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Benchmarking for Indian Airlines Industry in Contemporary Market Scenario

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GJMBR-A Classification: *JEL Code: L10*



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Benchmarking for Indian Airlines Industry in Contemporary Market Scenario

N. Thamarai Selvan [α], B. Senthil Arasu [σ] & S. Thanigai Arul [ρ]

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Findings: The study proves that DEA can be used as is an effective tool in analyzing the production, marketing and overall efficiency airlines operating in India. Two significant results of this study are that Low Cost Carrier (LCC) is a bench mark airline for production and overall efficiency parameters in Indian airlines industry and that the production efficiency has higher impact on overall efficiency than marketing efficiency.

Research limitations/implications: These findings will help strategic decision makers of Indian airline companies to focus on improving production performance and also to emulate Low Cost Carrier models. The analysis carried out using five years data up to the year 2014 in domestic market will be of help to stake holders in the Indian aviation industry.

Keywords: benchmarking, two stage DEA, super efficiency model, indian airlines industry.

I. Introduction

India is one of the fastest growing aviation markets and currently the ninth largest civil aviation market in the world and is projected to be the third largest aviation market by 2020. Total passenger traffic stood at 190 Million during Financial Year (FY) 2015(Airport Authority of India –Passenger statistics-2015).Growth in passenger traffic has been strong since the new millennium, especially with rising individual incomes and low-cost aviation. Passenger traffic expanded at a Compounded Annual Growth Rate (CAGR)of 10% since 2009. The international and domestic passengers carried in last six years, along with growth rate from 2009-2015 is shown in figure 1.

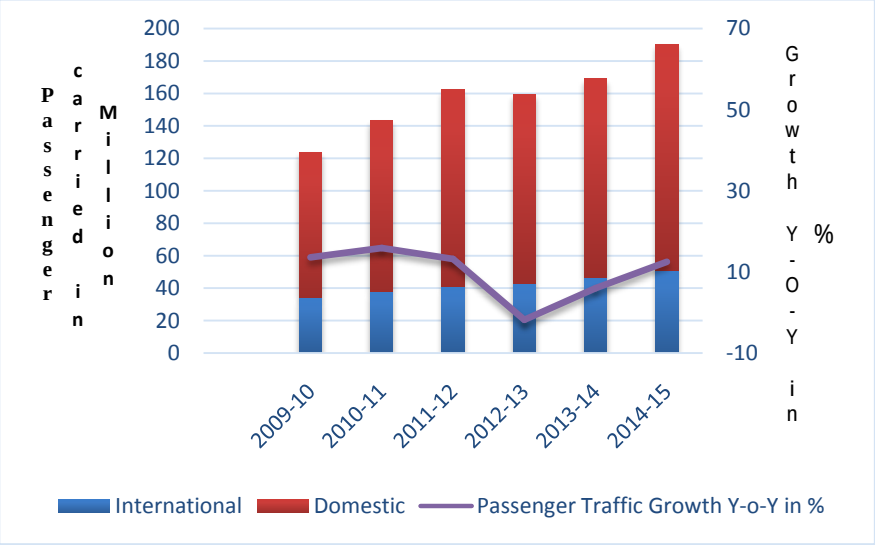

Figure 1: Passenger Carried (Millions) and Growth

Source: Airport Authority of India –passenger statistics -2009-15

Eighty five International airlines fly in the Indian sky, connecting over 40 countries. Although India's middle-income population is expected to increase from 160 Million in 2011 to 267 Million by the year 2016, the Indian air transport sector is one of the least penetrated air markets in the world with just 0.04 trips per capita per annum as compared to 0.3 in China and more than 2 in

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the USA. As there is good potential for growth, Indian carriers plan to increase their fleet size to reach 800 aircrafts by 2020.The Indian aviation sector is likely to see investments totaling USD 12.1 Billion during 2012-17 of which USD 9.3 Billion is expected to come from the private sector(Government of India's Make in India portal).

II. Indianair Transport Industry (IATI) - an Overview

Presently eight airlines are operating in India of which, five airlines account for 97% of the market share. New startups Air cosata, Air Asia-India and Vistara are yet to make a noticeable impact in the market. Indigo, the market leader, Spice jet, and Go Air are Low Cost Carriers (LCC) and Air India (Owned by Government of India) and Jet Airways are Full Service Carriers(FSC). The market share as on August 2016 is represented in the following Figure 2.

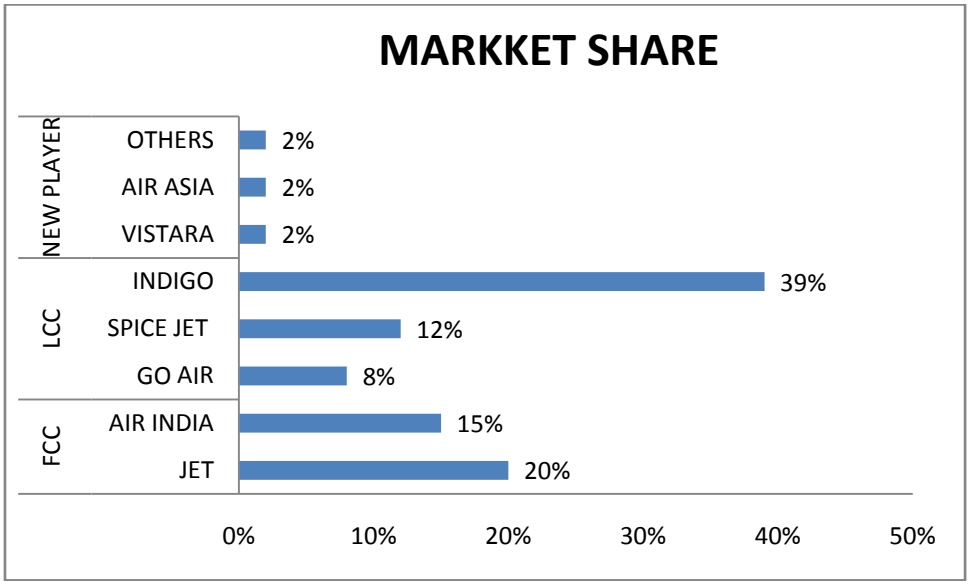

Figure 2: Market share as on August 2016

Source: Director General of Civil Aviation (DGCA), India

While India's LCCs have a domestic market share of 59%, passengers flying on full service airlines pay close to LCC fares in economy class. As a result India is virtually a 100% low fare market. In the Indian market LCCs and FSCs both operate from the same airports with new aircraft, offering high frequencies on key markets. LCC reliability, on time performance, consistency, ground product and cabin crew service standards, are comparable with or even better than FSCs. As per center for Asia pacific aviation (CAPA) report on Indian aviation states that from the Indian passenger's perspective there is little to distinguish between an LCC and an FSC in economy class other than the fact that the latter offers a complimentary onboard meal.

a) Strategic issues in IATI

Despite the phenomenal growth of the Indian aviation market and a very positive forecast for the future, Indian Air transport operators continue to struggle to stay afloat and make profits mainly due to low fares, drop in premium travels, low yields and tax burdens on fuel,. Many international airlines from other countries have started making profits after drop in oil price but in India the FSCs have been consistently making losses for last four years on the other hand, the LCCs, Indigo and Go Air are earning profits. Expected profit/ Loss for Indian airlines for FY 2015 are shown in Table 1.It's alarming to note that the total debt of Indian Airlines industry stands around $11.3 billion and 8 airlines have become defunct in last 10 years.

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Table 1: Net Profit/Loss of Indian Carriers – (FY- 2014-2015)

Airline	Net Profit/(Loss) In $ -Million
Indigo	150-175
Go Air	14-15
Spice Jet	(-107)
Jet Airways	(-343)
Air India	(-900to –920)
New Airlines: Air Asia India, Air CoastaandVistara	(-50to -60)

Source: Center for Aviation – India (CAPA) Market study-2015

To avoid mounting losses and to continue to grow in the field the top management of IATI requires a clear vision that can be translated into adaptable strategies and managerial decisions to turn the airlines around. A comprehensive study including vital performance indicators as major input and output parameters have not yet been carried out for IATI. It is felt that Bench marking of Airlines must be carried out using performance indicators to achieve this objective. So far, the analyses carried out in India are primarily based on one of the many key performance indicators such as revenue earned, total number of passenger carried, passenger load factor, profit generated etc.

It is conceived that Data Envelopment Analysis (DEA) can be used to analyse the performance of IATI using the performance indicators. This study uses a two-stage DEA model to overcome shortcomings of the traditional one-stage DEA. Of the many key performance indicators used in studies reported in literature, the input and intermittent output variables for this study are selected after extensive discussions with Indian aviation experts and also with top management executives of IATI. The production, marketing and overall efficiency ranking are obtained using a super-efficient DEA model. The findings from the analysis are discussed. This article concludes with managerial implications, limitations of the study and future scope for academic research.

III. Literature Review

Data Envelopment Analysis (DEA) is a linear programming based technique that converts multiple output and input measures into a single comprehensive measure of performance. This is performed by the construction of an empirical-based production or resource conversion frontier, and by the identification of peer groups. DEA has also been widely applied in evaluating airline performance.

Schefczyk et al. (1993) used the DEA technique to analyze and compare operational performance of 15 international airlines using non-financial data such as available ton kilometer, revenue passenger kilometer etc. The study demonstrated that DEA can be a very effective tool to assess the technical efficiency of international airlines compared to financial analysis. Sickles et al. (1995) examined the performance of the eight largest European and the eight largest American airlines for a ten year period between 1976-1986 using two methods –parametric analysis using statistical estimation and non-parametric analysis (DEA) using linear programming. The authors observed discrepancy in the productive efficiency of European airlines even under the conditions of deregulations and liberalization of the airline industry. Michaelides et al. (2009) have employed both Stochastic Frontier Analysis (SFA) and DEA using a panel data set of 24 world's largest network airlines to estimate technical efficiency in International Air Transport for the period 1991-2000. The authors observed that the airlines achieved constant returns to scale with technical efficiencies ranging from 51% to 97%. They also observed that ownership (private or public) did not affect the technical efficiency of the airlines and the results from both SFA and DEA did not vary significantly. GeorgeAssafet.A.et al. (2009) measured the operating efficiency of UK airlines in the years 2002-2007. The study measured the technical efficiency of airlines through data envelopment analysis bootstrap methodology. The efficiency of UK airlines was found to continuously decline since 2004 to reach a value of 73.39 per cent in 2007. Factors that were found to be significantly and positively related to technical efficiency variations included airline size and load factor. Boon L. Lee et al. (2010) determined the Relative Efficiency of International, Domestic, and Budget Airlines. This study determined whether the inclusion of low-cost airlines in a dataset of international and domestic airlines has an impact on the efficiency scores of 'prestigious' and purportedly 'efficient' airlines. The findings reveal that the majority of budget airlines are efficient relative to their more prestigious counterparts. Moreover, most airlines identified as inefficient are so largely because of improper utilization of non-flight assets. Domenico Campisi et al. (2010) analyzed the relationship between low cost carriers (LCC) passenger traffic, secondary airports utilization and regional economic development in Italy. LCCs have been the fastest growing sector of the aviation industry. The

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routes served by these carriers were undersized in comparison with principal routes. The findings indicated that increased service at Italian secondary airports could affect economic development in the surrounding regions, including increased tourism and the potential for cluster development. Wen-Min Lu et al. (2011)analyzed the effects of corporate governance on airline performance (Production and marketing efficiency). The study applied two-stage Data Envelopment Analysis (DEA) truncated regression to find out if the characteristics of corporate governance affect airline performance. The results demonstrate that corporate governance influences firm performance significantly. Seong-Jong Joo and Karen L. Fowler (2012) studied comparative efficiency and determinants of efficiency for major world airlines found that revenues and expenses were significant in explaining the efficiency score of airlines.

Atul Raiet. al. (2013) determined the technical efficiency of US airlines during 1985-1995 using the DEA model. Results of efficiency analysis were applied to determine if efficiency and stock returns were related. Two portfolios, one consisting of efficient airlines, and the other consisting inefficient airlines, were compared. The efficient portfolio was found to outperform the inefficient portfolio by an annual margin of 23% using raw returns.

It can be seen that no bench marking tools including DEA have included Indian Airlines in their study and a literature survey shows that there are, hitherto, no articles reporting analysis of IATI. The input/output variables used in earlier DEA analyses of the airline industry and their key findings are given in Table2.

Table 2: Parameters studied and Findings

Year and name	Parameters		Findings
	Inputs	Outputs	
Schefczyk M (1993)	Available Ton-Kilometres (ATK), operating costs, and non-flight assets (NFA)	Passenger Revenue, Non passenger revenue(NPR)	DEA can be very useful tool to assess the technical efficiency of international airlines which otherwise was difficult to do using financial data
MICHAELIDES(2009)	employee, fuel and oil, fleet	total annual passenger-kilometers	Airlines achieved constant returns to scale with technical efficiencies ranging from 51% to 97%. ownership (private or public) does not affect the technical efficiency of the airlines
A. George Assafet al (2009).	labour expenses, aircraft fuel and oil expenses, aircraft value	Tone kilometers, available and total operational revenues	The technical efficiency of UK airlines has continuously declined since 2004 Airline size and load factor positively affect the efficiency.
Boon L. Lee (2010)	available ton-kilometers (ATK), operating costs, and non-flight assets (NFA)	revenue passenger-kilometers (RPK) and non-passenger revenue	Majority of budget airlines are efficient compare to their more prestigious counterparts. Most airlines identified as inefficient are mainly because of the overutilization of non-flight assets.
Domenico Campisi et al. (2010)	Accessibility and traffic growth.	Passenger traffic growth	LCCs have been the fastest growing sector of the aviation industry. Increased service level at Italian secondary airports could positively affect economic development in the surrounding regions.
Wen-Min Lu et al (2011).	FTE-Full time employees, Fuel, Seats, Flight Maintenance expenditure	RPK, NPR- Non passenger revenue	Two-stage Data Envelopment Analysis (DEA) is used corporate governance influences firm performance significantly.
Seong-Jong Joo and Karen L. Fowler (2012)	Expenses	Revenues, passengers, RPK, Seat factor	Efficiency of the airlines in Europe is the lowest comparing with Asia and North America.

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Atul Rai (2013).	Number of planes, number of employees, and gallons of fuel consumed.	Revenue passenger miles, number of departures, number of passengers, and available ton-miles.	Airlines are grouped in to efficient and inefficient airlines The efficient portfolio outperforms the inefficient portfolio by an annual margin of 23% using raw returns

From the literature available, it can be inferred that DEA serves as an effective bench marking tool and multiple important parameters used as input and output variables can be extended to the Indian context as well. As most of the earlier studies have been carried out using older data sets, the findings probably may not be appropriate for present managerial decisions. This paper aims at analyzing the IATI using DEA model with vital parameters as variables. Five year data from FY 2009-2014 are collected for analysis so that the findings would not only give directions to guide in managerial decisions but also helps for future strategic planning.

IV. The Efficiency Analysis

Charnes, Cooper and Rhodes (CCR) model of DEA was firstused to study the performance of Indian Airlines. The choice of the CCR model is based on the evidence from prior literature that the airline industry shows a constant return to scale. Five airlines with 97% market share are taken as Decision Making Units (DMU) for analysis. CCR model analysis resulted in unity score for more than one DMU. It is also seen that five DMUs are not sufficient to analyse the performance using DEA model. Hence super efficient DEA model is used for analysis and to rank the airlines. With the super-efficiency model, a ranking among the DMUs are possible.

a) Two-stage model

Evaluating the organizations performance is a complex process that cannot take just one criterion or one dimension. Traditional DEA neglects the intermediate measure or linking activities (Fare and Whittaker, 1995; Chen and Zhu, 2004; Tone and Tsutsui, 2009). In this study two stage DEA model is applied. The overall efficiency score is calculated by combining production and marketing process. In the first stage, the production efficiency is calculated using three inputs namely fleet, employees and operating expenses, which produce two outputs which are taken available ton kilometers, and available seat kilometers. These two intermittent variables are taken as input variables for marketing efficiency calculations. The final out variables-parameters considered are revenue passenger kilometer, Total operating revenue and total cargo carried. The input, output, intermittent variables used in two stage DEA Model are shown in Figure 2.

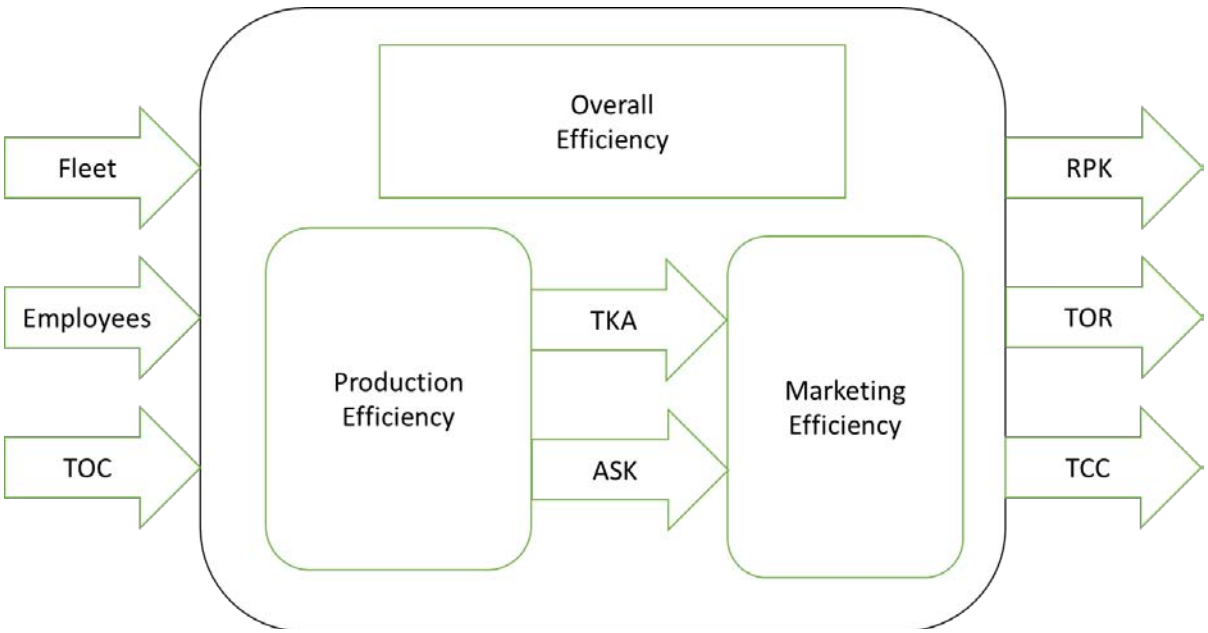

Figure 2: Two stage transformation model

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The key parameters considered for this study after detailed discussions with Aviation experts and top management of IATI with definitions are listed in Table3.

Table 3: List of Key Performance indicators analyzed

Variables	Unit /Measurement	Definition
Input		
Aircrafts (Fleet)	Numbers	Total number of aero planes operated by the airlines including leased flights.
Employees	Numbers	Total number of full time employees
Operating cost (TOC)	Million in INR (Indian rupee)	Total cost spent for operations of the all aircrafts
Intermediate		
Available tone kilometer (ATK):	Million	The number of tonnes of capacity available for the carriage of revenue load (passenger and cargo) multiplied by the distance flown.
Available seat KM's(ASK):	Million	Available seat kilometres (ASK). The number of seats available for sale to passenger multiplied by the distance flown
Output		
Revenue Passenger KM's (RPK):	Million	The number of revenue passengers carried multiplied by the distance
Total Operating Revenue (TOR)	Million in INR(Indian Rupee)	Revenues received from total airline operations including scheduled and non-scheduled service
Total Cargo Carried (TCC)	Tons	The freight plus mail carried by an aircraft.

b) Super-efficient DEA Analysis

In standard DEA, DMUs are identified as fully efficient and assigned an efficiency score of unity if they lie on the efficient frontier. Inefficient DMUs are assigned scores of less than unity. To illustrate, figure 3shows four DMUs producing a single output and consuming two inputs x1 = x2. Minimum input combinations lie on the frontier connecting A, B and C, i.e., no other DMU produces the same output with a lower input combination. Unit D is dominated by the other three DMUs and produces the same output although with a higher input combination. The inefficiency of unit D can be measured by its radial distance to the frontier along the ray extending from the origin to D and intersecting the AB segment of the frontier.

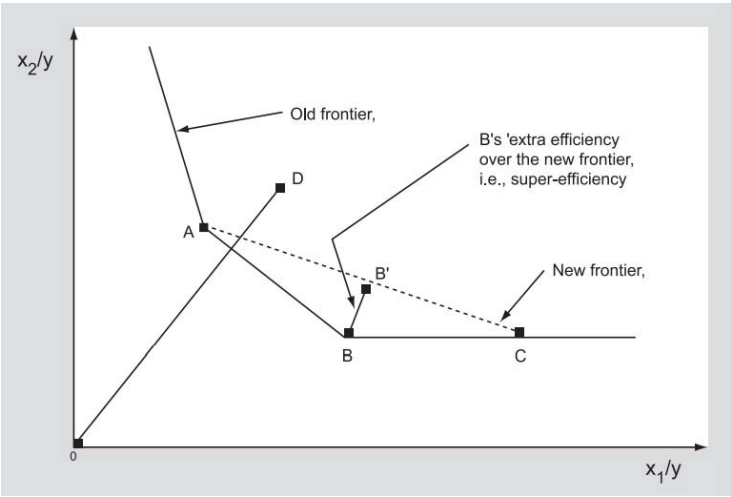

Figure 4: Standard and Super-efficient DEA Input-oriented Model

Source: Bruno Yawe (Zambia social science Journal 05-10-2010)

Further ranking of the efficient set of DMUs is possible by computing efficiency scores in excess of unity. Consider unit B in figure 4. If it were excluded from the frontier, a new frontier would be created comprising only units A and C. The super-efficient score for unit B is obtainable by calculating its distance to the new frontier whereby this 'extra' or 'additional' efficiency denotes the increment that is permissible in its inputs before it would

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become inefficient. The consequence of this modification is to allow the scores for efficient units to exceed unity. For instance, a score of 1.25 for unit B would imply that it could increase its inputs by 25 percent and still remain efficient. This super-efficient model (Andersen and Petersen, 1993) is applied in this analysis using the approach described in Zhu (2004).

V. Data Analysis and Findings

After selecting the parameters to get the best results from the study, the required data on TKA, ASK, RPK and TCC are collected for five years from DGCA yearly aircraft statistics published. Further, annual reports and balance sheets of these airlines are also referred to collect data on the number of employees, fleet, TOC& TOR. The analysis is carried out on five Indian airline companies operating in the domestic sector in the years 2009-10 to 2013-14 which account for 97% Indian domestic market. The airline companies include Air India, Jet airways, -FSC, Spice jet, Go air and Indigo-LCC. Each airline company is treated as one DMU in DEA analysis. Descriptive statistics for the airline sample taken for the year 2009 – 10 is shown in Table 4.

Table 4: Descriptive statistics for the year 2009-10.

Fleet	Employee	TOC	RPK	TOR	TCC
Min. : 8.0	Min. : 1216	Min. : 9088	Min. : 2398	Min. : 8961	Min. : 0
Median : 25.0	Median : 2691	Median : 21548	Median : 7268	Median : 26015	Median : 50296
Mean : 62.6	Mean :10064	Mean : 72006	Mean : 6920	Mean : 51308	Mean : 52302
Max.:147.0	Max. :31444	Max. :190318	Max. :10792	Max. :120485	Max. :101468

The minimum values represent the Go air (LCC) and the maximum values are for Air India (FSC).

Correlation coefficients for inputs and outputs for the overall efficiency for the year 2009-10 are presented in Table 5.

Table 5: Correlation coefficients matrix

	Fleet	Employee	TOC	RPK	TOR	TCC
Fleet	1					
Employee	0.933909	1				
TOC	0.989943	0.97447	1			
RPK	0.611132	0.355764	0.51357	1		
TOR	0.873607	0.642135	0.797479	0.819656	1	
TCC	0.939756	0.851864	0.913292	0.767698	0.848707	1

The results of the correlation coefficient matrix show a significantly positive relationship between inputs and outputs. The data set satisfies the assumption of isotonicity wherein, increasing the value of any input while keeping other factors constant should not decrease any output but should instead lead to an increase in the value of at least one output.

The production efficiency scores obtained using super efficient DEA with input and output variables taken for study are shown in Figure 5.

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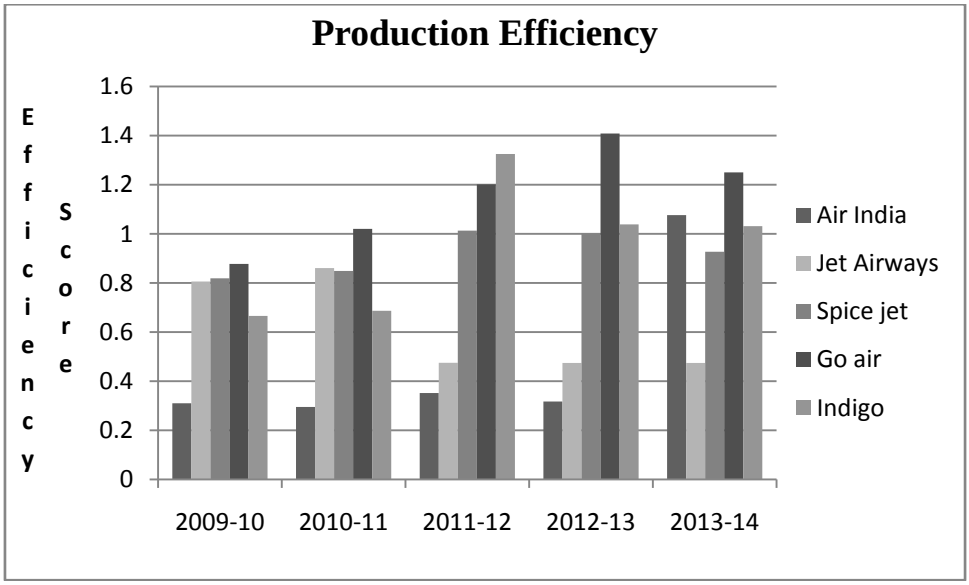

Figure 5: Comparison of Production Efficiency Scores

Table 6: Ranking of airlines by Production efficiency scores

	1	2	3	4	5
2009-10	Go air	Spice jet	Jet Airways	Indigo	Air India
2010-11	Go air	Jet Airways	Spice jet	Indigo	Air India
2011-12	Indigo	Go air	Spice jet	Jet Airways	Air India
2012-13	GO air	Indigo	Spice jet	Jet Airways	Air India
2013-14	GO air	Air India	Indigo	Spice jet	Jet Airways

LCC are seen to be very efficient, occupying the first position whereas FSCs are least efficient for all the five years. Indigo (LCC) occupied the fourth position in FY 2010- 11 had improved their performance in the following years. The finding is in line with higher aircraft utilization, more numbers of departures made by LCC (DGCA- Airlines performance data) than FSCs .This could be due to the reason that LCC's maintain similar type of aero planes, the maintenance of aircrafts, availability, and mandatory checks are optimized.

The marketing efficiency scores derived are reflected in Figure 6.

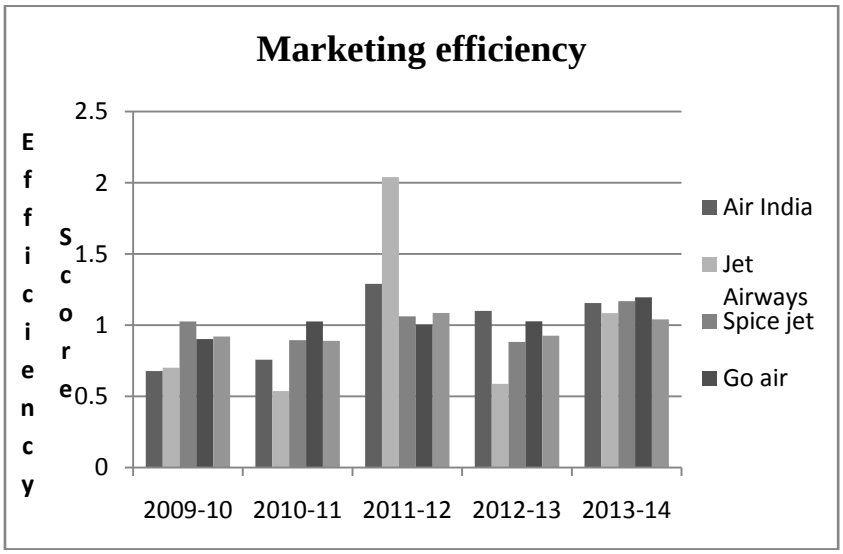

Figure 6: Comparison of Marketing Efficiency Scores

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Table 7: Ranking of airlines by marketing efficiency

	1	2	3	4	5
2009-10	Spice jet	Indigo	GO air	Jet airways	Air India
2010-11	Go air	Spice jet	Indigo	Air India	Jet airways
2011-12	Jet airways	Air India	Indigo	Spice jet	Go air
2012-13	Air India	Go air	Indigo	Spice jet	Jet airways
2013-14	GO air	Spice jet	Air India	Jet Airways	Indigo

There is no consistent occupier for the first and last ranking either from LCC or from FSC. It is also observed that IATI competes only on the price front by offering attractive fares. This could be due to the fact that Indian passengers are sensitive to price, which causes IATI to adopt predatory pricing strategy (center for monitoring Indian economy Pvt. Ltd- passenger forecast May 2015)

The overall efficiency scores obtained by the combination of all input and intermittent variables are shown in table 10.

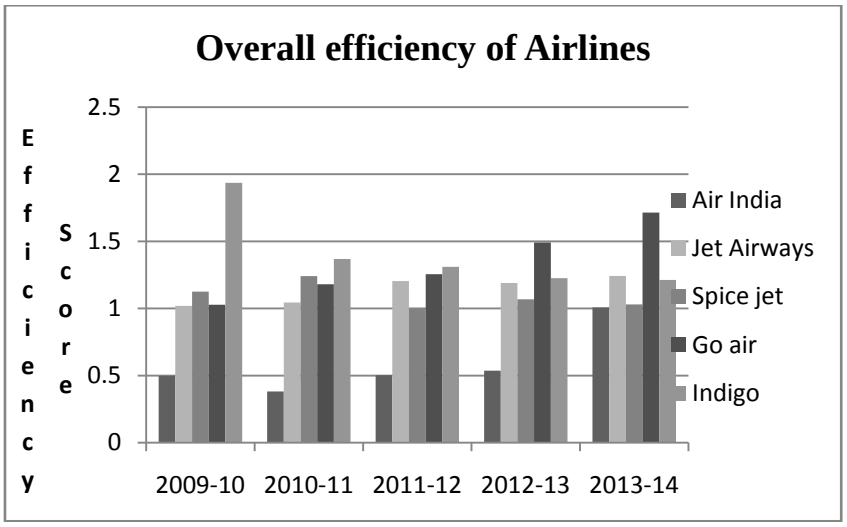

Figure 7: Comparison of Overall Efficiency Scores

Table 8: Ranking of Airlines by overall efficiency

	1	2	3	4	5
2009-10	Indigo	Spice jet	GO air	Jet airways	Air India
2010-11	Indigo	Spice jet	GO air	Jet airways	Air India
2011-12	Indigo	Go air	Jet airways	Spice jet	Air India
2012-13	GO air	Indigo	Jet airways	Spice jet	Air India
2013-14	GO air	Jet airways	Indigo	Spice jet	Air India

LCC are seen to be highly efficient and the Government-owned Airline Air India is least efficient consistently for five years. Spice jet –LCC is also found to be less efficient in the past three years, which is in line with losses observed by the airlines company. Similarly Go air has become profitable only in the past two years. Further analysis is carried out to find out the impact of production and marketing efficiency on overall efficiency. The correlation score is reproduced in the correlation matrix in table 9.

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Table 9: Correlation Matrix

	Production	Marketing	overall
Production	1		
Marketing	0.16	1	
overall	0.46	0.24	1

Both production and marketing efficiencies have positive impacts on overall efficiency whereas the increase in the production performance has a higher impact on the overall performance of the Indian airlines. Marketing efficiency has comparatively lower effect.

VI. Conclusion

This study has been performed using the latest data available and therefore, the results give valuable insights to airlines strategic decision makers to increase efficiency. Eight vital key performance indicators are taken as variables for analysis to produce reliable results. The practical implications from the study are

- Airlines in India must emulate the LCC model to be highly efficient.
- Available resources may be allotted to increase technical efficiency, which in turn produces more seats and capacity for sale.
- Marketing efficiency has less impact than production efficiency on overall efficiency of the Airlines. Indian Airline companies may try to adopt new innovative marketing strategies other than pricing to improve overall efficiency.
- FSCs must focus on improving their technical efficiency so that overall efficiency can be increased.

The results derived correlate well with the performance of the Indian air transport market in last five years. LCCs s are in a position to stay afloat but FSCs have been making heavy losses, which have gone as far as forcing Air India to go in for bailout package with Indian government and causing Jet Airways to sell their shares to foreign carrier Ethihad Airways. It is also observed that the no Indian airlines operator has hitherto implemented notable marketing initiatives that could change the market dynamics other than offering attractive fares.

The limitation of this study is that IATI is analysed, taking only the domestic market of Indian airlines, which account for 68% of passenger carried (for the FY2015). The performance of Indian Airlines has not been compared with foreign carries or other Asia pacific carriers. Future studies may be carried out by including international data and comparing with foreign carrier's data.

This study may lead to more analyses in the Indian aviation sector using proven tools, which will be helpful for all stake holders in the industry. Future studies could group Indian carriers into LCC, FSC and Government owned, to get better insights. Improvements in marketing efficiency may be attempted by carrying out gap analysis, important and performance analyses (Fang-Yuan et.al.) on Indian airlines sector. This work may also open up further academic research and analyses aimed at guiding the industry to optimize resources.

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