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Key Drivers of operational efficiency and its impact on Regional Connectivity Schem (RCS) – Under UDAN

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ABSTRACT:

Air transportation is essential for fostering economic development for any country, but its operations require substantial resource allocations to the air transport sector (ATS).To ensure the sustainable growth of the air transport industry, enhance resource utilization efficiency, and align ATS development with the overall macroeconomy, it is essential to accurately assess the operational efficiency of the industry. However, there is a scarcity of studies analysing the operational performance of ATSs across different regions. The Regional Connectivity Scheme (RCS) – Ude Desh Ka Aam Nagrik (UDAN), launched in 2017, by Government of India has been instrumental in transforming regional air travel and making aviation accessible to the general public specially in remote areas of the country.Ongoing advancements within the RCS initiatives have greatly improved the regional connectivity in India. Subsequently, a larger segment of the population now enjoys convenient and efficient air travel choices that resulting in time savings and improved overall connectivity that creates an opportunity for local employment and tourism in the remote and unexplored areas.

Post successful completion of four bidding rounds, the Ministry of Civil Aviation (MoCA) initiated the 5th round of UDAN in April 2023, aiming to further improve connectivity to remote and regional areas in the country to achieve the last mile connectivity goal. Regular evaluation of operational performance metrics and costs are fundamental for airlines to formulate a competitive business strategy. This study seeks to investigate the significance of specific indicators associated with management and operational efficiency in the airline industry. Comprehensive analysis of these indicators and potential strategies could pinpoint to a direct decision-making process that would improve the operational efficiency of airlines operating under Regional Connectivity Scheme (RCS)- UDAN.

Keywords: Sustainability; Operational efficiency; Air transport sector; Airline Pricing Power; RCS Performance metrics, Regional Connectivity:

1. Introduction:

The Ministry of Civil Aviation (MoCA), Government of India, announced the National Civil Aviation Policy 2016 (NCAP 2016), which seeks to increase regional connectivity through infrastructure development and financial support. Based on a research paper titled "Economic benefits of civil aviation ripples of prosperity," published by the International Civil Aviation Organization (ICAO), aviation's output and employment multipliers are 3.25 and 6.10, respectively. This demonstrates unequivocally that for every 100 Rupees spent on air travel, 325 Rupees in benefits result in overall economy, and for every 100 direct jobs in air travel, result in 610 jobs in the broader economy. The study attributes over 4.5% of the global Gross Domestic Product (GDP) to civil air transport.

Given the expected dispersal of consumption-led growth from densely populated metros to hinterland areas as the Indian economy grows, it is acknowledged that advancing regional air connectivity would hold public policy benefits. NCAP 2016 incorporates the Regional Air Connectivity Scheme (RCS) in recognition of the possible need for financial support, especially in the first term to stimulate engagement from stakeholders. A few airlines have prospered recently in spite of numerous obstacles; they continuously provide impressive results and demonstrate the Indian airline industry's potential for profitability within the Indian airline sector. Indigo Airlines was named the most profitable airline in India in 2023, according to the most recent report from the Airport Authority of India (AAI). This is due to the airline's well-known, persistent focus on important deliverables including punctuality, low pricing, and reliable on-board and ground services. Given that it is a low-cost carrier (LCC), this accomplishment is significant.

The literature that has already been written about the cost-effectiveness of the LCC method is reinforced by Indigo's success. It also raises questions about whether the LCC strategy entails anything more than just cutting costs. Finding the yield drivers becomes increasingly important as the value of premium services in pricing declines due to increased competition and surplus capacity. It's critical to proceed with caution and understand that improved operational efficiency in the aviation sector does not always equate to better financial performance (Scheraga, 2004). As the Financial Times pointed out in 2015, [1]the Indian airline industry finds itself in a pressing need to not only identify the drivers of operational efficiencies but also understand their correlation with financial and market performance given the significant financial pressures faced by airlines at this crucial juncture.

[1](Scheraga, 2004). As the Financial Times pointed out in 2015

As an example, different areas of China are required to demonstrate that they are qualified and able to enhance their infrastructure capacity. The legislative framework controlling the air transport business, the increased competition among airports for expanded capacity, and the significant demand for resource input are the driving forces behind this. In order to address these issues, it appears that the performance of the Air Traffic Service (ATS) must be evaluated. This paper uses the Data Envelopment Analysis (DEA) to assess efficiency in Civil Aviation with a special focus on improving operational efficiency in the management practices of airlines, airports, and civil aviation administration. These theoretical and practical considerations guide the analysis and measurement of productivity changes and efficiency within the air transport sector across the Indian States and UTs.

2. Literature Review:

2.1 Airlines Operational Efficiency:

To survive in a cutthroat market and in the face of economic headwinds, airlines must continuously evaluate the effectiveness of their whole operations. Introduce a linear fuel management model program when reviewing studies on airline operating efficiency in the body of current literature. This model provides a way to save fuel expenditures and increase profitability across a range of aircraft models by taking into account supplier, station, and price constraints. (Bieblich et al. (2018) use a hierarchical metamodeling technique [2]in their examination of how aircraft operational expenses affect airlines.This method uses a DirectOperating Cost (DOC) model to evaluate ticket pricing and profitability. Airlines decide on aircraft orders, change routes, and propose changes to their business model after costs are incurred. Nevertheless, this model has a propensity to overstate overall operating expenses and is unable to pinpoint the operational efficiency variables that can affect the financial success of an airline. The body of literature includes studies that examine various aspects of efficiency in their examination.

The variables listed in Table 01 below are a compilation of those found in the literature and can be used to measure different kinds of efficiency. These variables—which are listed in Table 01—have been taken from previous research and used to gauge effectiveness. Operational indicators like Revenue Passenger Kilometres (RPK), Available Seat Kilometres (ASK), Passenger Load Factor (PLF), stage length, fuel cost, operating cost and expenses, operating revenue, number of aircraft in operation, aircraft manufacturers, and flown routes have all been prominently highlighted in operational efficiency studies.

[2](Bieblich et al. (2018) use a hierarchical metamodeling technique

Table - 01

Author	Type of efficiency	Variables	Measurement forms
Lozano and Gutiérrez (2011)	Operational	Fuel Cost	TON x KM
		Flight and Ground assets	n
		Operating Cost	€
		RTK	TON x KM
Joo and Fowler (2014)		Revenues	USD
		Passengers	n
		RPK	million x KM
		PLF	percentage
		Expenses	USD
Choi (2017)		PLF	%
		CASM	million x mi
		RASM	million x mi
		Passenger yield	million x mi
		Fuel Expense	USD
		Passenger Revenue	USD
		Full-time Employee Equivalents	n
		Total Operating Revenue	USD
Kottas and Madas (2018)		Employees	n
		Operating costs	USD
		Number of Aircraft	n
		Revenue	USD
		RPK	million x KM
		RTK	million x KM

(Source: Research data)

3. Methodology:

A scientific study is carried out by using a particular approach or strategy designed to answer research questions and successfully accomplish predetermined goals. Furthermore, it is necessary to classify research objectives according to their means, purposes, and data type in order to support a variety of research goals (Davies, 2020). According to the frameworks put forward by Davies (2020) and Hancock et al. (2010),[3] the research conducted for this paper is categorized as exploratory, descriptive, and quantitative. It takes an exploratory approach with the goal of better understanding and identifying airline firms' performance and operational efficiency metrics. It also has a descriptive character, aiming to clarify any possible connections between these indicators and airline performance, as well as the strength and

[3]Davies (2020) and Hancock et al. (2010)

direction of those connections. Last but not least, it is quantitative, utilizing strategies for gathering numerical data that is then statistically analysed.

4. Data Analysis:

The present study employed a panel data analysis methodology to examine the data, incorporating the assumptions described by Wooldridge (2002), Batalgi (2008), and Washington et al. (2011).[4]

a. Regression in which the error term accounts for differences in time and between individuals (pooled), and the model intercept and angular coefficients are assumed to be constant throughout time and space.
b. Regression with fixed effects, where the intercept fluctuates throughout individuals but the angular coefficients stay constant.
c. Regression presuming that while the angular coefficients fluctuate over time and between people (random effects), the intercept takes a constant mean value across individuals.

The selection of criteria for evaluating airline operational efficiency in this study is contingent upon the data's accessibility, mostly derived from the ANAC dataset, and a thorough analysis of prior research outcomes. The National Civil Aviation Agency (ANAC) database in Brazil provided the explanatory variable data for this analysis. The data included operating indicators (PLF, ATK, and RPK), revenue, routes, stage length, cost and expense, fuel consumption, flying hours, and aircraft information. Complete data for the entire year 2018 was used to construct criteria for the data parameters. This study, which took its cues from Oliveira et al. (2021), focused on major Brazilian airlines, namely Latam, Gol, Azul, and Avianca. The total offered routes indicate the number of routes that are open for use by an airline. According to Singh et al. (2019), stage duration, which represents an aircraft's total operating hours, is calculated using block-to-block criteria and is derived from the aircraft's departure time until its stop. The total fuel used in litters is the total fuel spent by an airline on all of its aircraft. The term "take-off" (TOF) refers to the total number of take-offs that the fleet of aircraft, including

[4] Wooldridge (2002), Batalgi (2008), and Washington et al. (2011)

both domestic and foreign flights, has performed. Total flight hour, or TFH, is the total amount of time spent in the air, expressed in hours, from take-off to landing.

The number of aircraft in operation and the selection of different manufacturers (such as Airbus or Boeing) contribute to fleet optimization. While Gol operates a uniform fleet comprised solely of Boeing aircraft, other airlines operate a diverse fleet. A uniform fleet has cost advantages for an airline streamlining crew standardization, training, maintenance, purchasing, negotiations with manufacturers and suppliers, and bolstering the airline's market influence. Additionally, it can have a comprehensive positive impact on the airline's overall efficiency.

Table 02: (Main characteristics of the major Brazilian airlines (2017)

Characteristic	Latam	Gol	Azul	Avianca
Revenues				
Total revenue (billion USD)	4.7	3.2	2.5	1.2
Revenue: domestic (%)	59.0	83.8	84.3	96.2
Revenue: international (%)	41.0	15.1	15.7	3.8
Costs				
Total operating costs (billion USD)	3.8	2.3	1.9	0.9
Costs: fuel (%)	28.9%	39.3%	30.3%	36.5%
Cost per available seat-kilometer (CASK) (cents USD)	5.6	4.9	7.5	6.2
Profitability				
Total operating profits (billion USD)	0.9	0.9	0.6	0.2
Gross margin (%)	18.2	27.0	24.8	19.3
Market share (RPK) (%)	32.6	36.2	17.8	12.9
Average PLF (%)	83	80	80	85
Average aircraft size (seats)	173	168	109	151
Average aircraft age (years)	9	9	5	5
Aircraft flight hours per day	11.5	9.9	10.1	11.3
Average stage length (km)	984	1,014	700	1,036
Number of served cities	43	54	101	25

Source: adapted from Oliveira et al. (2021)

4.1 Findings:

It is appropriate to use the Random Effect technique to describe individual effects as randomly distributed across the observational units in statistical tests if there is no link between the effects and the explanatory variables. allowing the application of this model to multiple regression as a result. The Random Effect model assumes that the sample's regression coefficients can be extended to the population; in other words, the sample entities are thought to have been chosen at random to reflect the population as a whole.

4.2 Descriptive statistics of variables:

Sakthidharan and Sivaraman (2018) provide estimates that illustrate operational efficiency levels ranging from 70% to 90% for the particular timeframe of 2013 to 2014. This shows how efficiency has increased on a bigger scale in tandem with the growth of the Indian airline industry. The analysis shows that labour and maintenance expenditures account for a sizable portion of an airline's operating costs. Furthermore, the Low-Cost Carrier (LCC) model works better in India than the Full-Service Carrier (FSC) model since new and homogeneous fleets lead to higher operating efficiencies and reduced maintenance costs. Singh et al. (2019) demonstrates how operating larger aircraft and increasing cargo favourably effect operational cost efficiency using an economic model using multiple regression analysis.

In addition, a longer stage duration is beneficial for cost savings. Nevertheless, in order to analyse airlines' operating efficiency, the aforementioned study leaves out important factors like Available Seat Kilometres (ASK), operating cost and expense, and the quantity of aircraft and manufacturers. It examines the factors that determine operational efficiencies and how they affect airline market performance in accordance with the study's theme. The authors present a theoretical framework that connects the efficiency of airlines with a number of structural, operational, and regulatory factors. The results provided by the authors indicate that certain structural and regulatory factors negatively affect airline performance, while technical efficiency is a crucial factor in gaining market power. The characteristics listed in Table 2 above, which were gathered from the literature, have been used in studies that evaluate efficiency. Note that studies of operational efficiency make use of operational indicators like fuel cost, operating cost and expense, operating revenue, stage length, aircraft number in service, manufacturers and flown routes, Revenue Passenger Kilometres (RPK), ASK, PLF, and so on.

5. Discussion & Result:

It is reasonable to use the Random Effect technique to describe individual effects as randomly distributed across the observational units in statistical tests if there is no link between the effects and the explanatory variables. According to the test's interpretation, operational efficiency typically rises by 1.76 if the LRPK variable increases by 1 while keeping the other factors unchanged. This logic holds true for every other variable as well. The sample entities are taken to have been randomly chosen to represent the entire population, according to the Random Effect model, which assumes that the results of the regression coefficients for this sample can be extended to the population.

According to Sakthidharan and Sivaraman (2018), fuel economy can be enhanced by adopting an aircraft fleet with modern technology and design, which helps reduce fuel consumption. According to Singh et al. (2019), historical data has shown that high fuel prices have a negative impact on the demand for air travel. As a result, airlines may change other services, such as frequency of flights, to reduce fuel use in order to control pricing and operating expenses. The results of this study indicate that in this particular context, higher fuel consumption suggests a wider range of routes and more frequent flights in order to serve a greater number of passengers. Even if the Fuel variable might not be statistically significant, it is nonetheless regarded as a crucial indicator for understanding the airline's operational efficiency.

According to Kottas and Madas's (2018) survey[5], airlines operating in North America, especially the United States, have greater fleet sizes than those in Asia, Europe, and Oceania. Because of these aircraft's operational flexibility and economic viability, airlines operating in these regions face diseconomies of scale that affect both scale efficiency and overall efficiency. Executives and management of airlines are paying more attention to this, realizing that limiting airline size is necessary to achieve operational efficiency.

6. Recommendations & Suggestions:

The expected result of the inversely proportional relationship between Available Seat Kilometres (ASK) and operational efficiency is clear, as demonstrated by Kottas and Madas (2018). A lower number of available seats per kilometre indicates a more lucrative and efficient airline. The number of aircraft in operation is represented by the Available Seat Kilometre (ASK), which is a measure of a company's capacity and size. Limiting the amount of passenger traffic capacity (RPTC) can result in increased economies of scale, which can boost operational effectiveness and competitiveness. Contrary to Joo and Fowler's (2014) findings, the negative correlation between net operating revenue and passenger load factor (PLF) suggests that revenue growth has a detrimental influence on airline operational efficiency. This highlightsthe airline industry's competitiveness because rising ticket costs could drive away customers and force them to look for the cheapest options.

Revenue management advises the airline to grow strategically as well, but only to a certain extent in order to prevent diseconomies of scale, which cause operating expenses to rise faster than expected and cause losses for the airline. According to Yu et al. (2017)[6], there are more routes being used as waypoints, and this growth helps airlines operate more efficiently. Increasing the range of destinations, or waypoints, improves passenger convenience and draws

[5] Kottas and Madas's (2018) survey

[6] Yu et al. (2017)

more passengers. The development of alliance networks among airlines that offer a variety of destinations is also associated with the greater availability of routes. Routes may also adhere to precise timing schedules, which affects how many planes an airline needs to service a given area.

7. Limitation:

Contrary to the conclusions made by Joo and Fowler (2014), the inverse relationship between net operating revenue and passenger load factor (PLF) implies that revenue growth has a negative impact on airlines' operational efficiency. This finding emphasizes how competitive businesses are in the aviation sector, since rising ticket costs could drive away customers looking for the best deals. Revenue management advises airlines to aim for expansion, but to keep their size to a minimum to prevent running into problems with diseconomies of scale. This happens when operational expenses rise faster than expected, costing the businesses money.

Nevertheless, in order to analyse airlines' operating efficiency, the aforementioned study leaves out important factors like Available Seat Kilometres (ASK), operating cost and expense, and the quantity of aircraft and manufacturers. Saranga and Nagpal (2016) [7]investigate the factors that influence operational efficiencies and their effect on airline market performance, which is consistent with the concept put forward in this paper. The authors present a theoretical framework that connects the efficiency of airlines with a number of structural, operational, and regulatory factors. The results provided by the authors indicate that certain structural and regulatory factors negatively affect airline performance, while technical efficiency is a crucial factor in gaining market power. However, passenger load factor (PLF) is not used in the second stage of the regression analyses due to its high correlation with other independent variables, leading to multicollinearity.

8. Scope for Future Research:

The financial outcomes (net margin, gross margin, and EBIT margin) of the four airlines this study looked at declined between 2009 and 2017, according to the ANAC dataset (ANAC, 2017). Based on the literature on strategic management, which includes Porter's (1996) distinction between strategy and operational efficiency, future studies could address the performance paradox (Chaharbaghi, 2007) and the necessity of business model innovation (Spieth et al., 2014) in the airline sector. The decay of cause-and-effect models can help explain the performance paradox, which is defined as a circumstance where a considerable amount of work generates a minority of results (Chaharbaghi, 2007). For this reason, businesses should always look for and evaluate ways to improve their business models (Teece, 2010).

[7]Saranga and Nagpal (2016)

9. Conclusion:

The expansion seen in the aviation industry highlights the importance that stakeholders attach to this means of transportation. In order to improve the operational efficiencies of airlines, this study explores the significance of operational indicators. Airlines can become more competitive by putting plans into place that increase operational efficiency. These strategies also improve performance measures, raise passenger service, and lay the groundwork for further analysis of economic and operational indicators. When making strategic decisions, information on performance measures that affect airline costs and efficiency is crucial. Additionally, it gives airlines the knowledge they need to create policies for their short-, medium, and long-term strategic planning.

Using a panel data statistical regression model covering the years 2009 to 2017, the selected methodological technique worked well for estimating coefficients and obtaining the best fit for the given data. All data was obtained from reports published by the Brazilian National Civil Aviation Agency (ANAC), which is regarded as a highly credible and reliable source, in order to guarantee data consistency and dependability.

According to the study's regression model, airlines may improve operational efficiency by adding more routes to their fleet and increasing the frequency of their flights, which will meet passenger demand and increase revenue passenger-kilometers. On the other hand, limiting airline expansion through aircraft transport capacity denotes increased operational effectiveness, averting problems associated with diseconomies of scale that may result in losses. Furthermore, it was noted that operating efficiency is negatively correlated with a shorter stage duration and fewer take-offs, mostly because of fuel and energy efficiency issues.

The total flying hours parameter highlights the fact that airplanes are more efficient throughout the flight phase, particularly while cruising at higher altitudes because they are using less fuel during this phase. Consequently, this leads to improved flight autonomy. Fuel consumption drops when the aircraft is in flight, which eventually results in a decrease in the aircraft's weight and decreased fuel consumption. This dynamic contributes to increased operational effectiveness.

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