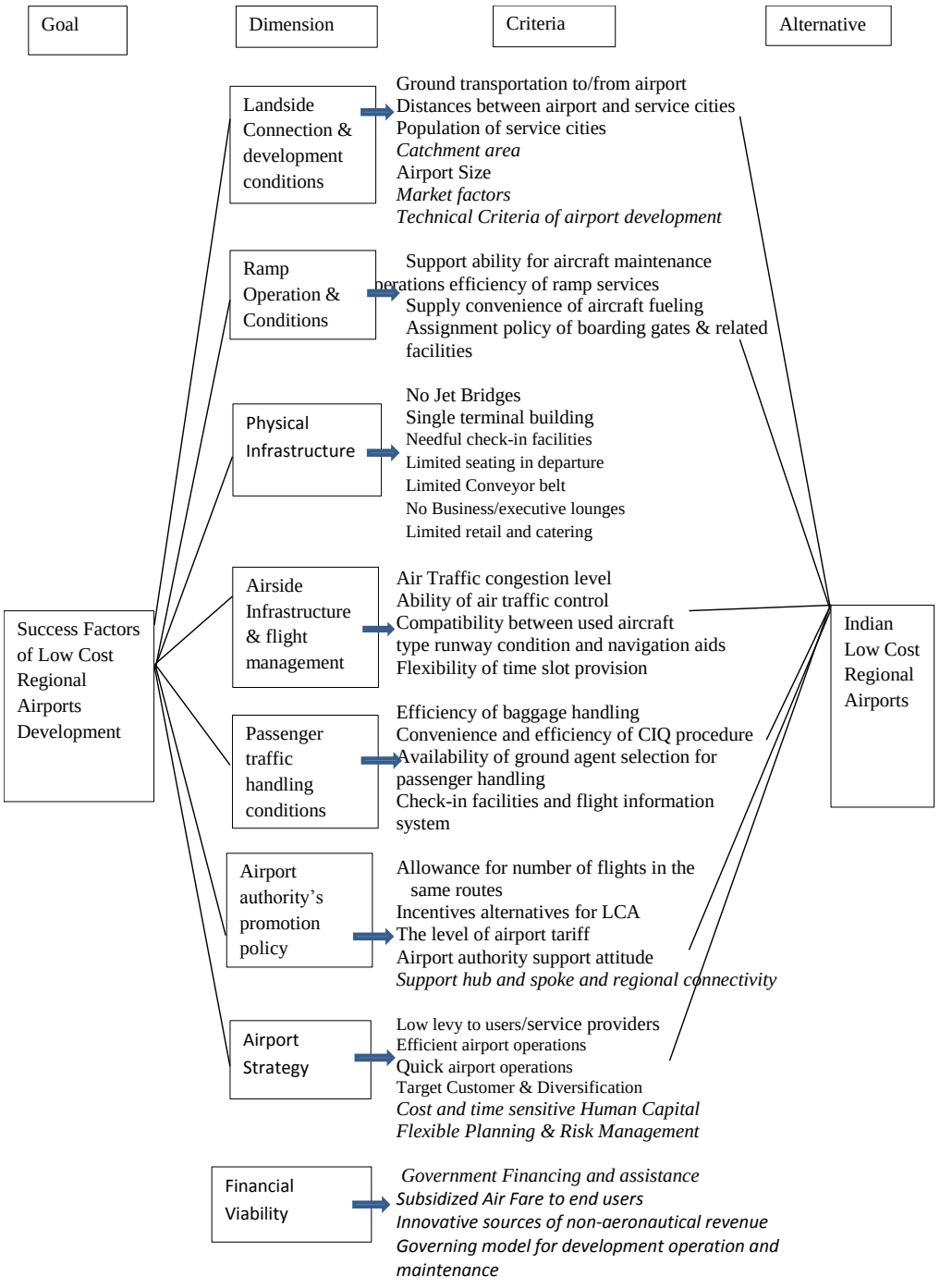

Figure 5: Results of Thematic Content Analysis for objective 1

4.1 Landside connection and development condition

The first dimension, Landside connection and development condition (D1), has been clubbed with the factors which are related as pre-requisite conditions

necessary for the development of airports. The first factor, 'Ground transportation to/from airport' (C1) has obtained the frequency count of 6 signifying its importance as success factor of low cost airport development. The factor C1 stresses on the importance of accessibility of the airport from passenger. Also, it emphasizes on the need of the seamless connectivity of airport with the potential catchment area.

The second factor 'Distance between airport and service cities' (C2) has obtained the frequency count of 5 in transcript content analysis signifying the relevance of criteria for low cost airport development in India. Usually the low cost airport may be located far away from main city with purpose to enhance non aeronautical revenue through car rental and parking also with purpose to reduce the land acquisition cost for airport development.

The third factor Population of service cities has obtained the frequency count of 5 depicting the importance of criteria in success of low cost airport development in India. The population of service cities is used as key criteria to estimate the potential demand of air travel. Hence adequate population of service cities is important to be evaluated prior to initiating low cost airport development.

Catchment area (C4) is the fourth factor grouped in the dimension 'Landside Connection & development Condition' with high frequency count of 11 obtained from content analysis of the interview transcript. Since C4 is the specific criteria utilized to estimate the potential demand of air travel in area on the basis of the per capita income and population size. As it is the key criteria to estimate the demand of air travel hence respondent have emphasized on the same.

The fifth criteria under the dimension D1 is 'airport size' (C5). Although C5 is indicated towards the extent of infrastructure to be deployed for low cost airport development still the respondent has less emphasize the relevancy of the criteria with the obtained the frequency count of 1 from content analysis of the interview transcript.

‘Market factors’ (C6) is the sixth factor grouped under dimension D1 obtaining the frequency count of 10 from the content analysis. The high frequency count of the criteria indicates towards the strong relevancy of the factor for success of low cost airport development in India. As the criterion is directly related to demand of air travel hence it gets high relevancy core in the construct.

The seventh factor clubbed under the dimension D1 is ‘technical criteria for airport development’ (C7). C7 has obtained the frequency count of 7 in the content analysis of the interview transcript. The ‘technical criteria for airport development’ refers to the factors which are considered in the feasibility study of airport development. As the compliance of these criteria is mandatory hence the criteria has obtained high frequency count signifying its importance.

4.2 Ramp Operations & Conditions

The second dimension Ramp operations and conditions consists of four criteria. The criterion ‘support ability for aircraft maintenance’ (C8) has obtained frequency count of 1 in the content analysis of the interview. The lower frequency count of the criterion is indicating less significance of the same. Similarly, the criteria ‘operations efficiency of ramp services’ (C9) and ‘supply convenience of aircraft fueling’ (C10) have the frequency count of one. The criterion ‘assignment policy of boarding gates & related facilities’ (C11) has obtained the frequency count of 2 in the content analysis of the interview.

4.3 Physical Infrastructure

The third dimension ‘Physical Infrastructure’ includes the factor representing the physical characteristics of the low cost regional airport. The criterion ‘No jet bridges’ (C12) has obtained the frequency count of 8 signifying the importance of factor in the low cost regional airport development. The

criterion C12, helps not only to reduce the capital expenditure but also facilitates the low cost airlines in reducing in the turnaround time.

The second criterion of the dimension 'single terminal building' (C13) has obtained the frequency count of 9, in the content analysis stressing its importance. The high frequency count of the criterion has been attributed to the need of keeping low capital expenditure and maximizing the efficiency of the resource deployed.

The criterion 'Needful check-in facilities' (C14) has obtained the frequency count of 7. The high score is signifying the importance of the factor and has been stressing on the maximizing the efficiency of the resources deployed.

The fourth criterion of the dimension 'Limited seating in departure' (C15) has obtained the frequency count of 8, showing its importance as factor for low cost regional airport development. The departure area receives the passengers departing from the airport and the passengers intend to get prompt check in facilities and other service. Hence in planning limited number seats will help in avoiding unnecessary cost to airport.

The fifth criterion of the dimension 'Physical infrastructure' is Limited conveyor belt' achieving the frequency count of 8 indicating the importance of the factor. The deployment of the limited number of conveyor belt will facilitate the reducing the capital expenditure and maximizing the capacity utilization.

The criterion 'No business/executive lounges' (C17) has obtained the frequency count of 4 indicating that the low cost airport may not like to provision the business and executive lounges in the terminal as LCA passengers may not like to sacrifice high price and facilities may remain under-utilized.

The last criterion of the current dimension is 'Limited retail and catering' (C18) has obtained the frequency count of 6 signifying the importance of the criteria. The LCA passengers prefer the catering facilities with reasonable price and many a times they will prefer receive the prompt necessary terminal

process so as to enable them to fly. Hence provisioning of too much catering retail outlets may be distractors in the passenger handling efficiency of the airport.

4.4 Airside Infrastructure and Flight Management

The current dimension accumulates the criteria related to airside of the airport. Four criteria, Air traffic congestion level (C19), Ability of air traffic control (C20), Compatibility between used aircraft type runway condition and navigation aid (C21) and Flexibility of time slot provision (C22) has been identified from literature survey has been verified for its relevance in Indian context. The frequency counts obtained upon transcript analysis is 3, 10, 3 and 1. Ability of air traffic control has been stressed by all respondents. They pointed that unnecessary air side infrastructure should be avoided for low cost airport development.

4.5 Passenger traffic handling conditions

The passenger traffic handling conditions consists of criteria Efficiency of baggage handling (C23), Convenience and efficiency of CIQ procedures (C24), Availability of ground selection for passenger handling (C25) and Check-in facilities and flight information system (C26) all of which have been identified in literature review and have been verified for their relevance in Indian context. The frequency counts of the respective codes obtained from transcript analysis is 7, 7, 1 and 4. It has been observed that criteria C23, C24 and C 26 have obtained high respective frequency counts. While the criteria C25 has been less relevant to Indian context.

4.6 Airport Authority's Promotion Policy

The current dimension consists of criteria which incentivize the airlines to operate from the low cost regional airports. It includes the criteria: Allowance for number of flights in same route (C27), Incentive alternatives for LCA (C28), The level of airport tariff (C29), Airport authority's support attitude (C30) and Support hub and spoke and regional connectivity (C31). All of the criteria have been identified from literature survey except C31 which has been

inducted through interview. The frequency counts for the criteria C27, C28 C29, C30 and C31 are 1, 3, 3, 4 and 5. The criteria C31 has been stressed by many experts pointing that the location of regional airports should support the airlines network strategy.

4.7 Airport Strategy

The dimension airport strategy consists of criteria related to strategy of airport in its offering to stakeholders which includes the criteria: Low levy to users (C32), efficient airport operations (C33), Quick airport operations (C34), Target Customer and Diversification (C35), Cost and time sensitive human capital (C36) and Flexible planning and risk management (C37). The transcript analysis of interview resulted in frequency counts of 8, 9, 7, 1, 12 and 2 for criteria C32, C33, C34, C35, C36 and C37 respectively. The criteria C36 and C37 have been inducted through interview while rest of the criteria have been incorporated on basis of literature survey and verified for relevancy in Indian context through interview. The Criterion C37 has the least frequency count pointing that above criteria is not very pertinent from Indian aviation context while rest of criteria attain high frequency counts.

4.8 Financial Viability

The dimension financial viability refers to all criteria which are important to be met to make the low cost regional airport financially feasible. It includes criteria: Government financing and assistance (C38), Subsidized air fare to end users(C39), Innovative sources of non-aeronautical revenue (C40) and Governing model for development operations and maintenance (C41). The criteria obtained the frequency counts of 10, 6, 7 and 8 for criteria C38, C39, C40 and C41 respectively. The high frequency of the criteria indicates their high importance for development of low cost regional airport in India.

4.9 Findings for Objective 1:

The first objective of the study aimed at identifying the success factors of low cost regional airports in India. The expert team constituted for interview included all representatives lying in airport service boundary for

example airlines, airports, government, regulators and consultancies integrating the interest of all stakeholders. The thematic content analysis of interview resulted in the development of analytical hierarchical structure showing the dimensions and criteria governing the success of low cost regional airport development in India. Although conceptual lens was taken from existing literature on the topic yet the interview resulted in identification and incorporation of following significant criteria:

a. Catchment area
b. Market Factors
c. Technical criteria for airport development
d. Support hub and spoke and regional connectivity
e. Flexible Planning & Risk Management
f. New generation human capital
g. Government financing and assistance
h. Subsidized air fare to end users
i. Innovative sources of non-aeronautical revenue
j. Government model for development operations and maintenance

All these criteria have been designated with appropriate dimensions. The finalized AHS have depicted in figure 2.

The first dimension Landside connection and development of airport has seven criteria of which criteria catchment area (C4), market factors (C6) and technical criteria for airport development (C7) have been included in the construct on the basis of transcript analysis. Rest of the criteria identified from literature very found relevant in Indian context. The criteria Airport size has obtained low frequency count in transcript analysis as in Indian context the airport size for low cost regional airport has to be small as market is infant

therefore criteria has been less relevant in Indian context. Although airport size has been as important consideration for low cost airlines as identified in the study of Warnock-smith (2015); however found to be less important in Indian aviation context.

For the second, third, fourth and fifth dimensions namely Ramp operations and condition, Physical Infrastructure, Airside Infrastructure and flight management and Passenger traffic handling conditions, none of the new variables have been identified in the transcript analysis of the interview. However, all the variables incorporated through deductive analysis of literature were verified to be relevant to the pertaining. However criteria supportability for aircraft maintenance (C8), Operational efficiency of ramp services (C9) and Supply convenience of aircraft fueling (C10) have obtained very less frequency counts. These criteria have been significant factor to attract low cost airlines at Taiwanese airport as observed by Lu and Mao (2013). However the same factors appear to be less relevant as factor for development of low cost regional airport development in India.

Similarly for criteria flexibility of time slot provisions has attained the frequency count of 1, indicating to be a weak predictor for the objective which is contrary to the study of Adler & Berechment (2001); Graham (2001); Gillen and Lall (2004) and Warnock-Smith & Porter (2005) where the above factor has been found a promising criterion for success of low cost airport.

In the sixth dimension Airport authority's support attitude, the transcript analysis of interview have resulted in incorporation of one new criteria 'support hub and spoke network and regional connectivity' (C31) with frequency count of 5 indicating to be pertinent variable in Indian aviation context. This criterion is important in Indian aviation context because it is very important for new low cost regional airports to support the interests of their primary stakeholder i.e. airline on meeting their network strategy. Apart from this the criteria allowance for number flights on same route has attained less frequency count indicating to be less relevant in Indian aviation context.

The seventh dimension airport strategy has obtained six criteria relevant on the basis of frequency counts of interview's transcript analysis. The two criteria Cost and time sensitive human capital (C36) and Flexible planning and risk management (C37) are newly inducted criteria obtained by transcript analysis suitable for Indian context while other four criteria are verified to be relevant as measure for success of low cost regional airport development in India. The respondent emphasized on need of fostering the development of appropriate human capital who can address the need of airport in flux with environment.

The criteria Target customer and diversification (C35) has obtained the least frequency count making it as less relevant measure for the pertaining. This finding of the study is contrary to finding of Lu and Mao (2015) in which it has been identified as influential factor for low cost airlines attractiveness at Taiwanese airport.

The eighth dimension financial viability reported with maximum frequency count in the transcript analysis. All the associated variables namely Government Financing and assistance, Subsidized Air Fare to end users, Innovative sources of non-aeronautical revenue and Governing model for development operation and maintenance has attained the maximum count emphasizing their importance which resulted to include them in model on the basis of inductive analysis.

4.10 Evaluation of Success Factors for Low Cost Regional Airport Development

The second objective of the study is to evaluate the success factors which help in development and operationalization of the Low Cost regional airports. For the current pertaining Fuzzy Graded Mean Integration Representation MCDM method has been utilized, the results of the analysis are summarized in Table 2 which reveals the evaluated construct for the development and sustenance of Low-Cost Regional Airports in India.

Out of the eight dimensions, the dimension financial viability has attained the highest importance weighted score of 0.0258, followed by Physical Infrastructure with score of 0.0254. Airport's promotion policy has scored third highest rank with weight of 0.0253. The dimension airport strategy obtained the weighted score of .0246. The dimension landside & development condition has attained the fifth rank with weighted score of 0.0244. The dimensions, Airside infrastructure & flight management has attained sixth rank with weighted score of 0.0233. Passenger traffic handling condition has been ranked seventh with weighted importance score of 0.0229. The dimension Ramp operation & condition is the eighth and last ranked with weighted score of 0.0224.

The dimension 'Financial Viability' is the highest ranked in terms of weighted score which is attributed to high importance score attained by its corresponding criteria Government Financing and assistance (C38), Subsidized Air Fare to end users (C39), Innovative sources of non-aeronautical revenue (C40) and Governing model for development operation and maintenance (C41) with importance score of 4.56, 4.36, 4.47 and 4.48 respectively.

The high weight of the dimension Physical Infrastructure is attributed to the importance designated by the respondents to all the factors of the dimension. It is observed that all the criteria of the dimension terminal building have attained high importance score. The criteria 'No Jet Bridges' (C12), 'Single terminal building' (C13), 'Needful check-in facilities' (C14), 'Limited seating in departure' (C15), 'Limited Conveyor belt' (C16), 'No Business/executive lounges' (C17) and 'Limited retail and catering' (C18) have scored 4.50, 4.46, 4.35, 4.32, 4.27, 4.34 and 4.46 respectively. The high weight obtained for all the factors of the dimension signifies the need to keep the low investment cost and efficient operations in airport development.

The dimension airport's promotion policy stands at third highest rank because of the exceptionally high importance score of the criteria 'level of airport tariff (C29)' 'Airport authority support attitude'(C30) and 'Support

Hub and Spoke' (C31) with 4.54, 4.52 and 4.46 respectively. The criteria Allowance for a number of flights in the same routes (C27) and Incentives alternatives for LCA (C28) have scored 4.07 and 4.33 respectively. The low levy of airport tariff and airport authority support attitude act as an enabler for the airport users. The supportive attitude of airport operator helps the airlines to maintain their efficiency apart from low levies which eventually catalyze the development of regional air transportation.

The fourth highest weight has been attained by dimension 'Airport Strategy'. The criteria 'Cost and time sensitive new generation human capital' (C36) 'Low levy to users/service providers' (C32), 'Efficient airport operations' (C33) and 'Flexible planning and risk management' (C37) with a score of 4.27, 4.27, 4.34 and 4.44 respectively. While the criteria 'Quick airport operations' (C34) and 'Target customer and diversification' (C35) has attained the score of 4.25 and 3.94 respectively. It can be inferred that the key stakeholders opine that low levy from airport users and efficient airport operations are a key success factor for the low-cost regional airport in India.

'Landside Connection & development' has high importance comprise of criteria 'Market Factor' (C6), 'Technical Criteria' (C7) 'Population of service cities' (C3), 'Catchment area' (C4) and 'Airport Size' (C5) with scores of 4.52. 4.49. 4.26, 4.30 and 4.2 respectively. While the criteria Ground transportation to/from the airport (C1) and Distances between airport and service cities (C2) have obtained the importance score of 3.91 and 3.80 respectively. It is inferred that demand for air travel is the key criteria for success of low-cost regional airports hence the factors such as C6, C3, C4 and C5 have obtained a good weight. Definitely the 'technical criteria' C7 is must for development of the airport hence attained the high score. The identified criteria should be assessed effectively for the success of low-cost regional airports in India.

The sixth-ranked dimension is 'Airside Infrastructure and flight management' has attained high importance comprising of criteria 'Compatibility between used aircraft type, runway condition and navigation aid' (C21) and 'Flexibility of time slot provision' (C22) with a score of 4.31 and 4.19 respectively. The criteria 'Air traffic congestion level' (C19) and

‘ability of air traffic control’ (C20) has scored 3.43 and 4.22 respectively. It can be inferred that efficient air traffic control services are required at Low-cost regional airport. Also, the congruency between aircraft type of the prospective LCA and airside facilities need to be established.

The dimension ‘Passenger traffic handling conditions’ has obtained the seventh rank on the basis of criteria ‘Efficiency of baggage handling’ (C23) with a score of 4.44. While the criteria ‘Convenience and efficiency of CIQ procedure’ (C24), ‘Availability of ground agent selection for passenger handling’ (C25) and ‘Check-in facilities and flight information system’ (C26) has attained the score of 3.88, 3.5 and 4.03 respectively. It can be inferred that the efficient baggage handling system is one of the most pertinent factors for the success of low-cost airport. As the low-cost airport stakeholders desire quick passenger flow in the terminal.

The dimension ‘Ramp operation and condition’ has obtained the eighth and last rank for which the criteria ‘operations efficiency of ramp services’ (C9) has highest weight of 4.32. The remaining criteria ‘support ability of aircraft maintenance’ (C8), ‘Supply convenience of aircraft fuel’ (C10) and ‘Assignment policy of boarding gates and related facilities’ (C11) have scored 3.86, 4.07 and 3.22 respectively. Hence efficiency of ramp services remains the key success factor of the current dimension.

Table 6: Results of evaluated success factors for Low Cost regional airport development in India

Goal	Dimension	Criteria	Criteria Average	Dimension Average	Criteria Weight	Dimension Weight
Evaluation of Success Factors for Development of Low Cost Regional Airports In India	D1	C1	3.91	4.21	0.0226	0.0244
		C2	3.80		0.0220	
		C3	4.26		0.0246	
		C4	4.30		0.0249	
		C5	4.20		0.0243	
		C6	4.52		0.0261	
		C7	4.49		0.0260	
	D2	C8	3.86	3.87	0.0223	0.0224
		C9	4.32		0.0250	
		C10	4.07		0.0235	
		C11	3.22		0.0186	
	D3	C12	4.50	4.39	0.0260	0.0254
		C13	4.46		0.0258	
		C14	4.35		0.0252	
		C15	4.32		0.0250	
		C16	4.27		0.0247	
		C17	4.34		0.0251	
		C18	4.46		0.0258	
	D4	C19	3.43	4.04	0.0198	0.0233
		C20	4.22		0.0244	
		C21	4.31		0.0249	
		C22	4.19		0.0242	
	D5	C23	4.44	3.96	0.0257	0.0229
		C24	3.88		0.0225	
		C25	3.50		0.0203	
		C26	4.03		0.0233	
	D6	C27	4.07	4.38	0.0235	0.0253
		C28	4.33		0.0250	
		C29	4.54		0.0262	
		C30	4.52		0.0261	
		C31	4.46		0.0258	
	D7	C32	4.27	4.25	0.0247	0.0246
		C33	4.34		0.0251	
		C34	4.25		0.0246	
		C35	3.94		0.0228	
		C36	4.27		0.0247	
		C37	4.44		0.0257	
	D8	C38	4.56	4.47	0.0264	0.0258
		C39	4.36		0.0252	
		C40	4.47		0.0258	
		C41	4.48		0.0259	

4.11 Findings for Objective 2

The second objective of the study was to evaluate the success factors for low cost regional airport development in India for which Fuzzy graded mean integration representation has been employed, rendering the evaluated success factors which has been reported in findings. It is noted that dimension financial viability has highest average importance score across all dimension. It is observed that criteria Government Financing and assistance (C38), Governing model for development operation and maintenance (C39), Innovative sources of non-aeronautical revenue (C40) and Subsidized Air Fare to end users (C41), has gained very high importance score emphasizing them to be prominent success factors in development of low cost regional airport in India. The initial years of the operations of the low cost regional airports requires the government financing and support. However as the regional aviation market matures the subsidies and support may be reduced and left to market mechanism. The extension of support and subsidy to low cost regional airport will bring indirect, induced and catalytic impact to regional economy of India (Kazda, A., Hromadka, M., Mrekaj,B., 2017).

The dimension 'Physical infrastructure' and 'Airport authority's promotion policy' has attained second and third rank respectively with respect to average importance score of dimension. All the criteria of the dimension physical infrastructure points towards need of minimizing the fixed cost by provision limited check-in facilities, conveyor belt, seating capacity and retail and catering. The scores indicate that there is no need to provide jet bridges and massive terminal building. The above finding is in line with study of De Neufville (2008). The finding indicates towards keeping the low fixed cost, enhancing the efficiency of the airport parallel to findings of Barret (2004).

For the dimension 'Airport authority's promotion policy' the criteria 'level of airport tariff' (C29), 'airport authority support attitude' (C30), Support hub and spoke and regional connectivity (C31) has attained high importance score emphasizing the need to keep low level of levies and support to all prime customers of airport. The above finding have been also endorsed in study of

Barret (2004) and Francis, Fidato & Humphrey (2003) were low levies and meeting the interest of prime stakeholders have been stressed as important success factor for low cost airport.

The dimension Airport Strategy has achieved fourth rank with high importance score for criteria 'Low levy to users/service providers' and 'efficient airport operation' corollary to the established primal strategies of low cost airports i.e. levying low from all users and rendering efficient operations at all points (Barrett, 2004;Francis, Fidato & Humphrey, 2003) .

The fifth rank has been obtained by dimension 'Landside connection & development conditions' with high importance score obtained by criteria Market factor, technical criteria for airport development and catchment area. The high importance score of these criteria are indicating towards the need of stimulating demand by enhancing the catchment area and enabling the market factors. It is important to assess the adequacy of demand for air travel prior to opening of airport. The above finding is parallel to findings of Francis, Humphrey and Ison (2004) who has stressed on the significance of market factor for the success of low cost airport. Similarly, Dennis (2007) has observed that catchment area of secondary airport in USA played vital role in their business success.

The sixth rank dimension 'airside infrastructure' emphasizes on the importance of criteria 'compatibility of runway characteristics with existing aircraft of prime LCA' and 'ability of air traffic control'. The airside facilities should have limited and needful infrastructure to keep the investment low and efficiency high. The above finding is corollary to the study of Singh DP (2015) which has stressed to keep minimum airside facilities to run the low cost regional airport in India.

The dimension 'Passenger traffic handling conditions' has achieved seventh rank with high importance score of the criteria, efficiency in baggage handling, limited check-in and flight information system and convenience and efficiency of CIQ procedure which again indicates towards keeping low capital investment with maintaining high efficiency of the resources deployed.

The above finding is corollary to study of Barret (2004) where he has emphasized to keep short walking distance, less congestion limited facilities in terminal and maintain high efficiency of every resource deployed.

The last and eighth ranked dimension is 'Ramp operation & conditions' have low weightage with two criteria of high importance, 'Operational efficiency of ramp services' and supply convenience of aircraft fueling'. The high importance score of two criteria of the dimension is indicating towards need of LCA to maintain fast turnaround time by enhancing efficiency in ramp services and aircraft fueling. The above finding is parallel to study of Warnock-smith & Potter (2005) in which the low cost airport has been characterized by facilitator of fast turnaround time of aircrafts.

Chapter 5: Framework for Low-Cost Regional Airport Development in India

The third objective of the study is to develop the framework for Low Cost regional airport development in India. For the above pertaining Fuzzy AHP method has been employed utilizing the detailed steps mentioned under methods section.

The findings of the Fuzzy AHP analysis is summarized in table 3. It is observed that the dimension 'Airport Strategy' (D7) has obtained the highest rank with importance weight score of 0.334. The second rank on the basis weight score of .274 has been achieved by dimension 'Financial viability' (D8). The dimension 'Airport Authority's Promotion Policy' has attained the weight score of 0.101 and has obtained the third rank. It is very closely followed by the dimension 'Physical Infrastructure' (D3) with weight score of 0.1. The dimension 'Landside connection and development' (D1) has achieved the fifth rank with weightage of 0.079. The sixth rank has been attained by the dimension 'Passenger traffic handling conditions' (D5) with weight score of 0.058. The dimensions 'Airside Infrastructure & Flight Management' (D4) and 'Ramp Operations & Conditions' (D2) have obtained the seventh and eighth rank with weightage of 0.028 and 0.026 respectively.

For the dimension 'Airport Strategy' (D7), the criteria 'Low levy to users/service providers' (C32), 'Efficient airport operations' (C33) and 'Quick airport operations' (C34) are top three ranked criteria with weightage 0.333, 0.311 and 0.151 respectively. The criteria 'Flexible planning and risk management' (C37) 'Cost, time sensitive & new generation human capital' (C36) and 'Target customer and diversification' (C35) has been ranked fourth fifth and sixth with weightage of 0.115, 0.060 and 0.030 respectively within the dimension D7.

The second ranked dimension 'Financial Viability' (D8) includes the criteria 'Government financing and assistance' (C38), 'Subsidized air fare to end users' (C39), 'Innovative sources of non-aeronautical revenue' (C40) and 'Governing model for development, operation and maintenance of airport'

(C41) with weightage of 0.255, 0.244, 0.250 and 0.251 respectively. Government financing and assistance is the most important criterion within dimension followed by Governing model for development, operation and maintenance of airport. Innovative sources of non-aeronautical revenue is third most important criterion within dimension while subsidized air fare to end users is the last ranked criterion.

The dimension 'Airport authority's promotion policy' (D6) has attained the third rank which comprises of criteria 'The level of airport tariff' (C29), Airport authority support attitude (C30), Support hub and spoke (C31), 'allowance for number of flights in same route' (C27) and 'Incentive alternatives for LCA (C28) with weightage of 0.477, 0.223, 0.223, 0.047 and 0.030. C29, C30 and C31 have been the primal important criteria of the dimension which is corollary to findings of Warnock-Smith (2016) and De Neufville (2008).

The dimension 'Physical Infrastructure' (D3) which has fourth most important dimension consists of criteria 'No Jet Bridges' (C12), 'Single terminal building' (C13), 'Needful Check-in facilities' (C14), 'Limited Seating in departure' (C15), 'Limited Conveyor Belt' (C16), 'Limited retail and catering' (C18) and 'No Business and executive lounges'(C17) with respective weightage depicted in decreasing order 0.379, 0.197, 0.175, 0.071, 0.061, 0.028 and 0.09. The findings of the study is parallel to study of Neufville Warnock smith.

The fifth ranked dimension 'Landside connection and development conditions' includes the criteria 'Market factors' (C6), 'Technical criteria for airport development'(C7), Catchment area (C4), Population of service cities (C3), 'Airport Size' (C5), 'ground transportation to/from airport' (C1) and Distances between airport and service cities (C2) with weightage 0.335, 0.234, 0.130, 0.106, 0.092, 0.055 and 0.047 respectively. The decreasing order of criterion weightage within dimension has been depicted above. The criterion C6, C7, C4 and C3 are prominent criterion under current dimension.

Hence the for low cost airport development in India the criteria market factors, technical criteria required for airport development and enhancement of the catchment area should be given due importance with regard to the current dimension.

The sixth ranked dimension 'Passenger traffic handling conditions' (D5) constitute of criteria 'Convenience and efficiency of CIQ procedures' (C24), 'Efficiency of baggage handling' (C23), 'Check-in facilities and flight information system' (C26) and 'Availability of ground agent selection for passenger handling' (C25) with weightage 0.502, 0.22, 0.22 and 0.058 respectively. With regard to the dimension the finding points that due importance should be given to the factor C24, C23 and C26 in low cost regional airport development.

The dimension 'Airside Infrastructure & flight management' (D4) has obtained seventh rank and includes criteria 'Ability of Air Traffic Control' (C20), 'Air Traffic Congestion Level' (C19), 'Compatibility between used aircraft type, runway condition and navigation aid' (C21) and 'Flexibility of time slot provisions' (C22) with respective weight of 0.384, 0.347, 0.142 and 0.128.

The eighth and last ranked dimension 'Ramp operations and conditions' includes the criteria 'operational efficiency of ramp services', 'supply convenience of aircraft fueling', 'Assignment policy of boarding gates and related policies' and 'support ability of aircraft maintenance' with respective weight of 0.496, 0.197, 0.178 and 0.129. It is observed C9 & C10 are significant criteria for the dimension.

For all rank wise pair comparison consistency check has been executed and the obtained results are summarized in Table 4. Since for all the Fuzzy AHP analysis the Consistency Index values are not beyond 10% hence the obtained weightage from results are validated to be consistent.

Table 7: Results of framework prioritized factors for Low Cost regional airport Development

Goal	Dimension	Dimension Weight	Criteria	Weight overall dimension	Weight within dimension
Framework for development of Low Cost Regional Airports In India	D1	0.079	C1	0.023	0.055
			C2	0.022	0.047
			C3	0.025	0.106
			C4	0.025	0.130
			C5	0.024	0.092
			C6	0.026	0.335
			C7	0.026	0.234
	D2	0.026	C8	0.022	0.129
			C9	0.025	0.496
			C10	0.024	0.197
			C11	0.019	0.178
	D3	0.100	C12	0.026	0.379
			C13	0.026	0.197
			C14	0.025	0.175
			C15	0.025	0.071
			C16	0.025	0.061
			C17	0.025	0.090
			C18	0.026	0.028
	D4	0.028	C19	0.020	0.347
			C20	0.024	0.384
			C21	0.025	0.142
			C22	0.024	0.128
	D5	0.058	C23	0.026	0.220
			C24	0.022	0.502
			C25	0.020	0.058
			C26	0.023	0.220
	D6	0.101	C27	0.024	0.047
			C28	0.025	0.030
			C29	0.026	0.477
			C30	0.026	0.223
			C31	0.026	0.223
	D7	0.334	C32	0.025	0.333
			C33	0.025	0.311
			C34	0.025	0.151
			C35	0.023	0.030
			C36	0.025	0.060
			C37	0.026	0.115
	D8	0.274	C38	0.026	0.255
			C39	0.025	0.244
			C40	0.026	0.250
			C41	0.026	0.251

Table 8: Consistency Index Values obtained in Fuzzy AHP analysis

Pairwise Comparison	Consistency Index Value
Within D1	6.98%
Within D2	2%
Within D3	8.28%
Within D4	1%
Within D5	6%
Within D6	4.90%
Within D7	5.87%
Within D8	5.51%
Inter Dimensions	7.70%

The third objective of study is to devise an integrated framework for development of low cost regional airport in India for which Fuzzy-Analytical Hierarchical Process has been utilized to furnish the hierarchical output for the pertaining. The finding of the objective has been presented in above section with summary depicted in Table 4. Across dimensions, it is observed Airport Strategy has the highest weightage with 33.4% followed by Financial Viability with 27.4% followed by Airport Authority's Promotion policy with 10.1% followed by Physical Infrastructure with 10% followed by Landside Connections & development conditions with 7.9% followed by Passenger traffic handling conditions with 5.8% followed by Airside infrastructure and flight management with 2.8% and Ramp operations conditions with 2.8%. It is noted that top five rank dimensions contribute 88.8% of weightage to success factor. Hence there specific need to pay heed to the high weighted dimensions in while laying out plan for development of low cost regional airport in India. For the dimension airport strategy, the criteria 'low levy to users', 'efficient airport operations and quick airport operations have attained high weightages which is supporting the basic business model of LCA. Hence need to be emphasized upon in the strategic planning of the airport. The findings of the

study is corollary to previous study of De Neufville (2008) Barret (2004) and Warnock-Smith (2005, 2016) emphasizing low levy to user and efficiency as the prime characteristics of airports facilitating low cost airlines.

For the dimension, financial viability, the criteria 'government financing and assistance', 'subsidized air fare to end users' and 'governing model for development, operations and maintenance' have achieved high weightages pointing towards need of high support from government to kick-start the projects and enable the market. The extension of support and subsidy to low cost regional airport will bring indirect, induced and catalytic impact to regional economy of India which will outweigh the cost burden (Kazda, A., Hromadka, M., Mrekaj,B., 2017).

The dimension 'Airport authority's promotion policy' is ranked third with high weightages of the criteria 'level of airport tariff', 'airport authority support attitude and support hub and spoke and regional connectivity. All of the mentioned criteria are enablers for an airline operation from the airport; hence need to be taken care to enhance the demand of air travel from airport. The support to above criteria have been also emphasized in studies of Barret (2004) and Francis, Fidato & Humphrey (2003) where they have contended that the low cost airport should devise the low levy strategy from the operating airlines form the airport. Also they have emphasize that the airport should support the airlines' network strategy.

The fourth ranked dimension 'Physical infrastructure' with seven criteria of 'No Jet bridges', 'Single terminal building', 'Needful check-in facilities', 'No business and executive lounges', 'Limited Seating in departure', 'limited conveyor belt' and 'limited retail and catering' is pointing towards need of keeping low capital expenditure with simple design and fast flow of traffic. The finding is corollary to study of Barret (2004) where he has contended that airport should keep the fixed investment cost low by providing minimum infrastructure and enhancing the efficiency. Parallel to above finding, De Neufville (2008) has also emphasized the need of not providing jet bridges,

provisioning of single terminal building, limited seating in departure, limited conveyor belts and retail area.

The dimension ‘landside connection & development conditions’ has achieved fifth rank with criteria Market Factors, technical criteria for airport development, catchment area and population of service cities as prominent weight. The criteria of the dimensions are indicating towards need to give due importance to assess the existence of demand for air travel prior to opening of airport. The findings also suggest the possibility to enhance the catchment area by connecting 3-4 cities with the airport. The above finding is corollary to study of Francis, Humphrey and Ison (2004) where the market factors and demand of air travel has been stressed as prominent factor for the success of low cost airport. Similarly, Dennis (2007) has observed that catchment area of secondary airport in USA gives important clue of possible business potential of the low cost airport.

The sixth rank dimension ‘passenger traffic handling condition’ has two criteria with prominent weight, ‘Convenience and efficiency of CIQ procedures’ and ‘Efficiency of baggage handling’ for which there is need to give due weightage in planning. Both the criteria are prominent aspects to derive passenger satisfaction from the airport. The above finding is in line with the study of Barret (2004) where he has emphasized to keep short walking distance in terminal, providing facilities in terminal with less congestion, bare minimum facilities in terminal with aim of maintaining high efficiency of every resource deployed.

The dimension ‘Airside infrastructure and flight management’ has attained seventh rank with prominent weight of criteria ‘ability of air traffic control’, ‘air traffic congestion level’ and ‘compatibility between used aircraft type and runway characteristics’. The inference drawn from prominent importance score of the criteria is aiming towards limited and needful airside facilities and infrastructure minimizing the capital expenditures. The above finding is parallel to the study of Singh DP (2015) where it has been emphasized to keep minimum airside facilities to run the low cost regional airport in India.

The dimension with the least weight is ‘Ramp operations and conditions’ with prominent criteria weight of ‘operational efficiency of ramp services’ and ‘supply convenience of aircraft fueling’ both of which are aiming towards facilitating the LCA with faster turnaround time. The same observation has been emphasized in the study of Warnock-smith & Potter (2005) in which the low cost airport has been characterized as facilitator of fast turnaround time of aircrafts.

The Figure 3 below outlines the key outcome of the third objective of the study. It depicts integrated framework for low cost airport development in India. The identified framework comprised of 8 dimensions and 41 respective criteria. The eight dimensions formulates the integrative approach fulfilling the interests of primary stakeholders of airport lying within the airport service boundary.

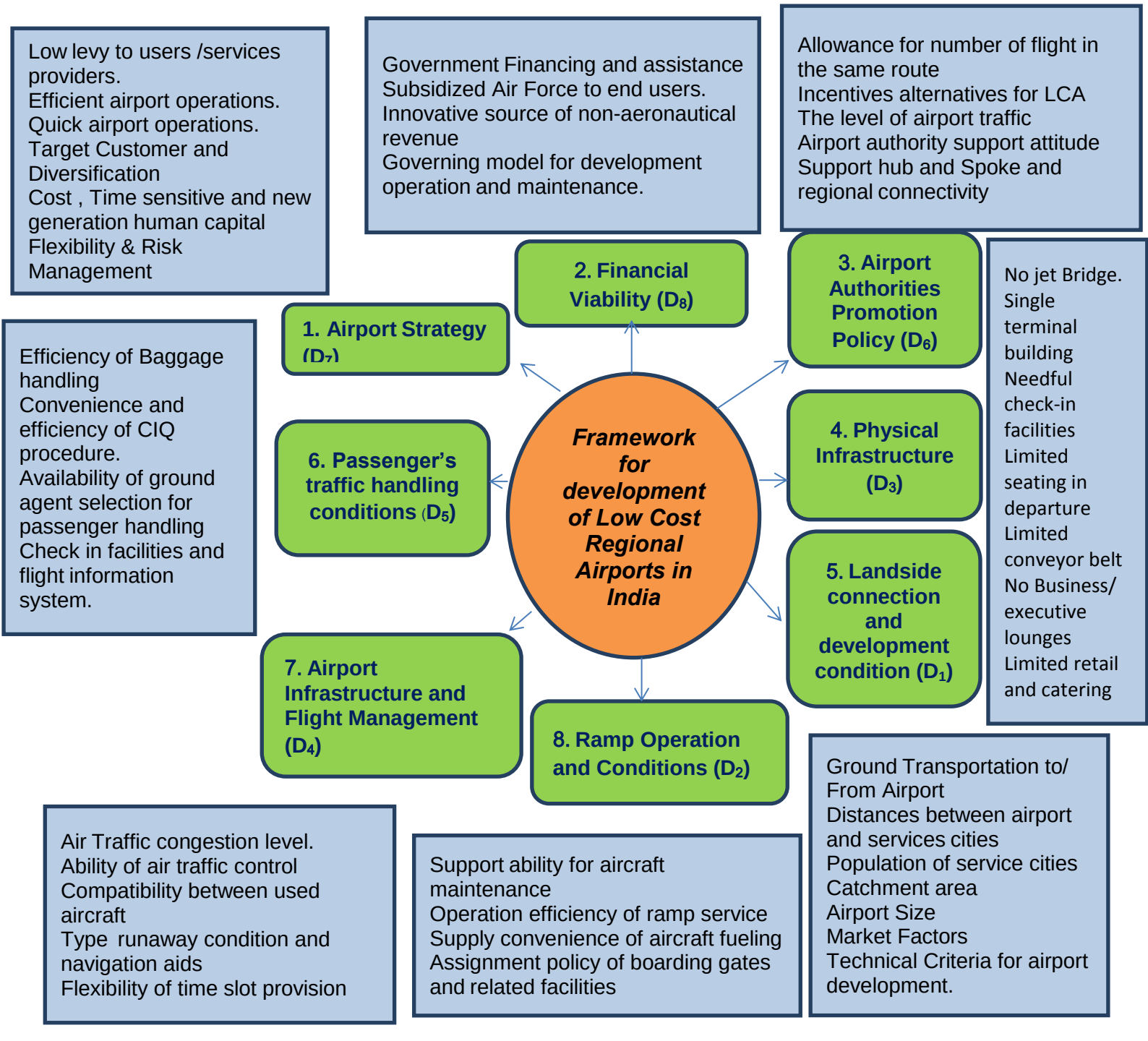

Figure 6: Integrated framework for development of Low Cost Regional airports in India

Chapter 6: Conclusion & Implications

The study identifies and prioritizes the key success factors for development of Low-Cost Regional airport in India. It also furnishes an integrated framework for development of low cost regional airport. An evaluation model based on Fuzzy MCDM method has been employed for prioritization and framework development of the success factors.

Addressing the first objective of the study, 41 key success factors clubbed in 8 dimensions have been identified for low cost regional airport development in India. Interview of expert team was conducted to verify and identify the key success factors. Conceptual lens drawn from literature resulted in identification of 32 success factors whose relevance was verified in Indian Context. The analysis of interview transcript resulted in identification of 9 new success factors which were incorporated in the construct. The nine success factors identified were:

a. Catchment area

b. Market Factors

c. Technical criteria for airport development

d. Support hub and spoke and regional connectivity

e. Flexible Planning & Risk Management

f. New generation human capital

g. Government financing and assistance

h. Subsidized air fare to end users

i. Innovative sources of non-aeronautical revenue

j. Government model for development operations and maintenance

The identified success factors for the low cost regional airport in India were prioritized utilizing the Fuzzy based evaluation model in the second objective of the study.

The evaluation of the success factors has identified that the dimension financial viability with highest weightage across all dimensions. The criteria Government financing and assistance, Governing model for development operation and maintenance, Innovative sources of non-aeronautical revenue and Subsidized Air Fare to end users, have gained very high importance score emphasizing them to be prominent success factors in development of low cost regional airport in India.

The dimension 'Physical infrastructure' is the second highest weighted dimension. All the criteria of the dimension physical infrastructure points towards need of minimizing the fixed cost by provisioning limited check-in facilities, conveyor belt, seating capacity and retail and catering.

The third ranked dimension in the construct is 'Airport authority's promotion policy'. The criteria under the dimension 'level of airport tariff', 'airport authority support attitude', and 'Support hub and spoke and regional connectivity' have attained high weightage emphasizing the need to keep low level of levies and render the support to all prime customers of airport.

The dimension Airport Strategy has achieved fourth rank with high importance score for criteria 'Low levy to users/service providers' and 'efficient airport operation'.

The fifth rank has been obtained by dimension 'Landside connection & development conditions' with high importance score obtained by criteria Market factor, technical criteria for airport development and catchment area. The high importance score of these criteria are indicating towards the need of stimulating demand by enhancing the catchment area and enabling the market factors.

The dimension 'airside infrastructure' has been ranked at sixth position. Prominent criteria under the dimensions are 'compatibility of runway

characteristics with existing aircraft of prime LCA' and 'ability of air traffic control'. The dimension 'Passenger traffic handling conditions' has achieved seventh rank with high importance score of the criteria, efficiency in baggage handling, limited check-in and flight information system and convenience and efficiency of CIQ procedure which again indicates towards keeping low capital investment with maintaining high efficiency of the resources deployed.

The last and eighth ranked dimension is 'Ramp operation & conditions' have low weightage with two criteria of high importance, 'Operational efficiency of ramp services' and supply convenience of aircraft fueling' indicating towards maintaining fast turnaround time of LCA.

The third objective of the study has furnished an integrated framework for low cost regional airport development in India. Fuzzy logic based Analytical Hierarchical Process method was employed to obtain the prioritized hierarchy framework for the development of low cost regional airport in India.

The finding points that the 'Airport Strategy' is the most important dimension with weight of 33.4%. The high weightage obtained by airport strategy due to prominence of success factors such as 'low levy to users', 'efficient airport operations' and 'quick airport operations'. They point the need towards keeping airport strategy in mirror with the low cost airline strategy with low levy to all users and efficient operation through-out the value chain.

The dimension 'Financial Viability' has attained second rank with weight 27.4%. The high importance of the dimension is attributed to the prominent contribution from success factors 'government financing and assistance', 'subsidized air fare to end users' and 'governing model for development, operations and maintenance'. The findings have emphasized that there is immense need of obtaining government support to kick-start and develop the sustainable regional air transport market. The financial viability dimension indicates towards the need of government support to develop the regional aviation market and deploy appropriate regulatory economic model for its sustenance.

‘Airport authority’s promotion policy’ is the third ranked dimension with weight 10.1%. The key success criteria of the current dimension are ‘The level of airport tariff’, Airport authority support attitude and Support hub and spoke. The findings points towards need of keeping low levies and support the airlines to make their business viable.

The dimension ‘Physical infrastructure’ has obtained fourth rank the weight 10%. The prominent success factors of the dimensions consist of all seven criteria. The finding has been indicating towards the need of keeping the low capital expenditures in airport development.

Fifth rank has been obtained by Landside connection and development condition with weight 7.9%. The key success factors for the current dimension include market factors, technical criteria for airport development, catchment area and population of service cities. The findings of the current dimension are pointing towards the need of assessing the market factors, technical criteria and catchment area prior to opening of airport.

The top five ranked dimensions have aggregate weightage of 88.8%. The remaining three dimensions Passenger traffic handling conditions, Airside Infrastructure & flight management and Ramp operations and conditions have weight of 5.8%, 2.8% and 2.6% respectively.

The dimension Passenger traffic handling conditions, Airside Infrastructure & flight management and Ramp operations and conditions are also signifying the need to keep the low investment cost and efficient operations meanwhile maximizing the return on Investment in airport development.

The study is the pioneer to furnish the Framework for development of low cost regional-airport in India by integrating the interest of primary stakeholders of airport lying within the airport service boundary. The study contributes to stakeholder theory by developing the hierarchical structure of the criteria governing the success in development of low cost regional airport in India. It also contributes to existing literature gaps with respect to key success factors

for development of low cost regional airport, their evaluation models and framework.

The implications and findings of the study will be useful to airport planner, low cost airlines, aviation policy makers, other aviation stakeholders, academician and society at large.

6.1 Suggestion and Recommendation

Based on the inductive analysis following are the suggestion and recommendation with regard to development of low cost regional airports in India:

6.1.1 As we have observed in our findings that criteria such as low levy to airport users, support hub and spoke network of airlines, airport's support attitude are prominent success factors. Hence, the strategy of low cost regional airport should be devised in mirror with the low cost airline strategy with special focus of low levy to all users and efficient operation through-out the value chain.

6.1.2 There is immense need of government support and assistance for developing the low cost regional airport in India. The government needs to furnish the assistance to primary stakeholders for initial years so as to kick-start air travel demand. Once regional aviation market strengthens the subsidies may be reduced gradually leaving the growth on market mechanism. Appropriate regulatory economic model need to be utilized for its sustenance.

6.1.3 The low cost regional airport should be developed with needful and limited physical infrastructure in order to keep the low capital expenditures in airport development. The total capital expenditure deployed for development of these airports should not be more than INR 100 crore. The capital expenditure employed for new terminals of Delhi and Mumbai airport has been INR 13000 crore while for Bangalore and Hyderabad airport has been around INR 2500 crore. Hence the low cost airport should not be at par with

terminal of these airports rather should have only necessary facilities to operate the flight.

6.1.4 Based on the findings on importance of criteria 'support hub & spoke and regional connectivity' the low cost regional airport should be developed in such a way that they turn up to be feeder airport to metro airports. The metro airport should promote and subsidize the regional/feeder airports operations.

6.1.5 The low cost airport should assess the market factors, technical criteria and catchment area prior to opening of airport. The regional airports can also explore the possibility to enhance the catchment area by connecting 3-4 cities with the airport.

6.1.6 Innovative sources of revenue generation such as integrated cargo services, the development of shopping and exhibition centres, industrial parks and entertainment/theme parks should be explored by low cost regional airports.

6.1.7 The findings of the study points on need of keeping limited infrastructure with high degree of flexibility which can be utilized as contingency plan. Hence, concept of central terminal or simple joint terminal can be utilized. The central terminal helps for linear expansion of terminal to accommodate for future requirement.

6.1.8 The low cost regional airports should support the network strategy of prominent airlines in the country. The regional airport should be developed as feeder airport for major airports supporting the airlines network strategy. Support for hub and spoke operations of airline by development of regional airport will boost untapped potential regional air transport.

6.1.9 The high importance of success factor 'cost and time sensitive human capital' points towards recruiting a completely new generation of airport managers who are cost and time sensitive. There is high importance of keeping skilled and highly efficient workforce for operations of the regional airport. The workforce employed need to undertake fast and efficient decision making. Lean organizational structure can be utilized for the faster decision making process of the regional airports.

6.1.10 State Governments has pivotal role for development of regional airport with interest to boost regional economies. It can be done by support in form of providing infrastructure, connecting the site with multi modal option and providing essential resources such as water, electricity and security at concessional rates.

6.1.11 During the initial period of operations of regional airport financing will be challenge however the international models of government financing for development of the regional airports should be explored.

6.1.12 The primary stakeholder's of airport should be actively engaged right from drafting of airport master planning stage. The primary stakeholders should be made a party to evaluate the prioritization of factor and action plan of airport development.

6.1.13 Limited facilities of the ATC services can be provisioned bring unit cost of operations lower. Modern efficient technologies like virtual ATC etc. should be explored.

6.1.14 The low cost airport may have a separate regulatory regime than traditional airport bringing down the safety and security infrastructural costs.

6.1.15 State Government can also consider becoming a business/equity partner in the remote area air transport business and airports. It is also important that the road connectivity etc. should be the top priority by the state government to provide access and connect such remote area airports. Without the active support and cooperation of state governments the development of Airport in Regional/ remote/inaccessible areas is next to impossible.

6.1.16 The air services from specified rural areas to city and vice versa can be considered on a subsidized basis by which the end consumer will be required to pay only the basic fare. No taxes to be further levied on the ticket. Even on the basic fare some 40 to 50% discount/subsidy can be considered and met from the specified Fund (RCF) or this can also be met by the concerned State Government. This will promote air travel to rural and remote areas.

6.2 Contribution of Study:

The current study contributes to literature on four fold as follows:

6.2.1 It is a pioneer study to identify and evaluate the success factors for development of low cost regional airport in India.

6.2.2 It has furnished a Fuzzy logic based MCDM evaluation model for prioritization of success factors for low cost regional airport development.

6.2.3 It extends the analytical framework for development of low cost regional airports in India integrating the interest of primary stakeholders of the airport. The findings of the study would be helpful in strategy formulation for Low cost regional airports in India.

6.2.4 Theoretically, the study contributes to stakeholder's theory by furnishing a pragmatic analytical heuristics to balance the interest of stakeholder. It has developed a method based on integrated approach, which balance the interest of multiple stakeholders. It has also checked the efficacy of analytical heuristics on stakeholders' interests and overall outcome.

The outcome of the current study would directly be fruitful to airport planner, low cost airlines, aviation policy makers, other aviation stakeholders, academician and society at large.

6.3 Limitations of the study

Apart from the contributions identified in the previous section, the study also has some limitations which are detailed below:

6.3.1 The generalization of the results is limited by the population used i.e., the results of this research reflected only the opinions of experts who participated in the three phases of this research.

6.3.2 The research was identified and validated the factors for Indian context. So the generalization of the results in other countries may

require a study to include several factors which are relevant to the specific geographical context.

6.4 Future Scope of Studies

The findings of this research support the view that the prioritization of success factors for low cost airport development should be further researched in order to understand the perspective of this portion of the regional low cost airport planning. Suggested areas of further research include, but are not limited to the following areas:

6.4.1 The framework identified may be verified for its relevancy in other geographical contexts.

6.4.2 The framework may be remodified specific to airport development stage which may be utilized for assessment purpose.

6.4.3 The framework may be remodified for specific need of the stakeholders which may be later utilized for evaluation of alternatives.

6.4.4 The framework may be enhanced with respect to precision of the measurement of the evaluation models.

6.4.5 Socio-Economic Impact of regional airport development should be undertaken to estimate the indirect, induced and catalytic benefits and efficient and sustainable regulatory economic model should be evaluated for the purpose.

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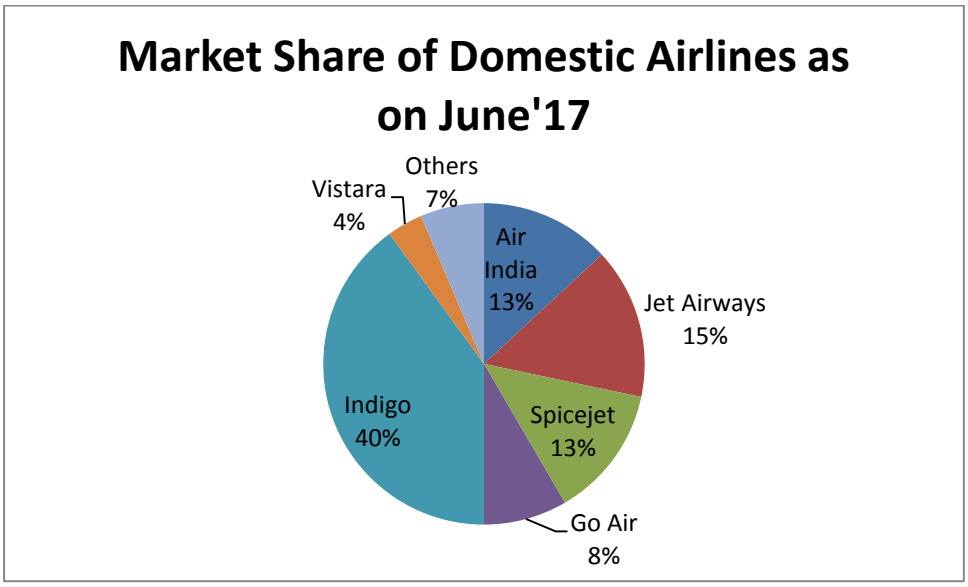
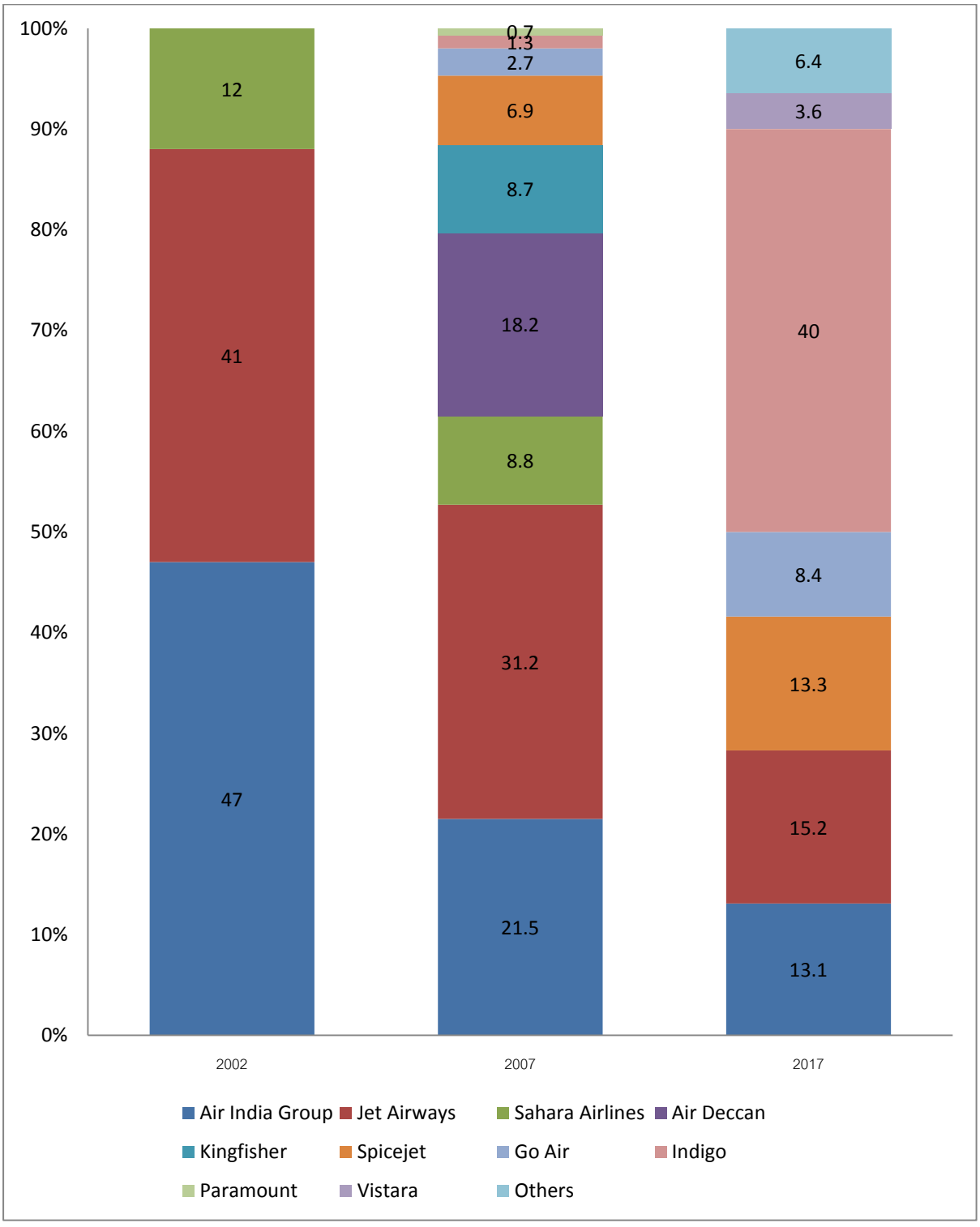
Appendix 1



Source: DGCA India, 2017

Figure 1: Market share of airlines in India



Source: DGCA India, 2017

Figure2: Rising market share of Indian Low Cost Airlines

Appendix-2

Code Groups	Code	Grounded
D1	C1	6
	C2	5
	C3	5
	C4	11
	C5	1
	C6	10
	C7	7
D2	C8	1
	C9	1
	C10	1
	C11	2
D3	C12	8
	C13	9
	C14	7
	C15	8
	C16	8
	C17	4
	C18	6
D4	C19	3
	C20	10
	C21	3
	C22	1
D5	C23	7
	C24	7
	C25	1
	C26	4
D6	C27	1
	C28	3
	C29	3
	C30	4
	C31	5
D7	C32	8
	C33	9
	C34	7
	C35	1
	C36	12
	C37	2
D8	C38	10

	C39	7
	C40	6
	C41	8

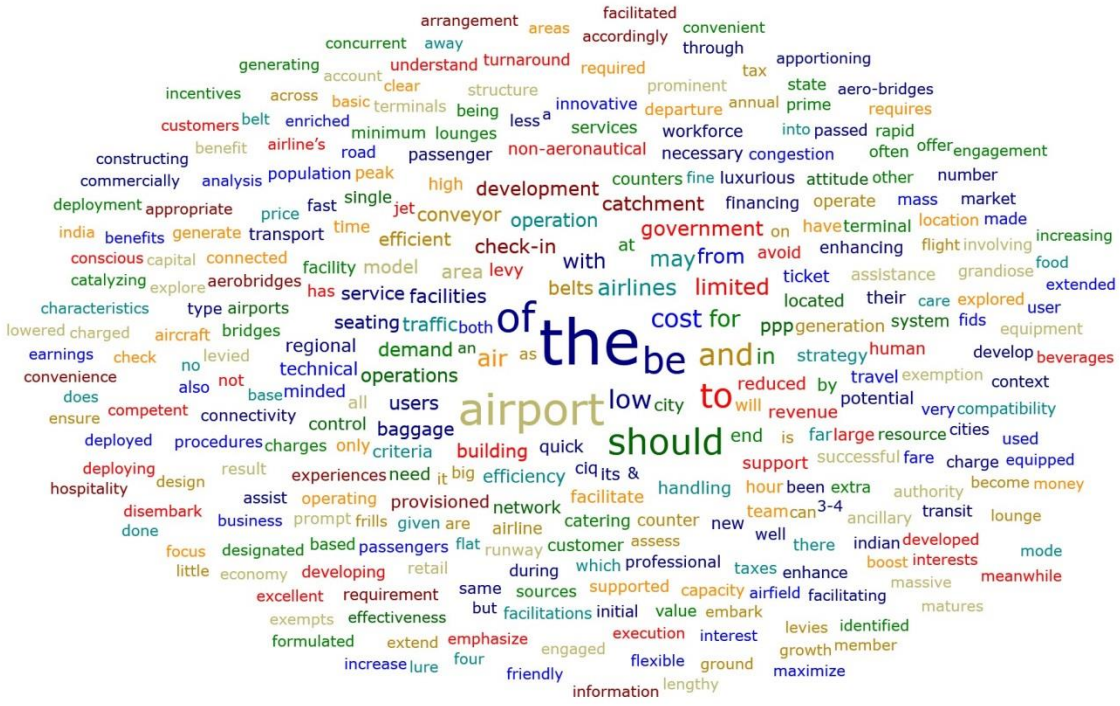


Figure 3: Word cloud of all codes

Appendix 3: Data Collection Tools

Interview Questions

1. What should be the cost reduction measures in design and development of low cost airports in India?

   ……
   ……
   ……
   ……

2. What should be the physical infrastructure of terminals for the proposed Low Cost Regional Airport?

   ……
   ……
   ……
   ……

3. What are the key Airside infrastructure & Air traffic control facilities to be rendered for Low Cost Regional Airport in India?

   ……
   ……
   ……
   …….

4. What are key passenger traffic operation conditions/facilities to be provided at Low Cost Regional Airport?

   ……
   ……
   ……
   ……

5. How should the strategy of low cost regional airports in India be designed for their long sustenance?

   ……
   ……
   ……
   ……

6. Could you advise the specific market factors to be considered before opening the low cost regional airport at a location?

   ……
   ……
   ……
   ……

7. Could you advise the amendments in existing policy/regulatory framework for the sustenance of low cost regional airport?

   ……
   ……
   ……
   ……

8. How can proposed low cost airports in India become a commercially viable entity?

   ……
   ……
   ……
   ……

9. Which type of the organizational structure and authority-responsibility constitution would be more appropriate for the proposed Low Cost Airports in India?

   ……
   ……
   ……
   ……

10. How the human capital development for both technical and non-technical positions should be planned for the proposed low cost airports?

    ……
    ……
    ……
    ……

11. Which financing model should be appropriate for development of low cost regional airports in India?

    ……
    ……
    ……
    ……

12. What should be the role of government in financing and assistance for the sustenance of low cost regional airports?

    ……
    ……
    ……
    ……

13. Please suggest measures to reduce investment cost for development of low cost airports.

……
……
……
……

Survey Form

Dear Sir / Madam

Greetings!

The current survey tool is going to be utilized for the doctoral research entitled as "Integrated Framework for Development of Low Cost Regional Airport in India". Kindly spare your valuable time for answering the questions below. Your responses would be kept confidential. I appreciate and would like to extend the sincere gratitude towards your valuable contribution.

Regards,
Mukesh Pandey
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Please rate the importance level of the items listed in the questions below with the given scale:

A. Landside connection & development conditions

	Not at all Important	**Slightly Important**	**Moderately Important**	**Very Important**	**Extremely Important**
1. Traffic convenience between airport and service cities	☐	☐	☐	☐	☐
2. Distance between airport and service cities	☐	☐	☐	☐	☐
3. Catchment area	☐	☐	☐	☐	☐
4. Airport Size	☐	☐	☐	☐	☐
5. Exclusive terminal for low cost carriers	☐	☐	☐	☐	☐

B. Ramp operation conditions

6. Support ability for the aircraft maintenance	☐	☐	☐	☐	☐
7. Operational efficiency of ramp services	☐	☐	☐	☐	☐
8. Supply convenience of aircraft fueling	☐	☐	☐	☐	☐
9. Assignment policy of boarding gates & other associated facilities	☐	☐	☐	☐	☐

C. Flight infrastructure management

10. Air traffic congestion level	☐	☐	☐	☐	☐
11. Ability of air traffic control	☐	☐	☐	☐	☐
12. Compatibility between used aircraft type, Runway conditions and navigation aids	☐	☐	☐	☐	☐

13. Flexibility of time slot provision	☐	☐	☐	☐	☐

D. Passenger traffic operation conditions	**Not at all Important**	**Slightly Important**	**Moderately Important**	**Very Important**	**Extremely Important**
14. Efficiency of baggage handling	☐	☐	☐	☐	☐
15. Convenience and efficiency of CIQ procedure	☐	☐	☐	☐	☐
16. Availability of ground agent selection for passenger handling	☐	☐	☐	☐	☐
17. Check-in facilities and flight information system	☐	☐	☐	☐	☐
E. Regulatory and Policy Factors					
18. Allowance for the number of flights in the same route	☐	☐	☐	☐	☐
19. Incentive alternatives for low cost carriers	☐	☐	☐	☐	☐
20. The level of airport's tariff	☐	☐	☐	☐	☐
21. Supportive attitude of government	☐	☐	☐	☐	☐
F. Physical infrastructure					
22. Presence of Jet Bridges	☐	☐	☐	☐	☐
23. Single and simple terminal design	☐	☐	☐	☐	☐
24. Needful and limited check-in facilities	☐	☐	☐	☐	☐
25. Limited seating in departure	☐	☐	☐	☐	☐
26. Limited conveyor belt	☐	☐	☐	☐	☐
27. Shared business lounge	☐	☐	☐	☐	☐
28. Limited retail and catering	☐	☐	☐	☐	☐
G. Airport Strategy					
29. Low levy to users /service providers	☐	☐	☐	☐	☐
30. Efficient airport operations	☐	☐	☐	☐	☐
31. Quick airport operations	☐	☐	☐	☐	☐
32. Target customer & diversification	☐	☐	☐	☐	☐

H. Market Factors

33. Per capita income (purchasing power parity) In the catchment area	☐	☐	☐	☐	☐
34. Population size of catchment area	☐	☐	☐	☐	☐
35. Potential switch from surface transport	☐	☐	☐	☐	☐
36. Seasonality trend in passenger demand	☐	☐	☐	☐	☐

I. Financing

37. Financing model	☐	☐	☐	☐	☐
38. Government Financing	☐	☐	☐	☐	☐
39. Incentives/subsidy from Government	☐	☐	☐	☐	☐

J. Human Capital & Organizational structure

40. Human Capital Development	☐	☐	☐	☐	☐
41. Lean Organizational Structure	☐	☐	☐	☐	☐
42. Cost and time sensitive professional	☐	☐	☐	☐	☐
43. Training & Development	☐	☐	☐	☐	☐

K. Demography

37. Gender: **Male** ☐ **Female** ☐

38. Age in years: **20-40** ☐ **40-60** ☐ **Above 60** ☐

39. Education: **Bachelor** ☐ **Master** ☐ **Doctorate** ☐

40. Designation: **Manager** ☐ **Director** ☐ **Vice President** ☐

Other……..

41. Organization Type: Airline ☐ **Airport** ☐ **Ground Handler** ☐ **Regulator** ☐

Service Provider ☐ **Consultancy** ☐ **Government** ☐ ☐

Others

Thank you so much for your kind help and valuable contribution!!!

Appendix 4: Research Paper Published

Evaluating the success factors for development & sustenance of low-cost regional airports in India using Fuzzy MCDM method

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Abstract:

The current study attempts to evaluate the success factors for development & sustenance of low-cost regional airports in India. The Fuzzy MCDM method has been utilized for the above pertaining. The findings of the study exhibit the importance to keep low investment cost in the development, low levies from the airport users efficient airport operations and due diligence prior to development to measure the demand for air transport effectively. The paper fulfills the gap in the literature by integrating the stakeholder's view in low-cost regional airport development. Methodically, the paper contributes by developing and demonstrating the application of the Fuzzy based MCDM model for evaluation of the success factors for low-cost regional airport development.

Keywords: Low-Cost Airport, Low-Cost Airlines, Success Factors, Fuzzy MCDM, Airport Strategic Planning

JEL Classification: C52; C44; C61; R40; R58.

1. Introduction

The unprecedented growth of Indian aviation has mandated for the capacity addition in airport infrastructure. Based on Naresh Chandra committee's policy framework Government of India

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(GOI), introduced Public-Private Partnership (PPP) model to modernize, develop and operate the brownfield Delhi and Mumbai airport in 2006 (ICAO 2015). Two greenfield airports of Bangalore and Hyderabad has also been operationalized since 2008 on the same model (ICAO 2015). While the Cochin International Airport has been the first greenfield airport under PPP mode which has been founded in 1994 and has been operational since 1999 (ICAO 2015). The five major airports under PPP mode are catering to the need of 60% of the country's air traffic (Nayar 2013). The Airport Authority of India has modernized and expanded Kolkata and Chennai airport (Nayar 2013). Also, 35 non- metro airports have been modernized with capacity enhancement under the 11th Five-year plan (Nayar 2013).

Keeping in view the success of airport operating under PPP mode, GOI has decided to transfer four existing airports Chennai, Kolkata, Ahmedabad and Jaipur and two greenfield airport projects at Navi Mumbai and Goa into PPP model in order to attract investments from private players. In May 2015, GOI has further approved 15 greenfield airports under PPP mode.

At present, out of 464 airstrips/ airports in India, only 116 are operational (AAI 2017). Recently GOI has announced the construction and development of 200 low cost 'No-Frills' airports within the budget of USD 7 million to USD 15 million each with the purpose to enhance the regional air connectivity (Ministry of Civil Aviation India 2016). In line with the stated plan, 160 non-functional airports were announced to be developed at a cost of INR 50-100 crore each in partnership with state government under the Union Budget of 2016. As GOI is planning to develop low-cost airports on a massive scale, it is essential to understand the key requirement of Low-Cost Airlines and other key stakeholders in the airport.

Regional airport development is critical for India's economic development and regional integration but it should be given a thoughtful consideration of meeting the needs of key stakeholders. Since 2009, GOI has spent over USD 50 million on eight non-functional airports with intent to develop it as no-frill airports; however, after development, they were unable to attract and retain their airline customer (Reuters 2015). Airports such as Jaisalmer, Sahnewal, Gondia, Mysore, Pondicherry, Kanpur, Juhu, Kolhapur, Sholapur, Akola, Jalgaon, Bhatinda, Pathankot, Malda, Cooch Behar, Warangal & Cuddupa are some of the examples of developed but non-operational airports in India (The Telegraph 2015). The industry experts opine that the above failure has occurred due to lack of a well-structured, demand driven and airline oriented plan in the low-cost airport development (CAPA 2017). *In sum and substance lack of integration of key stakeholder's interest in low-cost regional airport development is contributing in existence of developed but non-operational airport in India.*

The current paper attempts to identify and evaluate key success factors for development and sustenance of Low-Cost Regional airport in India using Fuzzy MCDM method. The current study would be addressing the gap of integrating the stakeholder's view in low-cost regional airport development in India. There is an immense need for investigation with systems based thinking that aligns the airport strategies with its key stakeholders. There is earnest need to understand the key success factors required to attract and retain the key stakeholders of the non-operational regional airports in India.

2. Literature Review

A theme based approach is used to search various sources of literature conducted in the past on the topic success factors for the development of low-cost regional airports. Sources which were reviewed included research articles and papers, newspaper articles, and industry reports. Three major themes indicated below have been evolved from a review of the literature:

a) Requirement of Low-Cost Airline (LCA) from airport
b) Design characteristics and strategy of Low-Cost Airport
c) Framework and strategy for Airport development

2.1. Requirements of LCA from the airport:

Berechman and de Wit (1996) identified that the requirements of the full-service carrier in airport selection varies from LCA for which the criteria varies from airport charges, demand and airport capacity. Adler and Berechman (2001) found that airport quality has a strong influence on airport choice factor of LCA. Gillen and Morrison (2003) also emphasized on the different requirement of LCA which necessitate the airport managers to tailor their strategy to suit their need. Francis, G. et al. (2003) explored that airports attract LCA on basis of hub routes offerings and rely more on aeronautical revenues. Gillen, D. and Lall, A. (2004) endorsed the existence of competition between airports based on LCA requirement and stated that airport tailors its offering as per the need of LCA. Barrett, S.D. (2004) has identified seven factors for airports to attract LCA namely low airport charges, quick turnaround time, single story airport terminal, quick check-in, good catering and shopping at the airport, good facilities for ground transport, and no executive/business lounge. However, the identified factors need to be verified in the current context of Indian low-cost regional airport development.

The secondary airport is located away from urban area increasing the car rentals to airport resulting an increase in non-aeronautical revenue compensated by a decrease in aeronautical charges levied to LCA (S. Barrett 2004). Airport charges and night curfew influence airport selection decision of LCA (Gardiner, Ison and Humphreys 2005). Eight LCA in Europe were surveyed revealing the differences in airport choice factor of LCAs' and the key result stated the core requirement of LCA has focussed on low-cost services. Lawton, T.C. and Solomko, S. (2005) observed that efficient operating condition is the most required expectation of LCA from the airport decreasing of turnaround time and resulting in higher aircraft utilization rate. Fifteen airport choice factors of which the fundamental factors related to quick and efficient turnaround facilities, convenient slot time and good aeronautical discount were identified (Warnock-Smith and Potter 2005). Chang, et al. (2008) modeled a framework in which airport charges, operations hours, surface transport, terminal floor area, navigational aid and estimated demand for the destination were pertinent factors for LCA choice of airport. LCA seeks to optimize profitability of their network by choosing an appropriate airport (Graham 2013). Graham (2013) reviewed the academic literature pertaining to the relationship between airports and development of LCA and identified that the LCA's choice of airport is determined by its business model. The passengers to secondary airports are willing to endure inconvenient airport location in exchange for a lower fare (Lu and Mao 2015).

As the most of the literature reviewed contend that low-cost airport development should mirror the strategy being practiced by LCA and other key stakeholders in the prevalent market. Since there is lack of academic literature to the pertaining to the requirements of LCA in Indian aviation context hence the current study would fulfill the existing gap in the literature.

2.1. Design characteristics of the Low-Cost Airports

The rise of LCA resulted in the development of low-cost airports and their related facilities (De Neufville 2008). De Neufville (2008) has identified the features of Low-Cost Airports which rely on the business motto of deriving economy through operational efficiency and minimum frill in parallel with the strategy of LCA. Low-cost airports have simple design, avoiding the grandiose building; the passenger building has less space per person emphasizing on higher utilization and productivity for every resource deployed in the airport; Retail and commercial space is limited in low-cost airport as building and operating retail area is expensive and cumbersome (De Neufville 2008). Low-cost terminal refers to the terminal developed with low capital investment cost offering limited facilities due to space restriction, favoring simplified and efficient services (Sabar 2009). Sabar (2009) identifies two types of terminal, converted and newly-built; and enumerate some typical characteristics as basic terminal facilities, avoidance of jet bridges, limited retail and catering, single story terminal, no executive or business lounges, only road services & coach services to nearest cities and short taxiing distances to and from terminal building. The low-cost terminal provides an opportunity to the airport to target the LCA segment however it has been criticized for duplicating the resources which are mandatory irrespective of the market focus (Njoya and Niemeier 2011). Also, it cannibalizes the traffic from other terminals and lacks the ability to expand (Blackman 2011); (Toh 2013). Recently, Hanaoka & Saraswati (2011) contend that the efficiency of the low-cost terminal is more dependent on its location rather than its configuration. The location with respect to runways affects the aircraft taxiing distance while simple terminal configuration helps to minimize the passenger walking distance. The Low-cost airports are characterized by simplified terminal building, limited and needful check-in facilities, extensive use of self-service check-in kiosks, luxury lounges are eliminated, the departure gate area with limited seating facilities and the arrival area with one or two conveyor belt (Hanaoka and Saraswati 2011).

European Low Fare Airline Association (2004) contended that Low-Cost Airport emphasizes more on non-aeronautical revenue by increasing the terminal shopping area. Conversely, Kalakou & Macario (2013) analyzed the business model of different airport categories and contended that low-cost airport does not emphasize much on retail activities. The volume and type of traffic have a strong influence on airport business model (ELFAA 2004). However, the feature of the low-cost facilities of secondary airports has not been elaborated in the study leading towards the scope of the future investigation.

Singh, Dalei and Raju (2015) have contended that Low cost, no-frills airport will focus on quality and efficiency of services. Airport Design is to permit 25-30 minutes of turnaround time. The net result is that the airlines operating at these airports often require around half the space per passengers as the legacy airlines. A general feature of low-cost airports is also the absence of a large amount of expensive commercial space. These airports will be developed in a phased manner, initially to cater the needs of 20/40/80 seater aircrafts depending on traffic forecast. Smaller aircraft should be treated as the main demand driver for the future growth of low-cost airports. Initially, these airports may function on the basis of VOR only with or without Night Operations facilities. These airports can have a Runway Length of 1400m to 1700m with 2 parking bays. The perimeter may be provided with chain link fencing instead of the permanent wall.

Graham (2013) contends that Low-cost airport facilitates for quick turnaround time, convenient slot time, lack of congestion, low aeronautical charges and another user cost, small airport size and encompasses larger catchment area. Dziedzic and Warnock-Smith (2016) defined that characteristics of the low-cost airport as an airport levying low cost to its users, higher catchment area, quick and efficient airport operations, proximity to the primary city and convenient slot availability.

Despite the increasing dominance of LCA in the aviation market, the academic literature is inconclusive about the design characteristics of low-cost airports.

2.2. **Framework and strategy for Airport Development**

Prior to liberalization, the world of non-competing airlines was mirrored by a world of the non-competing airport (Barrett S.D. 2000). The advent of deregulation catalyzed the competitiveness of the airports. As airlines are free to choose their destination and hub airports, hence the airports design their strategy to lure them, resulting in increasing competitiveness among airports. The changes in the organizational structure are also contributing to increasing competitiveness of airports (Starkie 2002). Earlier the airport competitions emphasized catchment area of city as more than one airport was planned in the metropolitan area (Lian and Rønnevik 2011). In the liberalized market the competition between airports has been intensified and evidence of competition have been identified in few studies (Starkie 2008; Forsyth et al. 2010; Copenhagen Economics 2012). However to devise an effective strategy for an airport it is necessary for an airport to understand their competitive environment and the way airport relate to their multiple stakeholders to align their strategies. To fulfill the above gap, Schaar & Sherry (2010) presented a model that attempts to describe the interrelationship between highly diverse entities of airports in terms of their responsibilities and needs for the United States. However, the model becomes too complex for role analysis of airport operator as it segregates the planning process among several entities of the airport. Jarach (2001) develop the air transport pipeline model to analyze the business relations among all entities of the airports. Tretheway & Kincaid (2010) utilized 'four Ps of marketing' to develop the strategy to cater the specific need of the airport customer. Graham (2010) performed competitive analysis for the airport based on Porter's five forces framework. However, the model has not been effective in airport context as airport involves multiple buyers and suppliers interacting simultaneously. Frank (2011) analyzed the business model of airports and concluded that the business model of airports is highly dependent on the context in which they operate. Kalakou & Macário (2013) evidenced the existence of diversity in the business model of 20 low-cost airports.

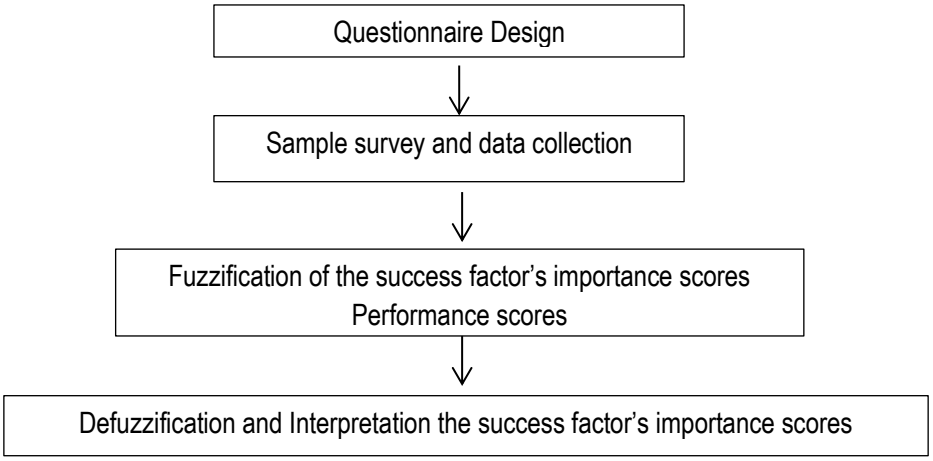
As evident from the most literature that the suitable business model of the low-cost airport is context dependent, which points the need to address the gap underlying for development of Indian Low-cost regional airports.

3. Methodology

The importance perception of the success factors of low-cost airport development is a subjective measurement. When it is measured on the basis of a numerical linguistic variable often results in incomplete, inconsistent, vague and imprecise results (Lupo 2015; Pandey 2016). On the contrary, it would be preferable to furnish interval value judgments rather than crisp value judgment (Chan and Kumar 2007). Since the measurement of success factor encompasses with intrinsic complexity related to nature of service, hence Fuzzy set theory render an effective approach to measure the expectation based on an interval-based linguistic variable (Lupo 2015; Pandey 2016).

Therefore the current study employed Fuzzy Multi-criteria Decision Making (MCDM) to evaluate key success factors for development and sustenance of Low-Cost Regional airport in India. The study has incorporated the following steps for the attainment of research objective: designing of the questionnaire, a collection of data, fuzzification of importance scores for evaluation of success factors of low-cost airport development and finally its defuzzification and interpretation which is depicted in figure 1. Further, an overview of Fuzzy set theory and principles and the main steps of the research process are detailed.

Figure 3: Research Process of Fuzzy MCDM



3.1. Fuzzy Set Theory and linguistic-fuzzy evaluation scales

The concept of the fuzzy set was propounded by Zadeh (1973) with the purpose to measure the human judgments or preferences more pragmatically by the help of linguistic terms. As the preferences expressed by human cannot be estimated with an exact numerical value, hence interval based linguistic term are used to describe the desired value (Zadeh 1973 ; Bellman and Zadeh 1970; Zadeh 1975; Hwang and Yoon 1981; Liang and Wang 1991; Hsu and Chen 1997; Chiadamrong 1999; Chien and Tsaia 2000; Chen 2001; Enrique 2004). The fuzzy set theory provides a strict mathematical framework in which vague conceptual phenomena can be precisely and rigorously studied (Zimmermann 2001). Fodor and Roubens (1994) derived mathematical details of Fuzzy MCDM analysis. Altrock (1995) applied fuzzy logic to describe the 30 case studies emphasizing wide application as a decision-making tool.

A fuzzy set is a set without a crisp, clearly defined boundary and contains elements with only a partial degree of membership (Mathworks 2012). Mathworks (2012) defines a membership function (MF) as a curve that explains how each point in the input space is mapped to a membership value (or degree of membership) between 0 and 1. The concepts of a linguistic variable can be quantified by fuzzy numbers using suitable membership functions.

In the current research linguistic variable were used to represent the experts' assessment of the success factors importance and positive triangular fuzzy numbers were employed to gauge the linguistic variable as depicted in Table 1.

The previous literature has already established the basic arithmetic operations on fuzzy numbers. If $A_1 = (l_1, m_1, u_1)$ and $A_2 = (l_2, m_2, u_2)$ are representing two distinct triangular fuzzy numbers then their algebraic multiplication operations can be expressed by equation 1.

$$A1 \otimes A2 = (l1, m1, u1) \otimes (l2, m2, u2) = (l1l2, m1m2, u1u2) \quad \text{Equation 1.}$$

Table 1: Linguistic variables for measurement of weight of success factors

Not at all important	(0.0, 1.0, 2.0)
Slightly Important	(1.0, 2.0, 3.0)
Moderately Important	(2.0, 3.0, 4.0)
Very Important	(3.0, 4.0, 5.0)
Extremely Important	(4.5, 5.0, 5.0)

The two main steps below shall describe the proposed method to conduct the current study:

Step 1: Data Collection and Sampling Framework: A questionnaire was designed on the basis intensive review of literature which contains seven Dimension and 32 success criteria for the development of low-cost airport which are indicated in Figure 2.

The data was collected from the expert team comprising of the senior executives employed with the key stakeholders of the airports in India. The key stakeholders included airlines, airports, regulators, consultants, policy makers and service providers. The survey was conducted throughout the month of December 2017 by employing purposive sampling method. A sample of 160 executives was undertaken for the study which is adequate for study in line with Norman and Streine (2003) who have stated that the adequate sample size to be five-fold of number of variables.

Step 2: Method Utilized for Fuzzification and Defuzzification of Success Factors Importance Score

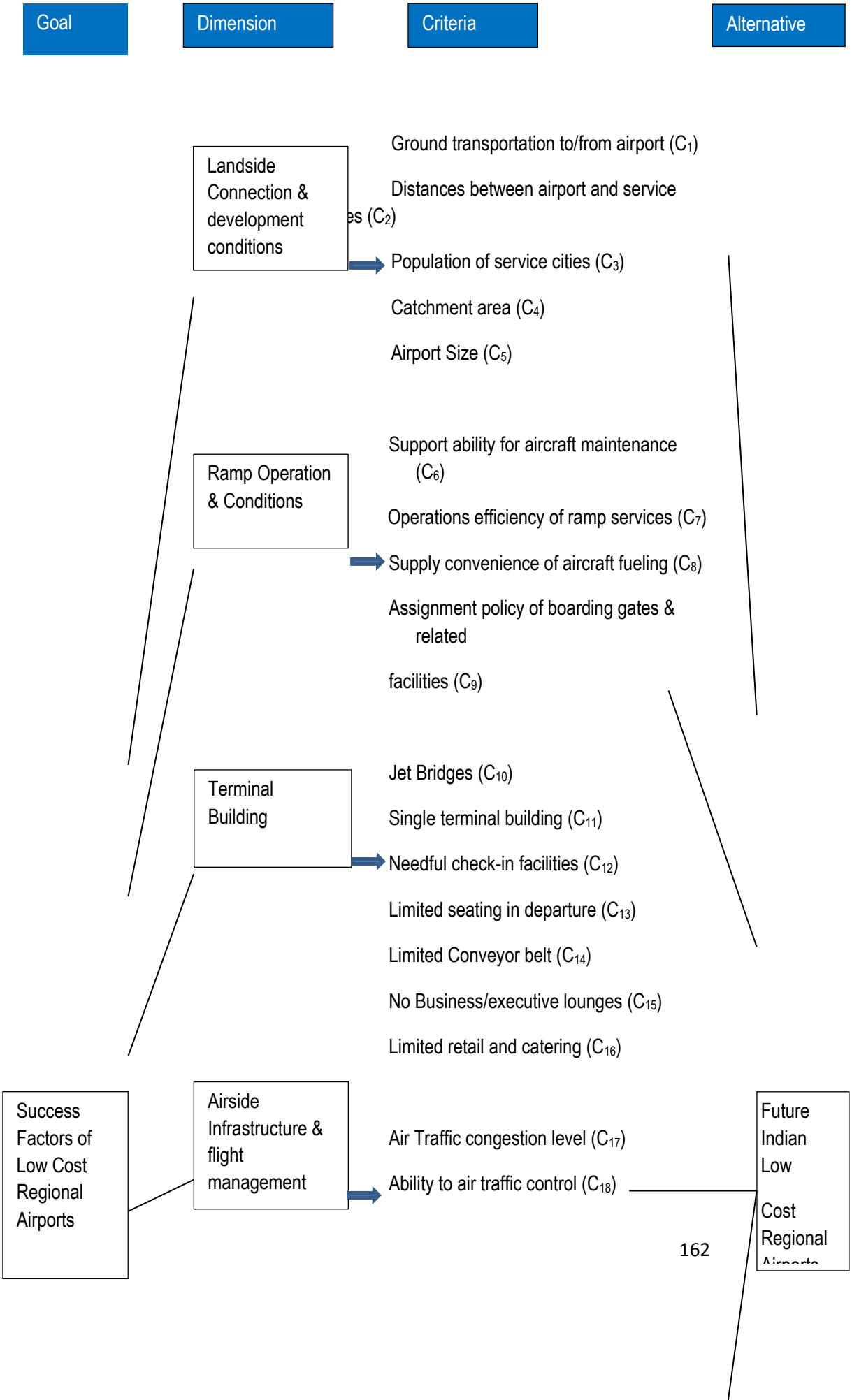
For a ranking of fuzzy numbers graded mean integration representation method was explored by Chen and Hesieh (1998). Further, Chou (2003) has identified a canonical representation of multiplication operation on two triangular fuzzy numbers by graded multiple integration representation methods. Chou (2006) applied inverse function arithmetic representation for multiplication operation of multiple trapezoidal fuzzy numbers and the framework was employed to solve MCDM problem by Chou (2007). Chien-Chang (2012) developed a fuzzy MCDM model for evaluating the service quality of the airports where the service quality criteria and importance weight both were transformed into a triangular fuzzy number.

This paper constructs fuzzy MCDM model for evaluating the success factor of Low-Cost Regional airport utilizing a canonical representation of TFN based on graded mean integration method which is in line with the study of Chien-Chang (2012). Later the defuzzification of the scores is done using Inverse Arithmetic representation method. By employing the graded mean integration method a TFN $Y_1 = (c_1, a_1, b_1)$ is represented utilizing Equation 2. The same representation is employed on all importance scores obtained from executives and then the average of the respective criteria is aggregated.

$$\mathrm{P(Y1)} = \frac{1}{6}(\mathrm{c1} + 4\mathrm{a1} + \mathrm{b1}) \qquad \text{Equation 2.}$$

The normalized weight of respective criteria is obtained by employing equation 3, where w_{in} represents the importance scores of i^{th} success factor (i=1,2,…….w) rendered by the n^{th} respondent (n= 1,2,…….n) and AW_i represents the aggregate normalized weight of i^{th} success factor.

$$\mathrm{AWi} = \frac{\sum_{n=1}^{N} win}{\sum_{i=1}^{I}\sum_{n=1}^{N} win} \qquad \text{Equation 3.}$$


Goal
Dimension
Criteria
Alternative
Success Factors of Low Cost Regional Airports
Landside Connection & development conditions
Ramp Operation & Conditions
Terminal Building
Airside Infrastructure & flight management
Ground transportation to/from airport (C1)
Distances between airport and service
es (C2)
Population of service cities (C3)
Catchment area (C4)
Airport Size (C5)
Support ability for aircraft maintenance (C6)
Operations efficiency of ramp services (C7)
Supply convenience of aircraft fueling (C8)
Assignment policy of boarding gates & related
facilities (C9)
Jet Bridges (C10)
Single terminal building (C11)
Needful check-in facilities (C12)
Limited seating in departure (C13)
Limited Conveyor belt (C14)
No Business/executive lounges (C15)
Limited retail and catering (C16)
Air Traffic congestion level (C17)
Ability to air traffic control (C18)
Future Indian Low
Cost Regional

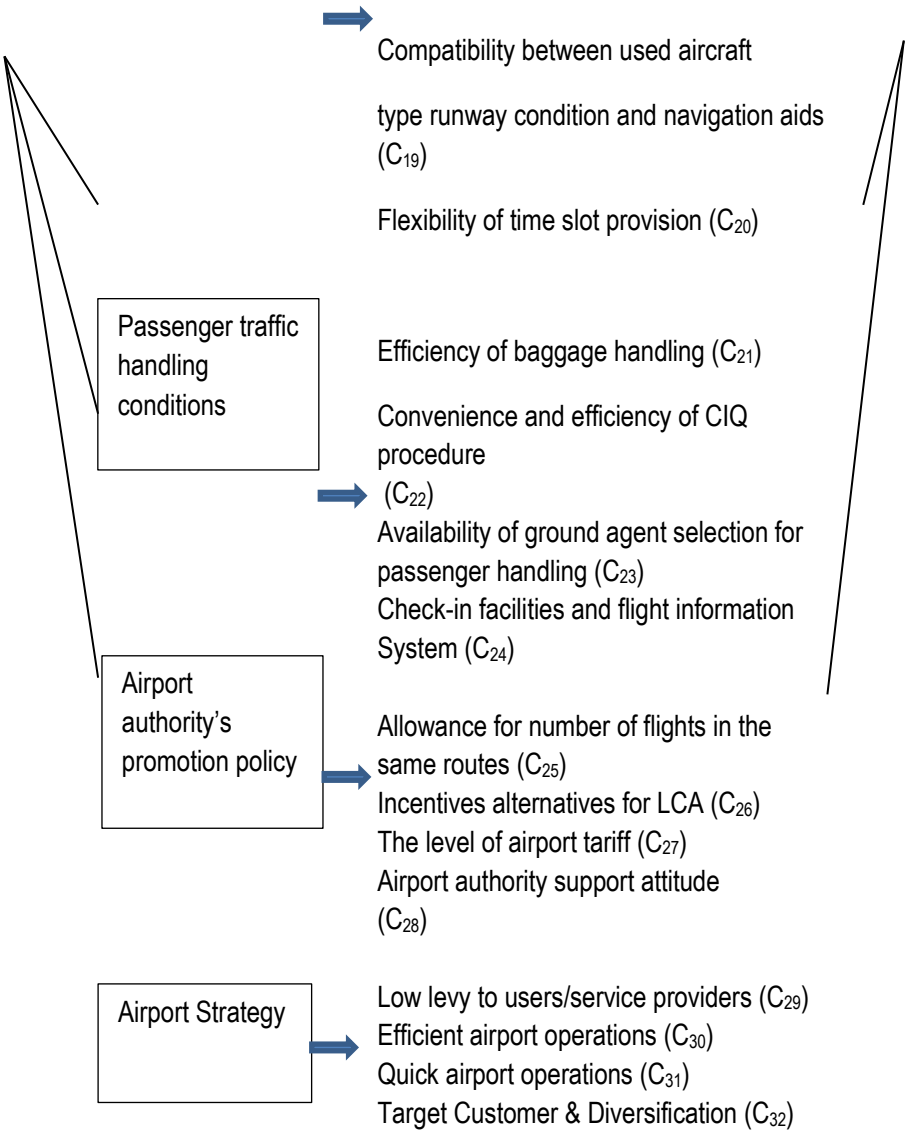

Compatibility between used aircraft type runway condition and navigation aids (C_{19})
Flexibility of time slot provision (C_{20})
Passenger traffic handling conditions
Efficiency of baggage handling (C_{21})
Convenience and efficiency of CIQ procedure (C_{22})
Availability of ground agent selection for passenger handling (C_{23})
Check-in facilities and flight information System (C_{24})
Airport authority's promotion policy
Allowance for number of flights in the same routes (C_{25})
Incentives alternatives for LCA (C_{26})
The level of airport tariff (C_{27})
Airport authority support attitude (C_{28})
Airport Strategy
Low levy to users/service providers (C_{29})
Efficient airport operations (C_{30})
Quick airport operations (C_{31})
Target Customer & Diversification (C_{32})

Table 2. Evaluation result of the success factors for Low-Cost Airport Development in India.

Goal	Dimension	Criteria	Criteria Score	Dimension Score	Criteria Weight	Dimension Weight
Success Factors of Low Cost Airport Development	Landside Connection & development conditions	C1	3.91	4.10	2.95%	3.10%
		C2	3.80		2.87%	
		C3	4.26		3.22%	
		C4	4.30		3.25%	
		C5	4.20		3.18%	
	Ramp Operation & Conditions	C6	3.86	3.86	2.92%	2.92%
		C7	4.32		3.27%	
		C8	4.07		3.07%	
		C9	3.22		2.43%	
	Terminal Building	C10	4.50	4.39	3.40%	3.31%
		C11	4.46		3.37%	
		C12	4.35		3.29%	
		C13	4.32		3.27%	
		C14	4.27		3.23%	
		C15	4.34		3.28%	
		C16	4.46		3.37%	
	Airside Infrastructure & flight management	C17	3.43	4.04	2.59%	3.05%
		C18	4.22		3.19%	
		C19	4.31		3.26%	
		C20	4.19		3.16%	
	Passenger traffic handling conditions	C21	4.44	3.96	3.36%	3.00%
		C22	3.88		2.93%	
		C23	3.50		2.65%	

		C24	4.03		3.04%	
	Airport authority's promotion policy	C25	4.07	4.36	3.07%	3.30%
		C26	4.33		3.27%	
		C27	4.54		3.43%	
		C28	4.52		3.41%	
	Airport Strategy	C29	4.27	4.05	3.22%	3.06%
		C30	4.34		3.28%	
		C31	4.06		3.07%	
		C32	3.55		2.68%	

4. Findings and Discussion

Based on the Fuzzy MCDM method, the analysis summarized in Table 2 reveals the evaluated construct for the development and sustenance of Low-Cost Regional Airports in India. Out of the seven dimensions, the terminal building and airport's promotion policy were most important with a weighted score of 3.31% and 3.30% respectively. The remaining dimensions, Landside Connection & development, airport strategy, airside infrastructure & flight management, passenger traffic handling conditions and ramp operation conditions have attained the weight of 3.10%, 3.06%, 3.05%, 3% and 2.92% respectively.

The high weight of the dimension terminal building is attributed to the importance designated by the respondents to all the factors of the dimension. It is observed that all the criteria of the dimension terminal building have attained high importance score. The criteria 'No Jet Bridges' (C10), 'Single terminal building' (C11), 'Needful check-in facilities' (C12), 'Limited seating in departure' (C13), 'Limited Conveyor belt' (C14), 'No Business/executive lounges' (C15) and 'Limited retail and catering' have scored 4.50, 4.46, 4.35, 4.32, 4.27, 4.34 and 4.46 respectively. The high weight obtained for all the factors of the dimension signifies the need to keep the low investment cost and efficient operations in airport development.

The dimension airport's promotion policy stands at second highest rank because of the exceptionally high importance score of the criteria 'level of airport tariff (C27)' and 'Airport authority support attitude'(C28) with 4.54 and 4.52 respectively. The criteria Allowance for a number of flights in the same routes (C25) and Incentives alternatives for LCA (C26) have scored 4.07 and 4.33 respectively. The low levy of airport tariff and airport authority support attitude act as an enabler for the airport users. The supportive attitude of airport operator helps the airlines to maintain their efficiency apart from low levies which eventually catalyze the development of regional air transportation.

The third highest weight has been attained by dimension 'Landside Connection & development' which is attributed to high importance obtained from criteria 'Population of service cities' (C3), 'Catchment area' (C4) and 'Airport Size' (C5) with scores of 4.26, 4.30 and 4.2 respectively. While the criteria Ground transportation to/from the airport (C1) and Distances between airport and service cities (C2) have obtained the importance score of 3.91 and 3.80 respectively. It is inferred that demand for air travel is the key criteria for success of low-cost

regional airports hence the factors such as C3, C4 and C5 have obtained a good weight. The identified criteria should be assessed effectively for the success of low-cost regional airports in India.

The dimension 'Airport Strategy' has obtained the fourth rank with high weight achieved from criteria 'Low levy to users/service providers' (C29) and 'Efficient airport operations' (C30) with a score of 4.27 and 4.34 respectively. While the criteria 'Quick airport operations' (C31) and 'Target customer and diversification' (C32) has attained the score of 4.06 and 3.55 respectively. It can be inferred that the key stakeholders opine that low levy from airport users and efficient airport operations are a key success factor for the low-cost regional airport in India.

The fifth-ranked dimension is 'Airside Infrastructure and flight management' with high importance achieved by criteria 'Compatibility between used aircraft type, runway condition and navigation aid' (C19) and 'Flexibility of time slot provision' (C20) with a score of 4.31 and 4.19 respectively. The criteria 'Air traffic congestion level' (C17) and 'ability of air traffic control' (C18) has scored 3.43 and 4.22 respectively. It can be inferred that efficient air traffic control services are required at Low-cost regional airport. Also, the congruency between aircraft type of the prospective LCA and airside facilities need to be established.

The dimension 'Passenger traffic handling conditions' has obtained the sixth rank with high weight achieved from criteria 'Efficiency of baggage handling' (C21) with a score of 4.44. While the criteria 'Convenience and efficiency of CIQ procedure' (C22), 'Availability of ground agent selection for passenger handling' (C23) and 'Check-in facilities and flight information system' (C24) has attained the score of 3.88, 3.5 and 4.03 respectively. It can be inferred that the efficient baggage handling system is one of the most pertinent factors for the success of low-cost airport. As the low-cost airport stakeholders desire quick passenger flow in the terminal.

The dimension 'Ramp operation and condition' has obtained the seventh and last rank for which the criteria 'operations efficiency of ramp services' (C7) has weight of 4.32. The remaining criteria 'support ability of aircraft maintenance' (C6), 'Supply convenience of aircraft fuel' (C8) and 'Assignment policy of boarding gates and related facilities' (C9) have scored 3.86, 4.07 and 3.22 respectively. Hence efficiency of ramp services remains the key success factor of the current dimension.

5. Conclusion

The current paper identifies and evaluates the key success factors for development and sustenance of Low-Cost Regional airport in India using Fuzzy MCDM method. The findings of the study point that the design of terminal building and Airport's authority promotion policy are the most important dimension for low-cost airport development. High weight has been obtained for all the factors of the dimension terminal building signifying the need to keep the low investment cost and efficient operations in airport development.

The factor low levy of airport tariff and airport authority support attitude has gained high weight in the dimension Airport promotion Policy signifying them to be the key enablers for the development and sustenance of low-cost regional airports. The factors related to 'demand for air travel' have also attained high weight necessitating the need to assess and evaluate them effectively prior to the development of low-cost regional airport development.

The factor efficient air traffic control services and compatibility of aircraft type of prospective LCA and airside facilities have also obtained high weight. It can be inferred that the key stakeholders opine that low levy from airport users, efficient airport operations, efficient baggage handling system and efficient ramp operations have emerged as a key success factor for the low-cost regional airport in India

This paper furnishes the evaluated success factors for low-cost regional airport development and sustenance in India which fulfills the gap in the literature by integrating the stakeholders view in low-cost regional airport development. Methodically, the paper contributes by developing and demonstrating the application of the Fuzzy based MCDM model for evaluation of the success factors for low-cost regional airport development.

As to contribute to future research in this domain, comprehensive functional success factors need to be explored and included in the evaluation model. Also, some more strategic critical factors related to airport development should be explored through expert interview may be included in the further study.

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Evaluating the service quality of airports in Thailand using fuzzy multi-criteria decision making method

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ABSTRACT

The highly competitive aviation industry necessitates for continuous improvement in service quality of airports. The study has attempted to investigate the service quality of two gateway airports of Thailand, Suvarnabhumi (BKK) and Don Mueang (DMK) and has identified the scope of improvements. The service quality of the airport was investigated using the Fuzzy Multi Criteria Decision Making (MCDM) Method. It also employs Improvement Performance Analysis using a fuzzy expert system which renders the managerial implications pertaining to identification of improvement areas. The findings of the study, exhibit that the service quality of both the airports, BKK and DMK, is satisfactory, however some areas require improvement which was identified and suggested. The study demonstrates and signifies that the Fuzzy MCDM method is promising and pragmatic decision making tool for the airport service quality measurements.

1. Introduction

Increasing wealth is driving the growth of demand of air travel both globally and regionally. However this growth has created its own challenges especially to the passenger experience, which has suffered as infrastructure is not keeping pace with the growth. This infrastructure bottleneck often compromises the values that airport delivers to its passengers and airlines. The growth of air travel has also increased the demand for airport services and mandated for more efficient process of service deliveries to its customer. It has also catalyzed the competition among airport operators to improve value proposition to its customer. The airlines seek to make their operations hub at the airport operating efficiently in order to reduce their costs and increase the quality of services rendered to their passengers (OUM, T.H. et al., 2003). Efficiency and service quality are key performance indicators for the operation of airport, which needs to be trade off to optimize the performance.

Efficiency evaluation of airport is widely used and applied in management of airport, which are mostly based on comparative analysis of airport's economic or operational performance, employing Data Envelopment Analysis (DEA) and Total Factor Productivity (TFP) (ATRS, 2004; Park, 2003). Although the efficiency evaluation of airport indicates the improvement areas however it fails to give managers, a quality perspective on the services provided, which may compromise sustainable development (Fernandes & Pacheco, 2002; Pacheco & Fernandes, 2003).

With the advent of commercialization, marketization and competition in airport business arena, the philosophy of airport management is undergoing transformation where customer service quality and customer delight are emphasized. For instance, in 2015, 300 airports across 80 countries participated in Airport Service Quality (ASQ) survey organized by Airport Council International (ACI) (AIRPORT COUNCIL INTERNATIONAL, 2015). Hence evaluating and improving the quality of service are main concerns of modern airport business. Many studies are conducted on evaluation of the quality of airline services but only few literatures in this context are available for airport. Hence the changing nature of airport business has necessitated for research in this context.

Most of the researches conducted on airport service quality are based on SERVQUAL method. However the SERVQUAL model is based on assumption that all the criteria used to gauge the quality are rated equally important (CHOU, C., 2009a). In order to address this limitation (CHOU, C. C., 2009c) proposed a Multi Criteria Decision Making (MCDM) method to gauge the service quality of airlines. Later Chou C., 2009b proposed fuzzy weighted SERVQUAL method for the evaluation of airline service quality. As Tsaur, Chang & Yen (2002) observed it is difficult explain and measure the service quality of airlines due to heterogeneity, intangibility and inseparability. Hence it is not easy for passengers to express their satisfaction and importance of criteria using an exact numerical value, therefore it is more realistic to use linguistic terms to describe the perception value and importance of evaluation criteria (CHIEN-CHANG, C., 2012).

This article attempts to evaluate the service quality of the two busiest airports operated by Airport of Thailand and identify the scope of improvement keeping in view the changing consumer needs. The service quality of airport was investigated using the Fuzzy Multi Criteria Decision Making Analysis (MCDM). It also employs Improvement Performance Analysis using fuzzy expert system to explore the enhancement of services at the airports.

2. Literature Review

Service quality can be defined as the whole of the explicit and tacit components on which complete satisfaction of customer needs depends (LAURA, Eboli and Gabriella, Mazzulla, 2009). Customer satisfaction is a measure of company performances as per the specific need of customer (HILL, N. et al., 2003). The measure of customer satisfaction provides the service quality measure (LAURA, Eboli and Gabriella, Mazzulla, 2009). Hence the measure of customer satisfaction on specific and overall service dimensions reflects the measurement of service quality.

The customer satisfaction survey has two important aspects: the perception, which measures the perceived benefits of customer and the expectation which explains the customer expectation from the service dimensions. And customer satisfaction can be evaluated by measuring the gap between customer expectation and perception (PARASURAMAN, A. et al., 1985).

FODNESS, D. et al. (2007) conducted an empirical study for evaluation of service quality of airport in which it was concluded that passenger's expectation to ASQ depends on three key dimensions: interaction, function and diversion. The key measure of effective airport management is the opinion of passengers to airport services (LUBBE, B. et al., 2011). Lubbe, Douglas et al. (2011) conducted an empirical study based on FODNESS, D. et al. (2007)

measures of ASQ and identified the difference in opinion of corporate and leisure travellers on expectation on service quality of airport.

For assessing the service quality of airports (CHOU, C.C. et al., 2011) developed scale based on SERVQUAL methodology, the traditional approach of measuring service. Erdil & Yildiz,(2011) also evaluated the service quality of airport based on SERVQUAL approach with 22 service criteria. LIOU, James J.H. et al. (2011) employed a new method- dominance based rough set approach (DRSA) to assess the service quality of airport in which passengers evaluated the level of airport services by ranking varied sets of service criteria. DRSA method was useful for the purpose of development of strategies to improve service quality.

Magri & Alves (2005) employed the Airport Council International (ACI) framework of 36 criteria to measure the service quality of airport but overall service quality was not aggregated in their study which gave fragmented results. The ACI (2000) developed a scale for measurement of service quality of airport based on opinion of 512 airport members in which 13 Objective criteria and 38 subjective criteria are used. Later the scale was revised and is employed in the current research for measuring the service quality (ACI, 2012).

Since the subjective evaluation of service quality is difficult to be expressed in number, there is existence of uncertainty (fuzziness) (CHIEN-CHANG, C., 2012). Hence the use of Fuzzy MCDM model can be more realistic in assessing service quality as perception of passengers can be expressed in linguistic term. Fernandes & Pacheco (2010) evaluated the airport service quality using Fuzzy multi-criteria analysis and alpha cut concept. The author applied these methods on six airports in Brazil and rendered strategic framework for management of airport. Similarly, Chien-Chang (2012) also employed Fuzzy MCDM method to gauge the service quality of two airports in Taiwan and also give strategic solution to to improve the service quality performance of airport by employing fuzzy expert system.

In line with Chien-Chang (2012), this research attempts to fill the gap in literature by employing Fuzzy MCDM to measure the service quality of the airports.

3. Methodology

The concept of fuzzy set was propounded by Zadeh (1973) with the purpose to measure the human judgments or preferences more pragmatically by the help of linguistic terms. As the preferences expressed by human cannot be estimated with an exact numerical value the linguistic term are used to describe the desired value (Zadeh, 1973; Bellman and Zadeh, 1970; Zadeh, 1975; Hwang Yoon, 1981; Liang & Wang, 1991; Hsu & Chen, 1997; Chiadamrong, 1999; Chien & Tsaia, 2000; Chen, 2001; Enrique, 2004). Fuzzy set theory provides a strict mathematical framework in which vague conceptual phenomena can be precisely and rigorously studied (ZIMMERMANN, H.J., 2001). Fodor and Roubens (1994) derived mathematical details of Fuzzy MCDM analysis. Altrock (1995) applied fuzzy logic to describe the 30 case studies emphasizing wide application as decision making tool.

A fuzzy set is a set without a crisp, clearly defined boundary and contains elements with only a partial degree of membership (MATHWORKS, 2012). Mathworks (2012) defines a membership function (MF) as a curve that explains how each point in the input space is mapped to a membership value (or degree of membership) between 0 and 1. The previous literature has already

established the basic arithmetic operations on fuzzy numbers (). If A_1= (l_1, m_1, u_1) and A_2 = (l_2, m_2, u_2) are representing two triangular fuzzy numbers then their algebraic multiplication operations can be expressed by equation 1.

$$A1 \otimes A2 = (l1, m1, u1) \otimes (l2, m2, u2) = (l1l2, m1m2, u1u2)$$

Equation 1.

For ranking of fuzzy numbers graded mean integration representation method was explored by Chen and Hesih (1998). Further Chou (2003) identified canonical representation of multiplication operation on two triangular fuzzy numbers by graded multiple integration representation method. Chou (2006) applied inverse function arithmetic representation for multiplication operation of multiple trapezoidal fuzzy numbers and the framework was employed to solve MCDM problem by Chou (2007). Chien-Chang (2012) developed a fuzzy MCDM model for evaluation the service quality of the airports where the service quality criteria and importance weight both were transformed into triangular fuzzy number,

Y_1= (c_1,a_1,b_1) & Y_2= (c_2,a_2,b_2) and were represented using the graded mean integration method for which the generalized equation 2 is given below:

$$P(Y1) = \frac{1}{6}(c1 + 4a1 + b1)$$

Equation 2.

Later both the triangular fuzzy number were defuzzied by employing the inverse function arithmetic presentation (CHIEN-CHANG, C., 2012). Chien-Chang (2012) fuzzy MCDM model has been applied in the current research to gauge the service quality of the airports. The proposed research process to the current pertaining starts from designing of questionnaire, collection of data, Fuzzification of scores for service criteria and their respective weightage. Analysis and Interpretation of service criteria scores obtained, Fuzzification for Importance Performance Analysis and Defuzzification of IPA and its interpretation as indicated in Figure 1.

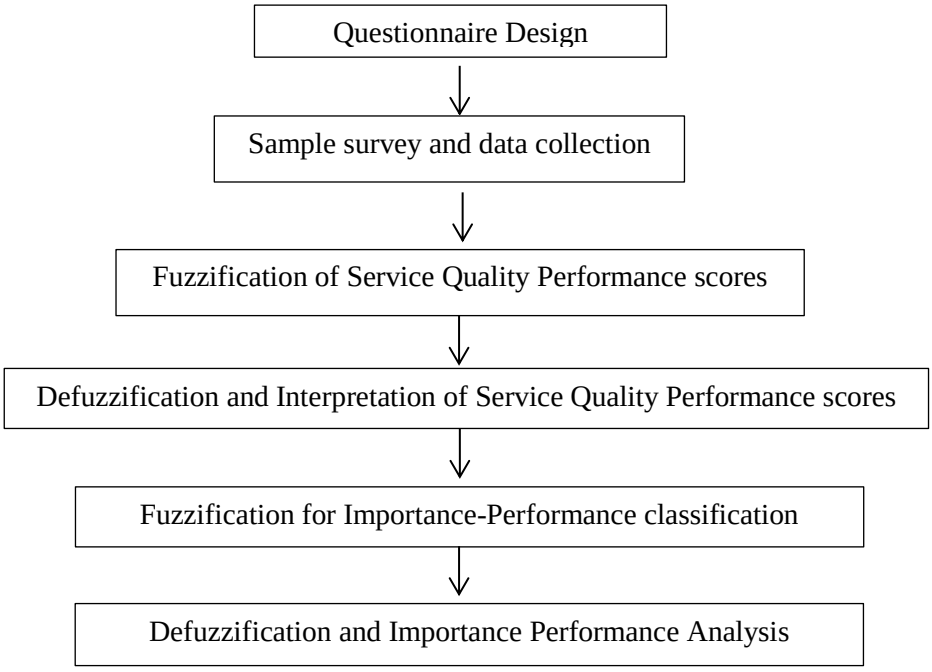


Figure 4: Research Process of Fuzzy MCDM

The scores are converted to triangular fuzzy number and are represented by applying the graded mean integration method as illustrated by equation 2. The calculation and defuzzification of the scores of service quality was done using the inverse function representation of multiplication operation of two triangular fuzzy numbers by employing the formula in equation 3 & 4 which is congruent to study of Chou (2006). N is the sample size or total number passengers interviewed. I indicate the total number of service criteria used in the study. W_{in} represents the weightage score given by n^{th} passenger for i^{th} service criteria. S_{ikn} symbolizes the performance score given by nth passenger for i^{th} service criteria of K^{th} airport Here AW_{ik} is the ratio of importance weight criteria C_i to Overall importance weight criteria for K^{th} airport. TS_k is the average score of service quality of K^{th} airport. Both AW_{ik} and S_{ikn} are fuzzy numbers.

$$\text{AWik} = \frac{\sum_{n=1}^{N} win}{\sum_{i=1}^{I}\sum_{n=1}^{N} win} \qquad \text{Equation 3.}$$

$$\text{TS}_k = \frac{1}{N}\sum_{i=1}^{I}\sum_{n=1}^{N} AWik \otimes Sikn \qquad \text{Equation 4.}$$

For Important Performance Analysis (IPA) the scores of service quality and weightage are fuzzified using graded mean integration representation method and then for defuzzification, fuzzy rule based expert system are employed to solve the classification problem by using IF-THEN Rule (KLOSE, C.D., 2002). Following four IF-THEN rule are applied in the current pertaining:

$IF\ S(i) > AS(i) AND\ S(p) < AS(p)\ THEN\ Quadrant\ I$ (1)
$IF\ S(i) > AS(i) AND\ S(p) > AS(p)\ THEN\ Quadrant\ II$ (2)
$IF\ S(i) < AS(i) AND\ S(p) < AS(p)\ THEN\ Quadrant\ III$ (3)
$IF\ S(i) < AS(i) AND\ S(p) > AS(p)\ THEN\ Quadrant\ IV$ (4)

Where $S_{(i)}$ stands for average score of importance for i^{th} criteria, $AS_{(i)}$ stands for overall average score of importance, $S_{(p)}$ indicates the average score of performance for p^{th} criteria and $AS_{(p)}$ indicated overall average score of performance.

A questionnaire was designed in line with the ASQ survey of ACI (2012) which contains seven Dimension and 33 service criteria which are detailed in Figure 2. The passenger's service quality perception of each service criteria is gauged using the linguistic variable scale which were labeled as 'very poor', 'poor', fair, good and very good and their respective rating are indicated in Table 1 Similarly for importance weight criteria linguistic variable used are and their respective ratings are specified in Table 2

Table 2: Linguistic variables for service quality performance

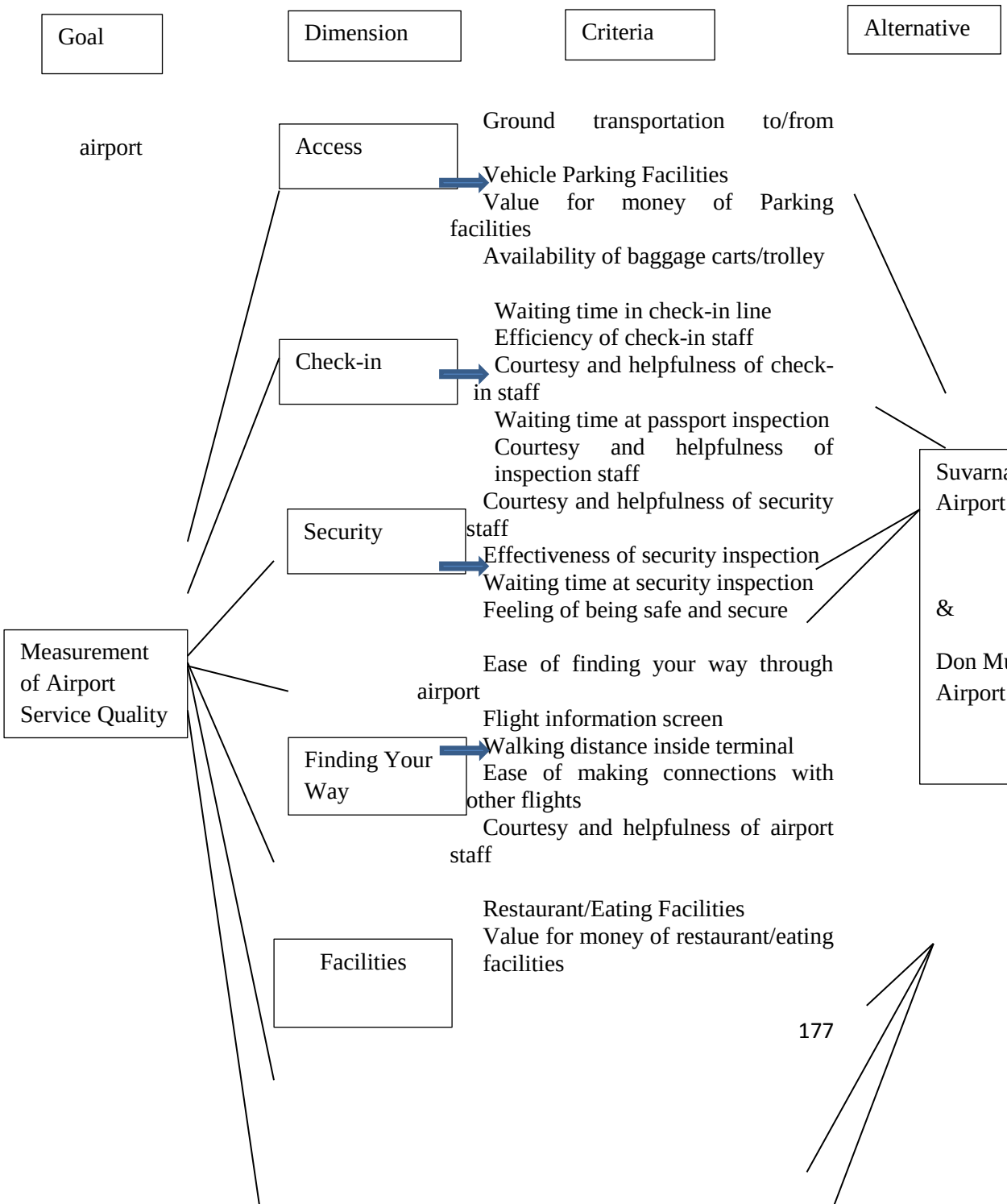
Poor	(0.0, 1.0, 2.0)
Fair	(1.0, 2.0, 3.0)
Good	(2.0, 3.0, 4.0)
Very Good	(3.0, 4.0, 5.0)
Excellent	(4.5, 5.0, 5.0)

Table 3: Linguistic variables for weight of service criteria

Not at all important	(0.0, 1.0, 2.0)
Slightly Important	(1.0, 2.0, 3.0)

Moderately Important	(2.0, 3.0, 4.0)
Very Important	(3.0, 4.0, 5.0)
Extremely Important	(4.5, 5.0, 5.0)

The data was collected from the departing passengers at Suvaranabhumi and Don Mueang airports in Thailand. The survey was conduct throughout the month of February 2016 by employing simple random sampling without replacement method. A sample of 320 passengers for Suvarnabhumi and 305 Don Mueang airport respectively were taken for the study which is corollary to Iacobucci & Churchill (2010) sample size estimation when population standard deviation is unknown and it estimates sample size of 300 and 284 for Suvarnabhumi and DonMueang airport respectively. 500 questionnaires were distributed in survey for which response rate obtained at Suvarnabhumi and Don Mueang airport was 64% and 57% respectively.



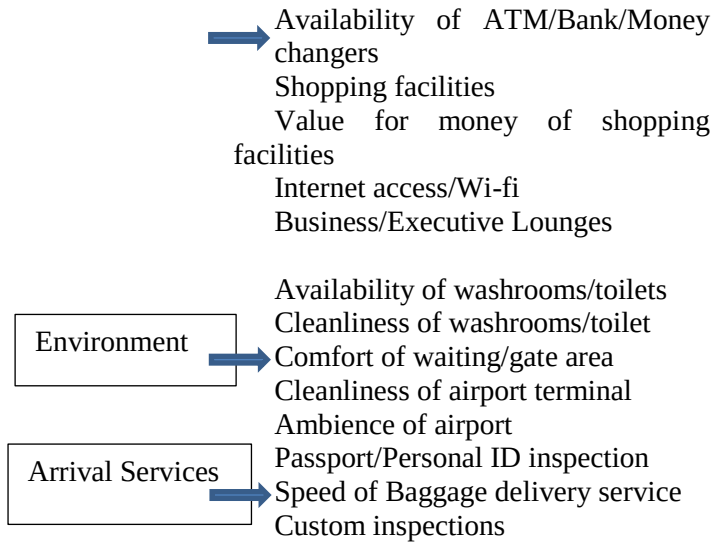


Figure 5: Hierarchical analysis structure for evaluation of the quality of airport service of high importance

4. Findings

The average score of overall service quality performance of Suvarnabhumi and Don Mueang Airports are 3.97 and 3.61 respectively and overall service quality expectations for BKK and DMK are 3.75 and 3.39 respectively demonstrating that at both airports actual benefit received by passengers for overall service quality is higher that perceived benefits and is indicating that passengers at both airports are satisfied of the service quality. The scores of service quality performance and expectations for each service criteria is listed in table 3 for the studied airports.

Table 4: Service Quality Weight and Performance Score

Dimensions	*Service Criteria*	*Suvarnabhumi Airport Weight Score*	*Suvarnabhumi Airport Performance Score*	*Don Mueang Airport Weight Score*	*Don Mueang Airport Performance Score*
Access	Ground transportation to/from airport (I_1)	3.96	4.01	3.96	4.03
	Vehicle Parking Facilities (I_2)	3.90	3.88	3.90	3.70
	Value for money of Parking facilities (I_3)	3.67	4.04	3.67	3.51
	Availability of baggage carts/trolley (I_4)	3.76	4.01	3.76	3.49
Check-in Time	Waiting time in check-in line (I_5)	4.14	3.74	4.14	3.65
	Efficiency of check-in staff (I_6)	4.00	4.03	4.00	3.73
	Courtesy and helpfulness of check-in staff (I_7)	3.90	3.90	3.90	3.68
	Waiting time at passport inspection (I_8)	4.07	4.02	4.07	3.88
	Courtesy and helpfulness of inspection staff (I_9)	3.51	3.98	3.51	3.73
Security	Courtesy and helpfulness of security staff (I_{10})	3.67	3.89	3.35	3.65
	Effectiveness of security inspection (I_{11})	3.16	4.05	2.65	3.56
	Waiting time at security inspection (I_{12})	4.00	3.87	4.00	3.55
	Feeling of being safe and secure (I_{13})	3.72	3.94	3.38	3.62

Finding your way	Ease of finding your way through airport (I_{14})	4.17	3.90	4.17	3.90
	Flight information screen (I_{15})	3.76	4.08	3.76	3.64
	Walking distance inside terminal (I_{16})	3.85	4.04	3.00	3.59
	Ease of making connections with other flights (I_{17})	3.55	3.95	2.90	3.45
	Courtesy and helpfulness of airport staff (I_{18})	3.78	3.91	2.79	3.75
Facilities	Restaurant/Eating Facilities (I_{19})	3.50	3.89	3.18	3.64
	Value for money of restaurant/eating facilities (I_{20})	4.00	3.98	3.03	3.49
	Availability of ATM/Bank/Money changers (I_{21})	3.56	4.02	3.06	3.59
	Shopping facilities (I_{22})	3.49	4.02	3.16	3.75
	Value for money of shopping facilities (I_{23})	2.83	4.10	2.83	3.72
	Internet access/Wi-fi (I_{24})	3.72	3.95	2.89	3.54
	Business/Executive Lounges (I_{25})	3.64	4.14	2.96	3.58
Environment	Availability of washrooms/toilets (I_{26})	3.55	3.98	2.87	3.33
	Cleanliness of washrooms/toilet (I_{27})	4.11	3.90	4.11	3.47
	Comfort of waiting/gate area (I_{28})	3.68	4.03	2.83	3.47
	Cleanliness of airport terminal (I_{29})	3.77	3.79	2.10	3.45
	Ambience of airport (I_{30})	3.18	4.11	2.03	3.47
Arrival Services	Passport/Personal ID inspection (I_{31})	3.96	4.06	3.96	3.54
	Speed of Baggage delivery service (I_{32})	4.35	3.97	4.35	3.42
	Custom inspections (I_{33})	3.68	3.82	3.51	3.52
	Average	3.75	3.97	3.39	3.61

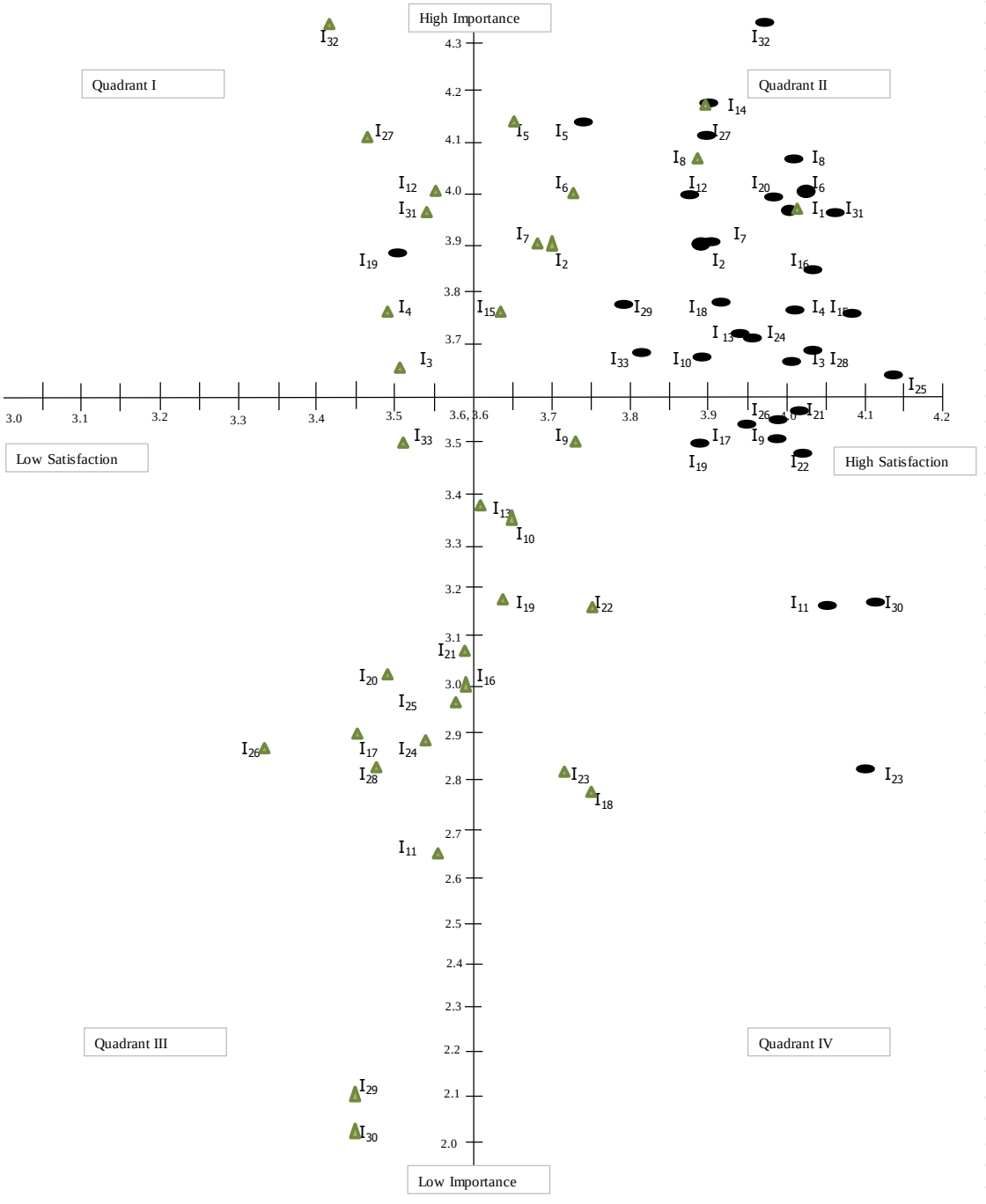


Figure 6: Importance-Performance Analysis Grid

It is found that at BKK airport, the performance and expectation scores for the service criteria, value for money of shopping is 4.10 and 2.83, ambience of airport is 4.11 and 3.18 and effectiveness of security inspection 4.05 and 3.16 respectively; and are top three performing criteria from passenger satisfaction per se. However BKK airport needs to improve on the service criteria, waiting time in check-in line, waiting time at security inspection, ease of finding way through airport, cleanliness of washrooms and speed of baggage delivery service where the score of performance is lower than expectation of passengers as indicated in table 3

At DMK airport, courtesy and helpfulness of airport staff, effectiveness of security inspection and value for money of shopping facilities are the best three performing service criteria passenger satisfaction wise, with scores of performance and expectation of 3.79 and 2.75, 3.56 and 2.65 and 3.72 and 2.83 respectively which can be observed from table 3

But DMK airport needs to improve on following service criteria, where the score for performance is lower than expectation as indicated in table 3, vehicle parking facilities, value for money of parking facilities, availability of baggage carts/trolley, waiting time in check-in line, efficiency of check-in staff, courtesy and helpfulness of check-in staff, waiting time at passport inspection, Courtesy and helpfulness of inspection staff, Waiting time at security inspection, Ease of finding your way through airport, Cleanliness of washrooms/toilet, Passport/Personal ID inspection and Speed of Baggage delivery service.

The results of importance performance analysis are plotted graphically in figure 3 where the satisfaction level of service criteria is indicated on horizontal axis while the importance of criteria is indicated on vertical axis. There are four quadrants in figure 3 of Importance Performance Analysis, where quadrant I represents 'concentrate here', quadrant II indicates 'keep up good work', quadrant III symbolizes 'low priority' and quadrant IV characterizes 'possible overkill' (Chen and Chang 2005). As displayed in figure 3 six criteria of DMK, speed of Baggage delivery service (I_{32}), cleanliness of washrooms (I_{27}), waiting time at security inspection (I_{12}), Passport/Personal ID inspection (I_{31}), availability of baggage carts/trolley (I_4) and value for money of parking facilities (I_3); and one service criteria of BKK, restaurant/eating facilities (I_{19}) lies in 'concentrate here' quadrant which means the performance results of the service criteria are reported poor although they are perceived to be important by passenger.

In 'keep up the good work quadrant' twenty four service criteria of BKK airport and eight criteria of DMK airport lies which are depicted in figure 3. The twenty four service criteria of BKK airport, lying in quadrant II are: Ease of finding your way through airport (I_{14}), waiting time in check-in line (I_5), cleanliness of washrooms/toilet (I_{27}), Waiting time at passport inspection (I_8), Efficiency of check-in staff (I_6), Value for money of restaurant/eating facilities (I_{20}), Waiting time at security inspection (I_{12}), Ground transportation to/from airport (I_1), Passport/Personal ID inspection (I_{31}), Courtesy and helpfulness of check-in staff (I_7), Vehicle Parking Facilities (I_2), Walking distance inside terminal (I_{16}), Cleanliness of airport terminal (I_{29}), Courtesy and helpfulness of airport staff (I_{18}), Availability of baggage carts/trolley (I_4), Flight information screen (I_{15}), Value for money of Parking facilities (I_3), Internet access/Wi-fi (I_{24}), Custom inspections (I_{33}), Courtesy and helpfulness of security staff (I_{10}), Value for money of Parking facilities (I_3), Business/Executive Lounges (I_{25}) and Comfort of waiting/gate area (I_{28}). And the Eight service criteria of DMK airport are waiting time in check-in line (I_5), efficiency of check-in staff (I_6), courtesy and helpfulness of check-in staff (I_7), vehicle parking facilities (I_2), Flight information screen (I_{15}), Waiting time at passport inspection (I_8), Ease of finding your way through airport (I_{14}) and Ground transportation to/from airport (I_1).These criteria are rated highly important and have received high score for performance as well. Airport management should direct the resources to maintain the performance in these areas.

The quadrant III which represents the low priority has twelve service criteria of only DMK airport. These service criteria are: Custom inspections (I_{33}), Availability of ATM/Bank/Money changers (I_{21}), Value for money of

restaurant/eating facilities (I_{20}), Walking distance inside terminal (I_{16}), Business/Executive Lounges (I_{25}), Internet access/Wi-fi (I_{24}), Ease of making connections with other flights (I_{17}), Availability of washrooms/toilets (I_{26}), Comfort of waiting/gate area (I_{28}), Effectiveness of security inspection (I_{11}), Cleanliness of airport terminal (I_{29}) and Ambience of airport (I_{30}). These criteria are rated low importance by passenger and have obtained low performance score as well. The Airport Management should give low priority to mobilize resources in these areas.

There are nine service criteria of BKK airport and seven of DMK airport lying in 'possible overkill' quadrant. The nine service criteria of BKK airport lying in quadrant IV are: Availability of washrooms (I_{26}), Availability of ATM/Bank/Money changers (I_{21}), Restaurant/Eating Facilities (I_{19}), Ease of making connections with other flights (I_{17}), Courtesy and helpfulness of inspection staff (I_9), Shopping facilities (I_{22}), Effectiveness of security inspection (I_{11}), Ambience of airport (I_{30}) and value for money of shopping facilities (I_{23}) while seven criteria of DMK are Courtesy and helpfulness of inspection staff (I_9), Feeling of being safe and secure (I_{13}), Courtesy and helpfulness of security staff (I_{10}), Shopping facilities (I_{22}), Restaurant/Eating Facilities (I_{19}), Feeling of being safe and secure (I_{13}) and Courtesy and helpfulness of airport staff (I_{18}). These criteria are having low importance but they have been rated as high performing areas by passengers.

5. Conclusion

This paper attempts to measure the service quality of the two gateway airports of Thailand Suvarnabhumi (BKK) and Don Mueang (DMK) by utilizing the Fuzzy MCDM Analysis and also conduct Importance Performance Analysis (IPA) using Fuzzy expert system. The paper suggests managerial implications on two fold. First it demonstrates the use of Fuzzy MCDM method to gauge the service quality of airport which is more reliable in measuring the perception. Second it exhibits the IPA using Fuzzy expert system which would be very useful to the airport management to prioritize their resource allocation for enhancement of their service weaknesses.

It was found that the service quality of both the airports is satisfactory however few avenues were identified to enhance the service quality of both airports. For BKK airport, there is need to improve on the service criteria pertaining to waiting time in check-in line, waiting time at security inspection, ease of finding way through airport, cleanliness of washrooms and speed of baggage delivery service.

DMK airport needs to improve on service criteria pertaining to vehicle parking facilities, value for money of parking facilities, availability of baggage carts/trolley, waiting time in check-in line, efficiency of check-in staff, courtesy and helpfulness of check-in staff, waiting time at passport inspection, Courtesy and helpfulness of inspection staff, Waiting time at security inspection, Ease of finding your way through airport, Cleanliness of washrooms/toilet, Passport/Personal ID inspection and Speed of Baggage delivery service.

The finding of IPA helps the airport manager to prioritize their resource allocation for enhancement of service quality. The finding suggests that the airport managers of DMK should prioritize quality enhancement of following service criteria: speed of Baggage delivery service, cleanliness of washrooms, waiting time at security inspection, Passport/Personal ID inspection, availability of baggage carts/trolley and value for money of parking facilities.

The airport managers of BKK should focus on service criteria of restaurant/eating facilities.

As measuring the perception of service quality based on crisp value can often be misleading hence the use of fuzzy MCDM method can give a more realistic measurement. Since there is dearth of research measuring the service quality of airport by employing Fuzzy MCDM method; hence the paper contribute theoretically to fill the gap to above pertaining and found that the Fuzzy MCDM method is promising and pragmatic in measuring the service quality of the airports.

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Evaluating the low cost airline's choice factors of airports in India using Fuzzy MCDM method

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Abstract:

The current study attempts to evaluate the low cost airline's choice factors of airports in India. The Fuzzy MCDM method has been employed for the above pertaining. The findings of the study exhibits that the airport catchment size, the level of airport's tariff, Incentive for LCA, Operational efficiency of ramp services, exclusive terminal for LCA and supportive attitude of airport are the prime factors of the low cost airline's choice factors of airports in India. The paper fulfills the gap in the literature by identifying the LCA's airport choice factors with special reference to India. Methodically, the paper contributes by developing and demonstrating the application of the Fuzzy based MCDM model for evaluation of the factors for the low cost airline's choice factors of airports.

Keywords: Low-Cost Airport, Low-Cost Airlines, Fuzzy MCDM, Airport Strategic Planning

JEL Classification: C52; C44; C61; R40; R58.

3. Introduction

The post liberalized era has evidenced high growth in national income of India. The real per capita of GDP during 1992-2001 has observed the Compound Annual Growth Rate (CAGR) of 3.9% which has now been increasing at CAGR of 6% during 2001-2016 resulting higher disposable income of Indian citizen (World Bank, 2017). The growth rate of national income and rising disposable income are the key drivers for the growth of aviation industry in India. It has been observed that Indian aviation industry has witnessed a phenomenal growth rate in last two decade. For the period 1990-91 to 2015-16 the domestic passenger has grown at the CAGR of 12.4% (Committee, Report on Civil Aviation Sector, 2012 & AAI, 2017).. During the same period international passenger has grown at the rate 8.71% and total passenger traffic has grown at the rate of 11.06% (Committee, Report of

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Working Group on Civil Aviation Sector, 2012 & AAI, 2017). For the period 2016-17 to 2031-32 the total passengers to be handled at Indian airports is forcasted to grow at Cumulative Annual Growth Rate (CAGR) of 10.3% (AAI, 2017). In 1997-98 the number of aircraft handling the scheduled operations was 106 which has grown to 555 in the September 2017 and is expected to induct 1019 aircrafts by the year 2030 (Committee, Report of Working Group on Civil Aviation Sector, 2012 and AAI, 2017).

The recent trend of economic growth in India is expected to be on high growth trajectory which reveals in tandem growth of aviation sector. However to unleash the future potential of the sector, appropriate capacity enhancement is mandated in right time.

At present, out of 464 airstrips/ airports in India, only 116 are operational (AAI 2017). Recently GOI has announced the construction and development of 200 low cost 'No-Frills' airports within the budget of USD 7 million to USD 15 million each with the purpose to enhance the regional air connectivity (Ministry of Civil Aviation India 2016). In line with the stated plan, 160 non-functional airports were announced to be developed at a cost of INR 50-100 crore each in partnership with state government under the Union Budget of 2016. As GOI is planning to develop low-cost airports on a massive scale, it is essential to understand the key requirement of Low-Cost Airlines and other key stakeholders in the airport.

Regional airport development is critical for India's economic development and regional integration but it should be given a thoughtful consideration of meeting the needs of key stakeholders. Since 2009, GOI has spent over USD 50 million on eight non-functional airports with intent to develop it as no-frill airports; however, after development, they were unable to attract and retain their airline customer (Reuters 2015). Airports such as Jaisalmer, Sahnewal, Gondia, Mysore, Pondicherry, Kanpur, Juhu, Kolhapur, Sholapur, Akola, Jalgaon, Bhatinda, Pathankot, Malda, Cooch Behar, Warangal & Cuddupa are some of the examples of developed but non-operational airports in India (The Telegraph 2015). The industry experts opine that the above failure has occurred due to lack of a well-structured, demand driven and airline oriented plan in the low-cost airport development (CAPA 2017). *In sum and substance lack of integration of Low Cost Airlines interest in low-cost regional airport development is contributing in existence of developed but non-operational airport in India.*

The current paper attempts to identify and evaluate the low cost airline's choice factors of airports in India using Fuzzy MCDM method. The current study fulfills the gap in the literature by identifying the LCA's airport choice factors with special reference to India.

4. Literature Review on LCA's airport choice factor

For the above theme extensive review of literature was conducted on major research database. Sources which were reviewed included research articles and papers, newspaper articles, and industry reports. The summary of review on Low-Cost Airline's airport choice factors are furnished below:

The fundamental point with regard to factors affecting the LCA's choice of airport indicates to philosophy that airport should mirror the strategy being practiced by LCA. It requires that airport strategy should fit in with the requirements of the LCA operating model. This involves providing facilities that will allow the LCAs to reduce costs and exploit density economies through high utilisation of aircraft (Pitt & Brown, 2001). This will be reflected in LCAs seeking quick turnaround times between arrivals and departures at airports (normally no more than 25-30 min which will enable them to achieve extra rotations a day), convenient slot times and lack of congestion on the ground and in the sky (which will result in less time spent queuing to take-off or in a stack waiting to land) (Warnock-Smith & Potter, 2005). Another crucial and well documented requirement that will enable LCAs to adhere to their low cost model is to serve airports that have low aeronautical charges and other user costs (Francis, Fidato, & Humphreys, 2003), or at least those that appear favourable and flexible to negotiating airport charges deals (Barrett, 2004a).

Berechman and de Wit (1996) identified that the requirements of the full-service carrier in airport selection varies from LCA for which the criteria varies from airport charges, demand and airport capacity. Adler and Berechman (2001) found that airport quality has a strong influence on airport choice factor of LCA. Gillen and Morrison (2003) also emphasized on the different requirement of LCA which necessitate the airport managers to tailor their strategy to suit their need. Francis, G. et al. (2003) explored that airports attract LCA on basis of hub routes offerings and rely more on aeronautical revenues. Gillen, D. and Lall, A. (2004) endorsed the existence of competition between airports based on LCA requirement and stated that airport tailors its offering as per the need of LCA. Barrett, S.D. (2004) has identified seven factors for airports to attract LCA namely low airport charges, quick turnaround time, single story airport terminal, quick check-in, good catering and shopping at the airport, good facilities for ground transport, and no executive/business lounge. However, the identified factors need to be verified in the current context of Indian low-cost regional airport development.

The secondary airport is located away from urban area increasing the car rentals to airport resulting an increase in non-aeronautical revenue compensated by a decrease in aeronautical charges levied to LCA (S. Barrett 2004). Airport charges and night curfew influence airport selection decision of LCA (Gardiner, Ison and Humphreys 2005). Eight LCA in Europe were surveyed revealing the differences in airport choice factor of LCAs' and the key result stated the core requirement of LCA has focussed on low-cost services. Lawton, T.C. and Solomko, S. (2005) observed that efficient operating condition is the most required expectation of LCA from the airport decreasing of turnaround time and resulting in higher aircraft utilization rate. Fifteen airport choice factors of which the fundamental factors related to quick and efficient turnaround facilities, convenient slot time and good aeronautical discount were identified (Warnock-Smith and Potter 2005). Chang, et al. (2008) modeled a framework in which airport charges, operations hours, surface transport, terminal floor area, navigational aid and estimated demand for the destination were pertinent factors for LCA choice of airport. LCA seeks to optimize profitability of their network by choosing an appropriate airport (Graham 2013). Graham (2013) reviewed the academic literature pertaining to the relationship between airports and development of LCA and identified that the LCA's choice of airport is determined by its business model. The passengers to secondary airports are willing to endure inconvenient airport location in exchange for a lower fare (Lu and Mao 2015).

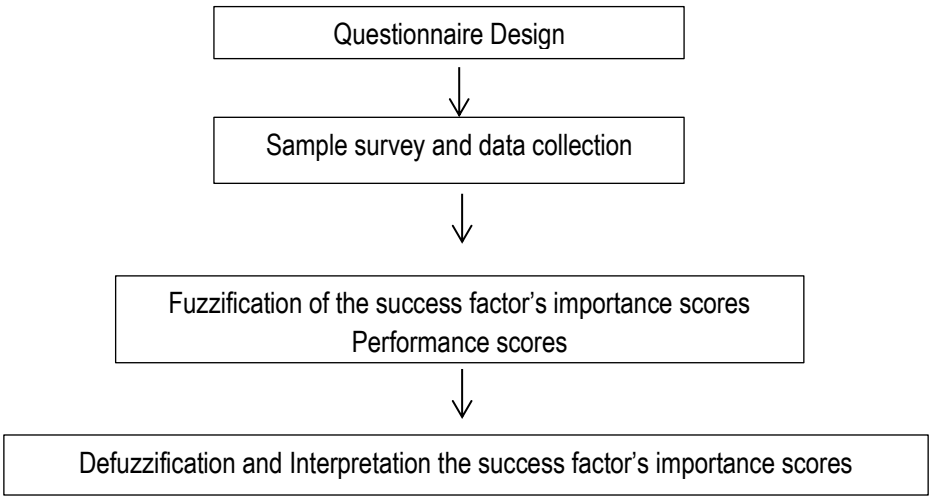
As the most of the literature reviewed contend that airports operating model should mirror the strategy being practiced by LCA keeping in view the rise of LCA. Since there is lack of academic literature to the pertaining to the LCA's airport choice factors in Indian aviation context hence the current study would fulfill the existing gap in the literature.

5. Methodology

The importance perception of relating to LCA's airport choice factors is a subjective measurement. When it is measured on the basis of a numerical linguistic variable often results in incomplete, inconsistent, vague and imprecise results (Lupo 2015; Pandey 2016). On the contrary, it would be preferable to furnish interval value judgments rather than crisp value judgment (Chan and Kumar 2007). Since the current measurement encompasses with intrinsic complexity as it is prone to vagueness of human subjectivity, hence Fuzzy set theory render an effective approach to measure the expectation based on an interval-based linguistic variable (Lupo 2015; Pandey 2016).

Therefore the current study employed Fuzzy Multi-criteria Decision Making (MCDM) to evaluate LCA's airport choice factor in India. The study has incorporated the following steps for the attainment of research objective: designing of the questionnaire, a collection of data, fuzzification of importance scores for evaluation of success factors of low-cost airport development and finally its defuzzification and interpretation which is depicted in figure 1. Further, an overview of Fuzzy set theory and principles and the main steps of the research process are detailed.

Figure 7: Research Process of Fuzzy MCDM



5.1. Fuzzy Set Theory and linguistic-fuzzy evaluation scales

The concept of the fuzzy set was propounded by Zadeh (1973) with the purpose to measure the human judgments or preferences more pragmatically by the help of linguistic terms. As the preferences expressed by human cannot

be estimated with an exact numerical value, hence interval based linguistic term are used to describe the desired value (Zadeh 1973 ; Bellman and Zadeh 1970; Zadeh 1975; Hwang and Yoon 1981; Liang and Wang 1991; Hsu and Chen 1997; Chiadamrong 1999; Chien and Tsaia 2000; Chen 2001; Enrique 2004).

A fuzzy set is a set without a crisp, clearly defined boundary and contains elements with only a partial degree of membership (Mathworks 2012). Mathworks (2012) defines a membership function (MF) as a curve that explains how each point in the input space is mapped to a membership value (or degree of membership) between 0 and 1. The concepts of a linguistic variable can be quantified by fuzzy numbers using suitable membership functions.

In the current research linguistic variable were used to represent the experts' assessment of the LCA's airport choice factors and positive triangular fuzzy numbers were employed to measure the linguistic variable as indicated in Table 1.

The previous literature has already established the basic arithmetic operations on fuzzy numbers. If $A_1 = (l_1, m_1, u_1)$ and $A_2 = (l_2, m_2, u_2)$ are representing two distinct triangular fuzzy numbers then their algebraic multiplication operations can be expressed by equation 1.

$$A1 \otimes A2 = (l1, m1, u1) \otimes (l2, m2, u2) = (l1l2, m1m2, u1u2)$$

Equation 1.

Table 5: Linguistic variables for measurement of airport choice factors

Not at all important	(0.0, 1.0, 2.0)
Slightly Important	(1.0, 2.0, 3.0)
Moderately Important	(2.0, 3.0, 4.0)
Very Important	(3.0, 4.0, 5.0)
Extremely Important	(4.5, 5.0, 5.0)

The two main steps below shall describe the proposed method to conduct the current study:

Step 1: Data Collection and Sampling Framework: A questionnaire was designed on the basis intensive review of literature which contains seven Dimension and 32 success criteria for the development of low-cost airport which are indicated in Figure 2.

The data was collected from the expert team comprising of the senior executives employed with the LCA's in India. The survey was conducted throughout the month of December 2017 by employing purposive sampling method. A sample of 160 executives was undertaken for the study which is adequate for study in line with Norman and Streine (2003) who have stated that the adequate sample size to be five-fold of number of variables.

↓

Defuzzification and Importance Performance Analysis

Step 2: Method Utilized for Fuzzification and Defuzzification of Success Factors Importance Score

For a ranking of fuzzy numbers graded mean integration representation method was explored by Chen and Hesieh (1998). Further, Chou (2003) has identified a canonical representation of multiplication operation on two triangular fuzzy numbers by graded multiple integration representation methods. Chou (2006) applied inverse function arithmetic representation for multiplication operation of multiple trapezoidal fuzzy numbers and the framework was employed to solve MCDM problem by Chou (2007). Chien-Chang (2012) developed a fuzzy MCDM model for evaluating the service quality of the airports where the service quality criteria and importance weight both were transformed into a triangular fuzzy number.

This paper constructs fuzzy MCDM model for evaluating the LCA's airport choice factor of utilizing a canonical representation of TFN based on graded mean integration method which is in line with the study of Chien-Chang (2012). Later the defuzzification of the scores is done using Inverse Arithmetic representation method. By employing the graded mean integration method a TFN $Y_1 = (c_1, a_1, b_1)$ is represented utilizing Equation 2. The same representation is employed on all importance scores obtained from executives and then the average of the respective criteria is aggregated.

$$P(Y1) = \frac{1}{6}(c1 + 4a1 + b1) \qquad \text{Equation 2.}$$

The normalized weight of respective criteria is obtained by employing equation 3, where w_{in} represents the importance scores of i^{th} success factor (i=1,2,…….w) rendered by the n^{th} respondent (n= 1,2,…….n) and AW_i represents the aggregate normalized weight of i^{th} success factor.

$$AWi = \frac{\sum_{n=1}^{N} win}{\sum_{i=1}^{I}\sum_{n=1}^{N} win} \qquad \text{Equation 3.}$$

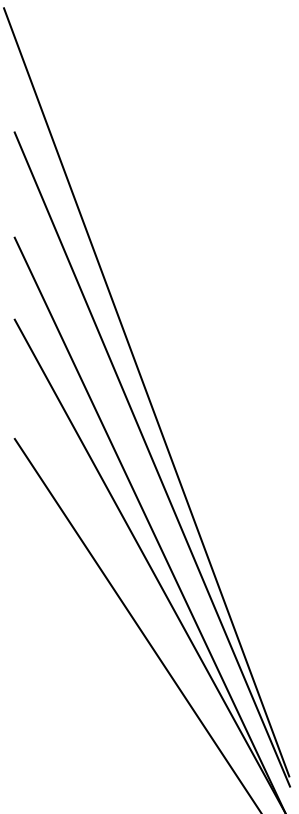
1. Traffic convenience between airport and service cities (C1)

2. Distance between airport and service cities (C2)

3. Airport catchment size (C3)

4. Exclusive terminal for low cost carriers (C4)

5. Support ability for the aircraft maintenance (C5)



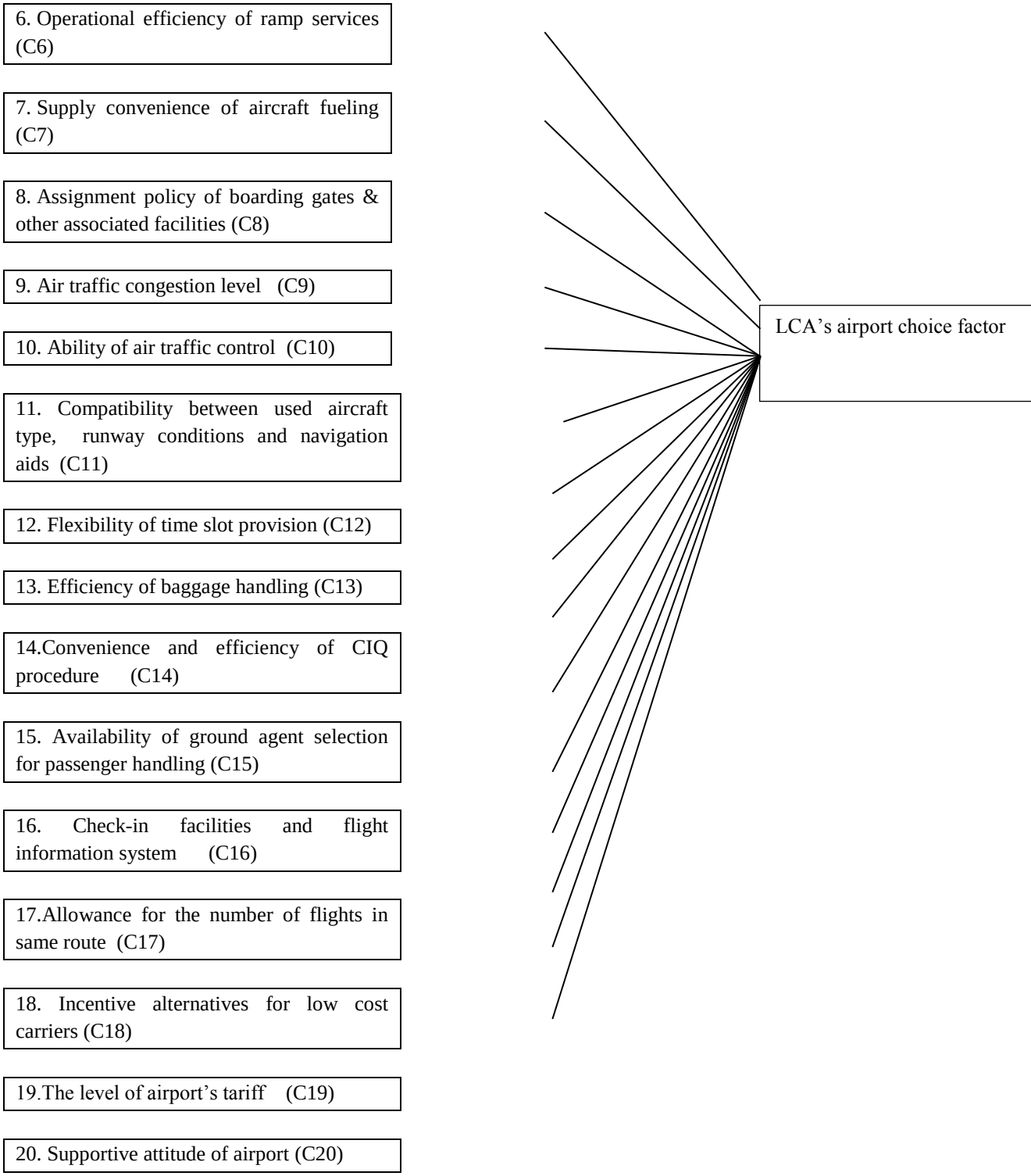


Figure 1: Analytical Hierarchical Structure for LCA's airport choice factors

6. Findings and Discussion

Based on the Fuzzy MCDM method, the results summarized in Table 2 indicates the evaluated construct for the LCA's airport choice factors in India. Out of the twenty factors, the five most important factors are airport catchment size, the level of airport's tariff, Incentive for LCA, Operational efficiency of ramp services, exclusive terminal for LCA and supportive attitude of airport with score of 4.4, 4.35, 4.25, 4.23, 4.2 and 4.2 respectively. All of the factors are directly contributing either to operational efficiency of airlines and facilitates in lowering cost.

The moderately important factors included Efficiency of baggage handling, Air traffic congestion level, Compatibility between used aircraft type, runway conditions and navigation aids, Flexibility of time slot provision, convenience and efficiency of CIQ procedures, check-in facilities and flight information system, availability of ground agent selection for passenger handling, allowance for the number of flights in same route and ability of air traffic control with the respective scores of 4.19, 4.13, 4.1, 4.09, 4.06, 4.06, 4.04, 3.99 and 3.97. All of the factors lying in this category are contributing directly to maintain the operational efficiency of the LCA.

The less importance was rendered to factors supportability for the aircraft maintenance, distance between airport and service cities, supply convenience of aircraft fueling, traffic convenience between airport and service cities and assignment policy of boarding gates & other associated facilities with importance scores of 3.85, 3.8, 3.7, 3.5 and 3 respectively.

Table 2. Evaluation result of the Low-Cost Airline's airport choice factor in India.

1. Traffic convenience between airport and service cities	3.5
2. Distance between airport and service cities	3.8
7. Airport Catchment Size	4.4
4. Exclusive terminal for low cost carriers	4.2
5. Support ability for the aircraft maintenance	3.85
6. Operational efficiency of ramp services	4.23
7. Supply convenience of aircraft fueling	3.7
8. Assignment policy of boarding gates & other associated facilities	3

9. Air traffic congestion level	4.13
10. Ability of air traffic control	3.97
11. Compatibility between used aircraft type, runway conditions and navigation aids	4.10
12. Flexibility of time slot provision	4.09
13. Efficiency of baggage handling	4.19
14. Convenience and efficiency of CIQ procedure	4.06
15. Availability of ground agent selection for passenger handling	4.04
16. Check-in facilities and flight information system	4.06
17. Allowance for the number of flights in same route	3.99
18. Incentive alternatives for low cost carriers	4.25
19. The level of airport's tariff	4.35
20. Supportive attitude of airport	4.2

8. Conclusion

The current paper identifies and evaluates LCA's airport choice factors in India using Fuzzy MCDM method. The findings of the study point that the airport catchment size, the level of airport's tariff, Incentive for LCA, Operational efficiency of ramp services, exclusive terminal for LCA and supportive attitude of airport are most pertinent factor for LCA to choose the airport.

This paper furnishes the evaluated LCA's airport choice factors for airport development in India which fulfills the gap in the literature by integrating the stakeholders view in low-cost regional airport development. Methodically, the paper contributes by developing and demonstrating the application of the Fuzzy based MCDM model for evaluation of the current objective.

As to contribute to future research in this domain, comprehensive functional success factors need to be explored and included in the evaluation model. Also, some more strategic critical factors related to airport development should be explored through expert interview which may be included in the further study.

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