

A SYSTEMATIC APPROACH TO BROWNFIELD AIRPORT PRIVATIZATION

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by

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submitted

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CERTIFICATE

This is to certify that the thesis titled “**A SYSTEMATIC APPROACH TO BROWNFIELD AIRPORT PRIVATIZATION**” which is being submitted by **Ms. SOUMYA JAIN** for the fulfilment of the requirements for the award of degree of **Doctor of Philosophy**, is a record of the student’s own work carried out at the **Indian Institute of Technology Delhi** under my supervision and guidance. The matter embodied in this thesis has not been submitted elsewhere for the award of any other degree or diploma.

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ABSTRACT

The air transport market has been showing steady growth for the past two decades. To cater to the growing demand, governments across the world are looking for avenues for fast and efficient infrastructure provision. One such avenue is the privatization of airports. The driving forces for airport privatization are the availability of funds and improvement in efficiency. Efficiency is improved with enhanced quality of service at the same cost. For high-income countries, which already had the infrastructure in place, increasing efficiency was the major driving force, whereas for middle- and low-income countries, availability of funds was and continues to be the driving force. However, nearly three decades of experience in PPP suggests that privatization is not a panacea, but it comes with its own set of problems in airport development and management.

Some of the problems encountered are incomplete contracts leading to disputes, aggressive bidding leading to bail out of private party and profit-motive without strong economic regulation leading to high airport charges for airlines and passengers. Drawing from the existing literature, this research attempts to identify and address the challenges faced in harnessing the advantages of private participation in airports, with the case of India. Taking cognizance of the need for airport infrastructure development, the government of India has been actively privatizing its major airports. Given the prominent role of privatization in airports, Indian civil aviation provides a fertile ground for research in the field of airport management.

Before moving forward with airport privatization, it is imperative to study the existing cases and assess whether privatization actually meets the objectives of infrastructure development and efficiency gains. Once the performance of privatized airports in comparison to public airports is evaluated, and the reasons behind the improved performance are known, the suitability of the PPP mode of airport development and management can be assessed. Even if PPP proves to be beneficial, private participation is not readily available for all airports. Consequently, an approach for systematically selecting airports within a network for privatization needs to be developed.

Although an airport is transferred to profit-driven private management, the purpose continues to be the provision of services to airlines and passengers. A fair valuation of the airport needs to be made at the time of privatization to make sure that the private management makes sufficient profits to make timely investments, and at the same time, airlines and passengers are not charged too high. Given the long concession period (30-50 years), the government needs to create a win-win situation because the cost of default as well as overinvestment will

ultimately be borne by the public. Thus, the price at which airports should be privatized needs to be developed. Since airports are typically auctioned to the technically qualified bidder quoting the highest revenue shared with the government, fair valuation can be done by calculating the reserve price or the lowest acceptable revenue share. In the pursuit of answering these questions, a systematic approach is developed to assess and enhance the outcomes of airport privatization through the four objectives described below.

Firstly, the factors influencing the performance of airports are identified through a systematic literature review and case studies. It is found that the factors influencing the operational performance of airports can be categorized based on airport characteristics: financial, operational, management, user, and regional. This categorization facilitates the apposite selection of variables for performance measurement as well as influencing factors.

Secondly, the operational performance of airports is measured using Data Envelopment Analysis along with the influence of factors affecting performance on airports' actual performance using the Wilcoxon rank-sum test. It is found that privatization and the large size of airports contribute towards enhanced performance. The results of the Wilcoxon rank-sum test are further evaluated with Malmquist Productivity Index to understand the reasons behind the change in airport efficiency over time.

Thirdly, privatization potential is assessed through a framework measuring the current status in terms of airport performance and future prospects in terms of passenger traffic growth of public-owned airports. The quadrant analysis in this objective provides the first-level insight into the selection of public-owned airports for privatization by dividing airports into the *best*, *explorable*, *cautious*, and *worst* case. The results of analysis on Indian airports reveal that most airports in the best quadrant are already lined up for privatization. Moreover, this analysis based on performance and traffic growth gives better metrics for selection as compared to profitability.

Finally, the minimum price at which public-owned airports can be auctioned, or the reserve price, is modeled through a fuzzy forecast of the net income of the airport operator over the concession period. The variables in the model are forecasted using country-specific (India in this case) assumptions. The range of reserve prices is derived by simulating four market scenarios and two economic shocks. The market scenarios capture the possibilities that cannot be mathematically incorporated in a forecast-based model. The economic shocks capture the extreme events that result in severe traffic contraction. The final results are validated with the recent auction of four Indian airports. Each of the objectives is a step towards assessing and valuing airports. But the financial model based on net income forecast is the most significant

contribution of this research. It can be used by developing economies for fair valuation of airports at the time of auction.

Keywords: *airport privatization, benchmarking, reserve price, scenario analysis, traffic forecasting*

सारांश

हवाई परिवहन बाजार पिछले दो दशकों से लगातार विकास दिखा रहा है। बढ़ती मांग को पूरा करने के लिए, दुनिया भर की सरकारें तेज और कुशल बुनियादी ढांचे के प्रावधान के लिए रास्ते तलाश रही हैं। ऐसा ही एक मार्ग है हवाई अड्डों का निजीकरण। हवाई अड्डे के निजीकरण की प्रेरक शक्ति धन की उपलब्धता और दक्षता में सुधार है। उसी कीमत पर सेवा की बढ़ी हुई गुणवत्ता के साथ दक्षता में सुधार होता है। उच्च आय वाले देशों के लिए, जिनके पास पहले से ही बुनियादी ढांचा था, बढ़ती दक्षता प्रमुख प्रेरक शक्ति थी, जबकि मध्यम और निम्न-आय वाले देशों के लिए, धन की उपलब्धता प्रेरक शक्ति थी और बनी हुई है। हालांकि, पीपीपी में लगभग तीन दशकों का अनुभव बताता है कि निजीकरण रामबाण नहीं है, लेकिन यह हवाई अड्डे के विकास और प्रबंधन में समस्याओं के अपने सेट के साथ आता है।

जिन समस्याओं का सामना करना पड़ा है उनमें से कुछ अपूर्ण अनुबंध हैं जो विवादों का कारण बनते हैं, आक्रामक बोली के कारण निजी पार्टी को जमानत मिल जाती है और मजबूत आर्थिक विनियमन के बिना लाभ-उद्देश्य से एयरलाइनों और यात्रियों के लिए उच्च हवाई अड्डा शुल्क होता है। मौजूदा साहित्य से आकर्षित होकर, यह शोध भारत के मामले के साथ, हवाई अड्डों में निजी भागीदारी के लाभों का उपयोग करने में आने वाली चुनौतियों की पहचान करने और उनका समाधान करने का प्रयास करता है। हवाई अड्डे के बुनियादी ढांचे के विकास की आवश्यकता का संज्ञान लेते हुए, भारत सरकार अपने प्रमुख हवाई अड्डों का सक्रिय रूप से निजीकरण कर रही है। हवाई अड्डों में निजीकरण की प्रमुख भूमिका को देखते हुए, भारतीय नागरिक उड्डयन हवाई अड्डा प्रबंधन के क्षेत्र में अनुसंधान के लिए एक उपजाऊ जमीन प्रदान करता है।

हवाई अड्डे के निजीकरण के साथ आगे बढ़ने से पहले, मौजूदा मामलों का अध्ययन करना और यह आकलन करना अनिवार्य है कि क्या निजीकरण वास्तव में बुनियादी ढांचे के विकास और दक्षता लाभ के उद्देश्यों को पूरा करता है। एक बार जब सार्वजनिक हवाई अड्डों की तुलना में निजीकृत हवाई अड्डों के प्रदर्शन का मूल्यांकन किया जाता है, और बेहतर प्रदर्शन के पीछे के कारणों को जाना जाता है, तो हवाई अड्डे के विकास और प्रबंधन के पीपीपी मोड की उपयुक्तता का आकलन किया जा सकता है। भले ही पीपीपी फायदेमंद साबित हो, निजी भागीदारी सभी हवाई अड्डों के लिए आसानी से उपलब्ध नहीं है। नतीजतन, निजीकरण के लिए नेटवर्क के भीतर व्यवस्थित रूप से हवाई अड्डों का चयन करने के लिए एक दृष्टिकोण विकसित करने की आवश्यकता है।

सबसे पहले, हवाई अड्डों के प्रदर्शन को प्रभावित करने वाले कारकों की पहचान एक व्यवस्थित साहित्य समीक्षा और केस स्टडी के माध्यम से की जाती है। यह पाया गया है कि हवाई अड्डों के परिचालन प्रदर्शन को प्रभावित करने वाले कारकों को हवाई अड्डे की विशेषताओं के आधार पर वर्गीकृत किया जा सकता है: वित्तीय, परिचालन, प्रबंधन, उपयोगकर्ता और क्षेत्रीय। यह वर्गीकरण प्रदर्शन मापन के साथ-साथ प्रभावित करने वाले कारकों के लिए चर के उपयुक्त चयन की सुविधा प्रदान करता है।

दूसरे, विलकॉक्सन रैंक-सम टेस्ट का उपयोग करके हवाई अड्डों के वास्तविक प्रदर्शन पर प्रदर्शन को प्रभावित करने वाले कारकों के प्रभाव के साथ-साथ डेटा लिफाफा विश्लेषण का उपयोग करके हवाई अड्डों के परिचालन प्रदर्शन को मापा जाता है। यह पाया गया है कि निजीकरण और हवाई अड्डों का बड़ा आकार बेहतर प्रदर्शन में योगदान देता है। समय के साथ हवाई अड्डे की दक्षता में बदलाव के कारणों को समझने के लिए विलकॉक्सन रैंक-सम टेस्ट के परिणामों का मूल्यांकन माल्मक्विस्ट उत्पादकता सूचकांक के साथ किया जाता है।

तीसरा, निजीकरण की संभावना का आकलन एक ढांचे के माध्यम से किया जाता है जो सार्वजनिक स्वामित्व वाले हवाई अड्डों के यात्री यातायात वृद्धि के संदर्भ में हवाई अड्डे के प्रदर्शन और भविष्य की संभावनाओं के संदर्भ में वर्तमान स्थिति को मापता है। इस उद्देश्य में चतुर्थांश विश्लेषण हवाई अड्डों को सर्वश्रेष्ठ, अन्वेषण योग्य, सतर्क और सबसे खराब स्थिति में विभाजित करके निजीकरण के लिए सार्वजनिक स्वामित्व वाले हवाई अड्डों के चयन में प्रथम स्तर की अंतर्दृष्टि प्रदान करता है। भारतीय हवाई अड्डों पर विश्लेषण के नतीजे बताते हैं कि सबसे अच्छे चतुर्थांश में अधिकांश हवाई अड्डे पहले से ही निजीकरण के लिए तैयार हैं। इसके अलावा, प्रदर्शन और ट्रेफ़िक वृद्धि पर आधारित यह विश्लेषण लाभप्रदता की तुलना में चयन के लिए बेहतर मीट्रिक देता है।

अंत में, न्यूनतम मूल्य जिस पर सार्वजनिक स्वामित्व वाले हवाई अड्डों की नीलामी की जा सकती है, या आरक्षित मूल्य, रियायत अवधि के दौरान हवाई अड्डा ऑपरेटर की शुद्ध आय के अस्पष्ट पूर्वानुमान के माध्यम से तैयार किया जाता है। मॉडल में चर का पूर्वानुमान देश-विशिष्ट (इस मामले में भारत) मान्यताओं का उपयोग करके लगाया जाता है। आरक्षित कीमतों की सीमा चार बाजार परिदृश्यों और दो आर्थिक झटकों का अनुकरण करके प्राप्त की जाती है। बाजार परिदृश्य उन संभावनाओं को पकड़ते हैं जिन्हें गणितीय रूप से पूर्वानुमान-आधारित मॉडल में शामिल नहीं किया जा सकता है। आर्थिक झटके चरम घटनाओं को पकड़ लेते हैं जिसके परिणामस्वरूप गंभीर यातायात संकुचन होता है। अंतिम परिणाम चार भारतीय हवाई अड्डों की हालिया नीलामी के साथ मान्य हैं। प्रत्येक उद्देश्य हवाई अड्डों के मूल्यांकन और

मूल्यांकन की दिशा में एक कदम है। लेकिन शुद्ध आय के पूर्वानुमान पर आधारित वित्तीय मॉडल इस शोध का सबसे महत्वपूर्ण योगदान है। इसका उपयोग विकासशील अर्थव्यवस्थाओं द्वारा नीलामी के समय हवाई अड्डों के उचित मूल्यांकन के लिए किया जा सकता है। दूसरे, विलकॉक्सन रैंक-सम का उपयोग करके हवाई अड्डों के वास्तविक प्रदर्शन पर प्रदर्शन को प्रभावित करने वाले कारकों के प्रभाव के साथ-साथ डेटा लिफाफा विश्लेषण का उपयोग करके हवाई अड्डों के परिचालन प्रदर्शन को मापा जाता है। परीक्षण। यह पाया गया है कि निजीकरण और हवाई अड्डों का बड़ा आकार बेहतर प्रदर्शन में योगदान देता है। समय के साथ हवाई अड्डे की दक्षता में बदलाव के कारणों को समझने के लिए विलकॉक्सन रैंक-सम टेस्ट के परिणामों का मूल्यांकन माल्मक्विस्ट उत्पादकता सूचकांक के साथ किया जाता है।

कीवर्ड: हवाई अड्डे के निजीकरण, बेंचमार्किंग, आरक्षित मूल्य, परिदृश्य विश्लेषण, यातायात पूर्वानुमान

TABLE OF CONTENTS

Certificate	i
Acknowledgements	ii
Abstract	iv
List of Figures	xi
List of Tables.....	xiii
Abbreviations	xiv
 CHAPTER 1 INTRODUCTION	 1
1.1 Background.....	1
1.2 Motivation and Research Questions	2
1.3 Research Objectives and Scope	3
1.4 Methodology in Brief	4
1.5 Organization of the Thesis.....	5
 CHAPTER 2 FACTORS INFLUENCING AIRPORT PERFORMANCE.....	 7
2.1 Introduction	7
2.2 Methodology.....	8
2.2.1 Measuring the Explanatory Variables	9
2.2.2 Combination of Explanatory Variables.....	18
2.3 Effects of Explanatory Factors	18
2.3.1 Effects of Airlines	18
2.3.2 Effects of Competition	19
2.3.3 Effects of Airside and Landside Delay	20
2.3.4 Effects of Airport Location	21
2.3.5 Effects of Ownership.....	22
2.3.6 Effects of Hinterland Population.....	23
2.3.7 Effects of Economic Regulation	23
2.3.8 Effects of Airport Size and Traffic Composition	24

2.3.9	Effects of other Variables	25
2.4	Concluding Remarks	26
CHAPTER 3 PERFORMANCE OF INDIAN AIRPORTS		27
3.1	Introduction	27
3.2	The Indian Context.....	27
3.3	Airport Benchmarking	33
3.4	Data Envelopment Analysis	35
3.4.1	The Concept.....	35
3.4.2	The Variants.....	37
3.4.3	Selection of Inputs and Outputs.....	37
3.4.4	Combination of Inputs and Outputs.....	39
3.4.5	Second-stage Analysis	42
3.4.6	Measuring the efficiency change over time	42
3.5	Data Collection.....	43
3.5.1	Variables selected as inputs and outputs.....	43
3.6	Analysis and Results	49
3.6.1	Relative Efficiency of Indian Airports.....	49
3.6.2	Second Stage Analysis.....	52
3.6.3	Malmquist Productivity Index	53
3.7	Discussion	58
3.8	Concluding Remarks	58
CHAPTER 4 PRIVATIZATION POTENTIAL OF INDIAN AIRPORTS.....		61
4.1	Introduction	61
4.2	Airport privatization.....	61
4.3	Literature Review.....	62
4.4	Framework for Assessing privatization potential	65
4.4.1	Computing the Current Status.....	67

4.4.2	Computing the Future Prospects	69
4.4.3	Algorithm	70
4.5	Application on Public Indian Airports.....	72
4.5.1	Current Status.....	72
4.5.2	Future Prospect.....	73
4.6	Discussion.....	76
4.7	Concluding Remarks	77
CHAPTER 5 RESERVE PRICE MODEL FOR AUCTION OF INDIAN AIRPORTS		79
5.1	Introduction	79
5.2	Airport privatization in india	80
5.3	The Model.....	81
5.3.1	Selection of Variables	86
5.3.2	Traffic forecast	87
5.3.3	Capital investment.....	90
5.3.4	Income forecast	93
5.3.5	Plausible scenarios	96
5.3.6	Economic Shocks	100
5.3.7	Results	100
5.4	Discussion.....	101
5.5	Concluding Remarks	103
CHAPTER 6 SUMMARY AND CONCLUSIONS		105
6.1	Summary.....	105
6.2	Findings	105
6.3	Policy Implications	107
6.4	Contributions from this research	108
6.5	Limitations.....	108

6.6	Directions for future research.....	109
	References.....	111
	Appendix A: List of Reviewed Articles	125
	Appendix B: Case Studies of Chennai and Mangaluru Airport.....	131
	Appendix C: Determination of Aeronautical Revenue using AERA Philosophy	142
	Appendix D: Overview of Sample Airports	143
	Appendix E: Sample Calculations for Optimistic Scenario of Lucknow Airport	144
	Appendix F: Sensitivity Analysis of DEA Results with and without Cargo Volume .	147
	List of Publications	149
	Curriculum Vitae	150

LIST OF FIGURES

Figure 2.1 Overview of chapter 2.....	7
Figure 2.2 Flowchart of qualitative analysis in NVivo	9
Figure 2.3 Geographical distribution of studied articles applying data envelopment analysis for measuring airport performance (2009-2017).....	11
Figure 2.4 Classification of explanatory variables.....	12
Figure 3.1 Overview of chapter 3.....	27
Figure 3.2 Key initiatives in the history of civil aviation in India	30
Figure 3.3 System oriented approach to performance measurement	34
Figure 3.4 Efficiency frontier in constant returns-to-scale and variable returns-to-scale DEA models (Source: Cooper <i>et al.</i> , 2007), and the difference between input- and output-orientation.....	36
Figure 3.5 Classification of Inputs	38
Figure 3.4 Annual passengers in millions, for 82 operational Indian airports in 2016-17	44
Figure 3.6. Histograms of input variables - Hours of operation per day, operational expenses in Rs million, runway length in metres, and terminal building area in square metres for the year 2016-17.	46
Figure 3.7. Histograms of output variables – passengers per year, aircraft movements per year, and non-aeronautical revenue in Rs million for the year 2016-17	47
Figure 3.8 Exogenous variables explaining the variation in airport efficiency.	48
Fig 3.9 Scale efficiency of sample airports.	51
Figure 3.10 Airport sample average for each period – Malmquist productivity index, efficiency change, and technological change	55
Figure 3.11 Average Malmquist productivity indices based on ownership and airport size	57
Figure 4.1 Overview of chapter 4.....	61
Figure 4.2 Types of airport privatization in emerging market economies	63
Figure 4.3 Position of airports based on their current status (technical efficiency) and future prospects (month-over-month passenger growth)	67
Figure 4.4 Algorithm to select the airport for privatization	71
Table 4.1 Descriptive statistics of inputs and outputs.....	73
Table 4.2 Mean CRS and VRS efficiency scores of sample airports.....	73
Table 4.3 Mean month-over-month passenger growth of sample airports	74

Figure 4.5 Privatization potential of sample airports.....	75
Figure 5.1 Overview of chapter 5	79
Figure 5.2 Components of the reserve price model	85
Figure 5.3 Fuzzy membership functions for low, medium and high passenger growth for Lucknow airport.....	88
Figure 5.4 Moderator exponential functions for low, medium, and high passenger growth	89
Figure 5.5 Fuzzy membership functions for low, medium, and passengers per ATM growth for Lucknow airport.....	90
Figure 5.7 Passenger growth with a corresponding increase in capacity through city-side capital investment at Lucknow airport.....	99
Figure B.1 Important facts about Chennai International Airport.....	134
Figure B.2 Findings from the case study of Chennai International Airport	134
Figure B.3 Important facts about Mangaluru International Airport	140
Figure B.4 Findings from case study of Mangaluru International Airport.....	140

LIST OF TABLES

Table 2.1 Measurement of explanatory variables	13
Table 2.2 Monad of explanatory factors with at least 3 articles using the individual factor	17
Table 3.1 Airport ownership models in India	29
Table 3.2: Dyad of inputs and outputs with at least 3 articles using the input-output combination	41
Table 3.3 Descriptive statistics of inputs and outputs for the year 2016-17	45
Table 3.4 Output-oriented VRS efficiency score of Indian airports from 2013 to 2017 (five years).....	50
Table 3.5 P-values of Wilcoxon Rank-sum test on DEA efficiency scores and exogenous factors over a period of five years	53
Table 3.6. Malmquist Productivity Index, technical efficiency change, technological efficiency change averaged over four annual periods (2012-13 to 2016-17)	54
Table 5.1 Evolution of PPP airport projects in India (Source: created by the author)....	83
Table 5.2 Net income models for airport concessions	84
Table 5.3 Variables affecting traffic forecast with equations	91
Table 5.4 Variables affecting capital investment and corresponding equations	92
Table 5.5: Phased airport costs.....	93
Table 5.6: Variables related to income forecast and their corresponding equations.....	95
Table 5.7 Details of risk modeling – passenger shock and airline shock.....	100
Table D.1 Input data for the reserve price model.....	143

ABBREVIATIONS

AAI Airport Authority of India

ACI Airports Council International

AERA Airports Economic Regulatory Authority

APAO Association of Private Airport Operators

ARR Aggregate Revenue Requirement

ATM Air Transport Movements

ATRS Air Transport Research Society

BOO Build Own Operate

BOOT Build Own Operate Transfer

BOT Build Operate Transfer

Capex Capital Expenditure

CRS Constant Returns-to-Scale

DDF Directional Distance Function

DEA Data Envelopment Analysis

DGCA Directorate General of Civil Aviation

EBIT Earnings before Interest and Tax

FSC Full-service Carrier

FTE Full-time Equivalent

GDP Gross Domestic Product

IATA International Air Transport Association

ICAO International Civil Aviation Organization

INR Indian National Rupee

JV	Joint Venture
LCC	Low-cost Carrier
MPI	Malmquist Productivity Index
NCAP	National Civil Aviation Policy
NIRS	Non-increasing Returns-to-Scale
NPV	Net Present Value
Pax	Passengers
PPP	Public-Private Partnership
PSO	Public Service Obligations
RCS	Regional Connectivity Scheme
SARS	Severe Acute Respiratory Syndrome
SFA	Stochastic Frontier Analysis
SPV	Special Purpose Vehicle
TFP	Total Factor Productivity
USD	United States Dollar
VFP	Variable Factor Productivity
VGf	Viability Gap Funding
VRS	Variable Returns-to-Scale