# DEVELOPING A FRAMEWORK FOR IMPROVING THE PERFORMANCE OF PPP METROPOLITAN AIRPORTS IN INDIA

A Thesis submitted to the
*UPES*

For the Award of
***Doctor of Philosophy***
in
*Management*

BY
Mohit Rishi

August 2024

SUPERVISOR
Dr. Prasoom Dwivedi


School of Business
UPES
Dehradun-248007: Uttarakhand

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SUPERVISOR
Dr. Prasoom Dwivedi
*Professor and Head – Research Projects & Funding*
Symbiosis Centre for Research & Innovation
Symbiosis International University
Lavale Hill Base, Lavale Campus, Pune.


School of Business
UPES
Dehradun-248007: Uttarakhand

# DECLARATION

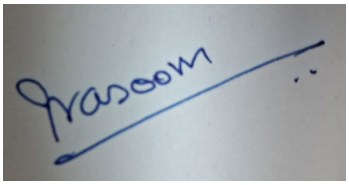
I declare that the thesis entitled **"Developing a Framework for Improving the Performance of PPP Metropolitan Airports in India"** has been prepared by me under the guidance of **Dr. Prasoom Dwivedi, Professor, Professor and Head – Research Projects & Funding, Symbiosis Centre for Research & Innovation, Symbiosis International University, Lavale Hill Base, Lavale Campus, Pune.** No part of this thesis has formed the basis for the award of any degree or fellowship previously.

**Mohit Rishi**

**02 August 2024**

# CERTIFICATE

I certify that Mohit Rishi has prepared his thesis entitled "Developing a Framework for Improving the Performance of PPP Metropolitan Airports in India", for the award of PhD degree from the University of Petroleum & Energy Studies, under my guidance. He has carried out work at the School of Business, University of Petroleum & Energy Studies.



**Dr. Prasoom Dwivedi**
Professor and Head – Research Projects & Funding
Symbiosis Centre for Research & Innovation
Symbiosis International University
Lavale Hill Base, Lavale Campus, Pune.

Date: 02 August 2024.

# ABSTRACT

Airports stand as indispensable pillars of both strategic and economic significance, functioning as vital nexus points for transportation and commerce, underlining their pivotal role in our infrastructure and socioeconomic landscape. The intricate process of airport development and operation entails the committed involvement of stakeholders who invest substantial time, resources, and effort, often involving sunk costs. Functionally, airports are designed to facilitate a wide range of aviation services for airlines and travelers alike. These services encompass a broad spectrum of aeronautical and non-aeronautical elements, including runway infrastructure for aircraft operations, fueling and maintenance terminals, passenger terminals, parking facilities, maintenance hangars, and navigational services, among others. The efficiency of air transport is pivotal for driving significant socioeconomic development, prompting various models of airport privatization worldwide. This privatization entails diverse approaches, ranging from complete transfer to private operation to partial ownership restructuring, aimed at redistributing governmental rights, functions, and responsibilities to private entities or companies. The benefits of airport privatization are manifold, including the reduction of government expenditure, enhancement of economic efficiency, and facilitation of ownership transitions.

Consequently, the topic of airport privatization has garnered considerable attention from professionals and academics, resulting in a rich body of literature dedicated to its exploration and analysis. In the context of India, airport privatization primarily takes the form of joint ventures (JVs) or partnerships with private sectors, allowing for partial privatization while maintaining government involvement. The adoption of the Public-Private Partnership (PPP) model has been widespread, aiming to generate financial value and allocate operational risks to the private sector. The journey towards airport privatization in India commenced in the late 1990s and early 2000s, spurred by escalating air traffic and the imperative for infrastructure expansion and modernization. The privatization policy was initiated to attract private investment through strategic

sales and divestments, marking a significant shift in airport governance and management paradigms.

The research significantly advances the Resource-Based View (RBV) theory by intricately linking tangible and intangible resources with construct variables, offering nuanced management approaches for Public-Private Partnership (PPP) airport operators. This empowers them to devise tailored strategies, fostering sustainable competitive advantages. The study outlines a three-step process:

1. Identification and prioritization of barriers hindering PPP airport performance.
2. To comprehensively analyze the symbiotic relationship between tangible and intangible resources and evaluate their profound implications on the overall performance and resilience of airports.
3. Strategic alignment with RBV theory constructs (Valuable, Rare, Inimitable, and Non-substitutable).

A key contribution lies in establishing a profound connection between RBV theory and airport resources, influencing PPP airport performance in India. Findings illustrate that distinct management styles can be explained by RBV's VRIN principles, enabling operators to craft intricate strategies. This facilitates policy changes by government bodies, fostering growth-conducive environments.

Keywords: Airport privatization, Barriers, Tangible & Intangible resources, RBV theory, Analytical Hierarchy Process, Fuzzy Analytical Hierarchy Process, Structural Equation Modeling, DELPHI method

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I attribute the successful culmination of this endeavor to the grace and wisdom bestowed upon me by the divine providence of the Lord "Shree Ram."

The journey toward earning a Ph.D. has been both demanding and extensive, marked by periods of fatigue and uncertainty, yet also enriched by moments of fulfillment upon reaching significant milestones. The realization of this substantial project is owed to the invaluable guidance, support, and contributions of numerous individuals, for whom I am deeply grateful.

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Special appreciation goes to Dr. Prasoom Dwivedi, my research guide, for his unwavering academic guidance, encouragement, patience, and time that facilitated the completion of my doctorate. His tireless dedication and dynamic approach were pivotal in enhancing my knowledge and motivation, especially during personal challenges amid the COVID-19 pandemic. I am also indebted to my former guide, Dr. D P Singh, and co-guide Dr. Ajay Jha, for their patient mentorship.

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In conclusion, I extend sincere thanks to all whose contributions have led to the successful completion of this thesis. With deep gratitude, love, and reverence, I dedicate this work to the cherished memory of my father, Lt. Shri R. S. Sharma, and my mother, Lt. Smt. S. Sharma.

**Dated: February 2024** **Mohit Rishi**

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# LIST OF ABBREVIATIONS

| Abbreviation | Full form |
|---|---|
| AAI | Airports Authority of India |
| ACDM | Airport Collaborative Decision-Making |
| ACI | Airport Council International |
| AHP | Analytic Hierarchy Process |
| APOC | Airport Operations Center |
| ASQ | Airport Service Quality |
| AVE | Average Variance Extracted |
| BIAL | Bangalore International Airport Limited |
| BOT | Build Operate and Transfer |
| CA | Competitive Advantage |
| CAGR | Compound Annual Growth Rate |
| CBP | Customs and Border Protection |
| CFA | Confirmatory Factor Analysis |
| CI | Consistency Index |
| CIAL | Cochin international Airport Limited |
| CR | Consistency Ratio |
| CSF | Crucial Success Factors |
| CSMIA | Chhatrapati Shivaji Maharaj International Airport |
| DGCA | Directorate General of Civil Aviation |
| DIAL | Delhi International Airport Limited |
| FAHP | Fuzzy Analytic Hierarchy Process |
| FCFS | First Come-First Serve |
| FDI | Foreign Direct Investment |
| FIPB | Foreign Investment Promotion Board |
| GoAP | Government of Andhra Pradesh |
| GoI | Government of India |
| GPFR | General Purpose Financial Reports |
| HTMT | Heterotrait-Monotrait Ratio |
| IATA | International Air Transport Association |
| IGIA | Indira Gandhi International Airport |
| IQR | Interquartile Range |
| JV | Joint Ventures |
| LCC | Low-Cost Carriers |
| MAHB | Malaysian Airport Holding Berhad |
| MCDM | Multi-Criteria Decision Making |
| MIAL | Mumbai International Airport Limited |
| MoCA | Ministry of Civil Aviation |
| MPPA | Million Passengers Per Annum |

| | |
|---|---|
| NCAP | National Civil Aviation Policy |
| NFI | Normed Fit Index |
| O/D | Origin-Destination |
| OMDA | Operation Management and Development Agreement |
| PLS-SEM | Partial Least Squares Structural Equation Modeling |
| PPP | Public-Private Partnership |
| PSP | Private Sector Participation |
| RBV | Resource-Based View |
| RGIA | Rajiv Gandhi International Airport |
| SEM | Structural Equation Modeling |
| SRMR | Standardized Root Mean Square Residual |
| TAM | Total Airport Management |
| TFN | Triangular Fuzzy Numbers |
| TFP | Total Factor Productivity |
| VFM | Value for Money |
| VIF | Variance Inflation Factor |
| VRIN | Valuable, Rare, Inimitable, and Non-substitutable |

# CHAPTER 1
# INTRODUCTION

## 1 Overview

In 2024, global airport passenger traffic is projected to rebound to the levels observed in 2019. By 2041, passenger traffic worldwide is expected to reach 19.3 billion and further increase to 23.9 billion by 2050. Regarding aircraft movements, there was a decrease from 102.9 million in 2019 to 73.6 million in 2021. However, it is forecasted to grow from 84.0 million to 111.6 million by 2026. By 2041, airports worldwide are expected to witness 153.8 million aircraft movements. The leading markets for aircraft movements in 2041 are predicted to be the United States, China, and India, hosting 23%, 16%, and 4% of global aircraft movements, respectively. In 2041, airports are expected to handle approximately 200 million tons of air cargo worldwide, with the United States and China remaining the largest markets, collectively accounting for 40% of global cargo (Research and Markets, 2023).

As for the airport construction market, in 2022, it was estimated at US$123.9 Billion in the U.S. China, ranked second in global economic stature, is anticipated to reach a market size of US$201.6 Billion by 2030, boasting a Compound Annual Growth Rate (CAGR) of 7.2% from 2022 to 2030. Other noteworthy geographic markets include Japan and Canada, each expected to grow at a CAGR of 2.7% over the 2022-2030 period. Germany is forecast to grow at approximately 2.6% CAGR within Europe. The market is forecasted to reach US$535.8 Billion by the year 2030 in the Asia-Pacific region, led by countries such as Australia, India, and South Korea (Airport Council International, 2022).

Airports are essential components of both strategic and economic framework (Edwards, 2005). They consist of complex facilities managed by multiproduct enterprises (Betancor et al., 1999). The development and operation of airports involve committed stakeholders who invest significant time and effort with sunk costs (Hart, 1995). From the 1980s onward, the privatization of major and

regional airports has become increasingly prevalent (Wittmer et al., 2011). Airports are principally structured to deliver aviation services to both airlines and passengers (Junior et al., 2021). These amenities cover a wide array of services, spanning aeronautical and non-aeronautical domains. This includes runway facilities for aircraft operations, fueling and maintenance terminals, passenger terminals, parking facilities, maintenance hangars, and navigational support services (Zhang et al, 2003). Effective air transportation is crucial for substantial socioeconomic progress (Tolcha et al., 2020).

Airport privatization takes on various models, which may involve the complete transfer of airport operations to private entities or the transfer of full ownership (Tang, 2021). This involves the transfer or joint management of public authority, roles, and obligations with private sector entities or companies (Hong et al., 2001). The significance of airport privatization is underscored by its three key benefits: diminishing government investment, enhancing economic efficiency, and enabling ownership transfers. As a result, this topic has gained substantial attention from professionals and academics alike, leading to a rich body of literature dedicated to its exploration and analysis. Many research papers have underscored the beneficial effects of airport privatization globally and within individual countries (Graham, 2020; Hooper, 2002; Matsumura et al., 2012). (Oum et al., 2006) emphasized the ways in which airport privatization has resulted in increased efficiencies in European nations and, (Chen et al., 2017) advocated for the improved operational and economic efficiency of privatized airports in both Europe and the Asia-Pacific region.

In Greece, 14 regional airports have been efficiently selected for privatization (Fragoudaki et al., 2020). Studies conducted in Latin America (Perelman et al., 2012) found that private airports demonstrated higher total factor productivity compared to public airports. Extensive research spanning 2,444 airports across 217 countries demonstrated that ownership by private equity firms significantly enhanced efficiency, drove up passenger traffic, and substantially increased the likelihood of receiving accolades (Weisbach et al., 2022). Despite successful implementations observed in other regions, the scale of airport privatization in

India has remained relatively limited compared to countries in Europe and other advanced economies.

### 1.1 The Significance of Airport Privatization

The British Government under Thatcher was the first to implement an airport privatization policy in the year 1987. The London airports, namely Heathrow, Gatwick, and Stansted, operated by the state-controlled British Airports Authority, were, privatized to improve the financial performance and make the system processes robust enough to handle growing passenger demand (Doganis, 1992). In the contemporary era, air transport stands as a widely acknowledged modern and integrated service (Ülkü et al., 2021). At the heart of this transportation system lie airports, vital hubs for commercial infrastructure (Wells et al, 2011). Beyond mere transportation centers, airports significantly contribute to local economies, fueling job creation and acting as gateways to international markets for local businesses (Olfat et al., 2016; Air Transport Action Group, 2018).

The idea of privatizing airports has been a topic of intense economic discussions and debates (Graham, 2011). Airport deregulation began to take shape in the mid-1970s, spearheaded by the United States government, initiating transformative reforms in airport infrastructure and airline industry management (Senguttuvan, 2005; Ashford et al., 2013). Encouraged by the positive outcomes observed in the UK, nations worldwide, spanning various continents, followed suit by embarking on major airport privatization initiatives (Poole, 2021).

Between 1990 and 2005, over 100 airports in 38 developing countries entered contracts with private sectors, embarking on ambitious projects to modernize airport infrastructure (Andrew et al., 2006). By 2017, more than 600 airports worldwide had undergone privatization, indicating a significant shift in airport management and ownership (Chaouk et al., 2019). This trend endured, leading to the privatization of approximately 20 percent of the world's airports by the year 2020 (Belsie, 2023).

Airport privatization has generated much interest in government policy documents globally. Between 1996 and 2000, several airports were, privatized in Europe, Australia, New Zealand, South Africa, and Central and South America. However, due to 9/11 and the outbreak of SARS in 2000, there was a break in this process. This trend gained momentum in 2004 when a number of airports were privatized in Europe (Paris, Brussels, Cyprus) and India (Delhi, Mumbai, Hyderabad, and Bangalore), (Graham, 2011).

## 1.2 Airport Privatization in India

The story of airport development in India can be traced back to a significant milestone in December 1912, marked by a historic flight from London to Karachi and Delhi, made possible under the auspices of the UK government (Singh et al., 2019). Since then, India has established an extensive network of airports, effectively connecting vast territories and regions (Kashiramka et al., 2016). However, the rapid growth in the airline industry and the increasing number of passengers have put considerable pressure on Indian aviation to upgrade and broaden its services to accommodate the needs of the growing economy (Raghavan et al., 2021).

In response to these challenges, India has explored various modes of airport privatization (Cruz et al., 2011). It's imperative to underscore that in India, privatization signifies private sector engagement rather than complete airport privatization. As of now, India hasn't fully privatized any airports but has instead embraced the Public-Private Partnership (PPP) model as the principal avenue for private sector participation. This strategy aims to curtail government investment, augment airport charges, foster competition, and mitigate concerns regarding monopolies (Ministry of Civil Aviation, MoCA, 2003).

Airport privatization in India adopts Joint Ventures (JVs) or partnerships with the private sector, facilitating partial privatization while retaining government involvement. The widely adopted and practiced PPP model aims to generate financial value and offload operational risk onto the private sector in airport privatization initiatives within India (Sresakoolchai et al., 2020). In India, airport privatization started in the late 1990s to early 2000s due to increased

traffic demands. The policy aimed to attract private participation through strategic sales and privatization (Estrin et al., 2018).

Airport privatization in India was encouraged by the presence of legislation such as Private Sector Participation (PSP) in infrastructure development (ADB, 2000). The Naresh Chandra Committee's report in 2003 on Indian civil aviation development played a crucial role in shaping the privatization policies for airports (MoCA, 2003). This suggestion established the framework for private sector involvement in Indian airports via the PPP model, aiming to close funding gaps and enhance the operational and managerial efficiency of air services (Puri, 2003).

The aging airports in India, constructed several decades ago, necessitated modernization and expansion to accommodate present demands. Recognizing that state-owned airport fees were comparatively high was one of the driving forces behind airport privatization (Moses, 2016). In response, the Airport Restructuring Committee in the Ministry of Civil Aviation identified the need for private sector involvement to upgrade Indian airports. Preliminary feasibility reports were disseminated to potential private investors (MoCA, 2003). This led to major airports metropolitan airports (Bengaluru, Delhi, Mumbai, and Hyderabad) being restructured under PPP Joint Venture (JV) concessions for 30 to 99 years, enhancing operational efficiency. The airports acquired through PPP endeavors aim to provide increased Value for Money (VFM) and enhance economic efficiency (Cruz et al., 2011).

The Cochin International Airport, privatized in 1994 under the PPP model, was a significant milestone in India's airport privatization journey (Kashiramka et al., 2016; Ohri, 2012). Following its success, other major airports in cities like Bangalore, Hyderabad, Mumbai, Delhi, and Nagpur were denationalized through PPP provisions, functioning within the Build Operate and Transfer (BOT) framework (Singh et al., 2015). The renovation of these aerodromes is instrumental in achieving the roadmap for civil aviation in India. The Government of India (GoI) made the PPP model its cornerstone for airport reforms, underscoring its pivotal role in driving modernization efforts (Bhadra, 2008).

To facilitate the PPP approach, the GoI implemented fresh legislation and regulations to entice private enterprise funding in the construction of new runways and terminals (Jacquillat et al., 2014). The PPP model is being utilized in both new and existing airport development and modernization projects. Several PPP agreements have been established with private sector investors, leading to the development of multiple airports, water drome's, and heliports (Iyer et al., 2021).

After the triumphant completion of six PPP projects, including Bangalore International Airport Limited (BIAL), Cochin International Airport Limited (CIAL), Delhi International Airport Limited (DIAL), and Mumbai International Airport Limited (MIAL), the Government of India (GoI) is actively pursuing the extension of the PPP model to encompass additional airports in Kolkata, Jaipur, Chennai, and Ahmedabad (Emrouznejad et al., 2016). Notably, in 2019, the Adani Group secured the bid for the concession of airports in Ahmedabad, Jaipur, Lucknow, Thiruvananthapuram, and Mangalore for a 50-year term (Poole, 2020). The Government of India (GoI) plans to lease out the top 25 AAI-owned airports to private firms as part of its broader diversification strategy (Majumder, 2023).

Supporting the advancement and modernization of airports, the Government of India (GoI) has authorized complete foreign investment in airport construction, development, and management, contingent upon specific sanction from the Foreign Investment Promotion Board (FIPB) (Singh, 2016; Yadav, 2020). By 2021, India's domestic aviation sector has secured the third position globally in terms of size and scale (IBEF, 2021).

## 1.3 Background and Objectives of the study

### 1.3.1 Indian Aviation Scenario

The Indian domestic and international passenger traffic demand experienced a significant double-digit growth rate. However, Indian airports were ill-equipped to handle this surge, leading to capacity constraints and various operational challenges. Investment in infrastructure and technology upgrades was needed to

accommodate the increasing number of passengers and flights effectively as is evident from Table 1.1

Table 1.1: Details of Domestic & International passengers

| YEAR | Domestic Passenger Carried (Lakhs) | Domestic Growth (%) | International Passenger Carried (Lakhs) | International Growth (%) |
|---|---|---|---|---|
| 1997 | 116.43 | -2.22 | 106.04 | 6.47 |
| 1998 | 118.6 | 1.86 | 108.39 | 2.22 |
| 1999 | 122.3 | 3.12 | 113.6 | 4.81 |
| 2000 | 133.21 | 8.92 | 119.99 | 5.63 |
| 2001 | 128.1 | -3.84 | 120.2 | 0.18 |
| 2003 | 145.42 | 9.2 | 140.37 | 9.93 |
| 2004 | 181.73 | 24.97 | 166.72 | 18.77 |
| 2005 | 223.07 | 22.75 | 189.63 | 13.74 |

Source: Air Transport Statistic, DGCA 2023

Table 1.2 provides a clear depiction of the challenges posed by the limited terminal capacity at Indian airports. The data illustrates that these airports were experiencing a high level of congestion, indicating that the existing terminals were struggling to handle the increasing volume of passengers and flights. The congestion likely resulted in long queues, overcrowded waiting areas, and delays in various processes such as check-ins, security screenings, and boarding. To address this issue and accommodate the surging domestic air traffic demand, a significant amount of capital investment was deemed necessary. The investment would be aimed at expanding and modernizing terminal facilities, upgrading infrastructure, and implementing advanced technologies to optimize airport operations. By making such vital investments, Indian airports could alleviate congestion, enhance passenger comfort and satisfaction, and improve overall efficiency in handling domestic air travel. It underscores the importance of strategic planning and financial commitment to ensure that the aviation sector adapts to the increasing requirements of a dynamic and expanding market.

Table 1.2: Four Metropolitan Airport before Expansion

| AIRPORT | Land Area | Passenger Capacity | Aircraft stands |
|---|---|---|---|
| HAL Airport | 700 acres | 3.6 million | 30 |
| DIAL - T2 | 5106 acres | 12 million | 10 |
| MIAL | 1850 acres | 7.5 million | 84 |
| HIAL | 790 acres | 3.5 million | 18 |

Source: Airport Website, 2022

In 2003, a five-member committee, chaired by Mr. Naresh Chandra, was appointed to formulate the roadmap for the New Civil Aviation Policy. The report by the Ministry of Civil Aviation (MoCA) highlighted that airport charges in India were significantly higher, by 78%, compared to the international average, and even exceeded charges in some South Asian countries like Malaysia and Sri Lanka.

The Airports Authority of India (AAI) managed 94 airports, but only 10 of them were profitable in 2001, despite a threefold increase in landing charges over the previous 15 years. Congestion became a pressing issue, particularly at Delhi and Mumbai airports, which accounted for over 40% of the passenger traffic due to inadequate infrastructure on both airside and landside.

To address these challenges, the Government of India initiated a decision to restructure Delhi and Mumbai airports on September 11, 2003. This initiative marked a significant milestone, as the AAI (Amendment) Act, 2003, facilitated the transfer of operation and management of AAI airports to private consortiums through long-term leases.

Following this strategy, the development of Greenfield airports was set in motion near Bengaluru at Devanahalli through the Public-Private Partnership model. Likewise, the Government of Andhra Pradesh (GoAP) chose a collaborative alliance led by M/s GMR Infrastructure Ltd. in collaboration with Malaysian Airport Holding Berhad (MAHB) to undertake the establishment of a Greenfield airport at Shamshabad, close to Hyderabad. These initiatives were implemented with the aim of fostering progress, enhancing airport efficiency,

and bolstering the overall aviation infrastructure in the nation. Figure 1.1 shows the airport infrastructure development timeline at four metropolitan cities.

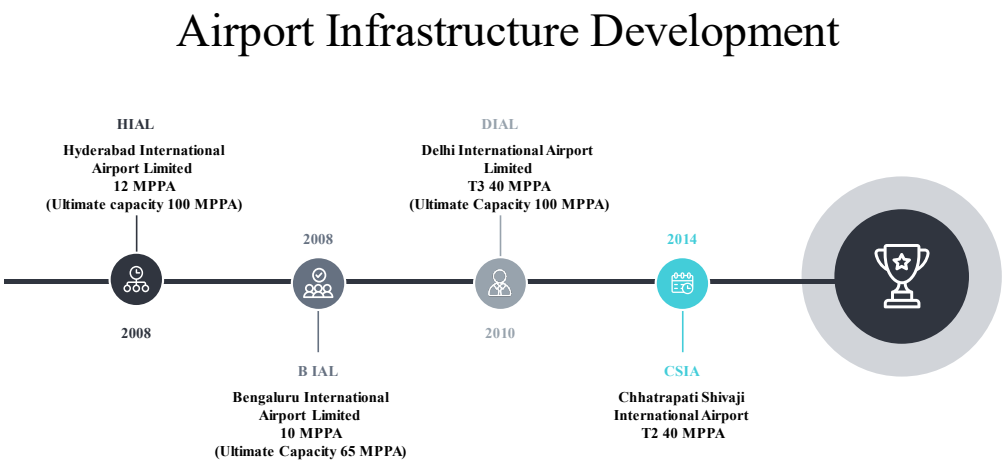


Figure 1.1: Airport Infrastructure Development Timeline

Source: AAI OMDA & Airport Website, 2022

### 1.3.2 Objectives of airport privatization

Airports Authority of India (AAI) board approved modernization proposal in 2003 with certain objectives to transform airport infrastructure to global level (Jain, Raghuram, & Gangwar, 2007) as depicted in Figure 1.2.

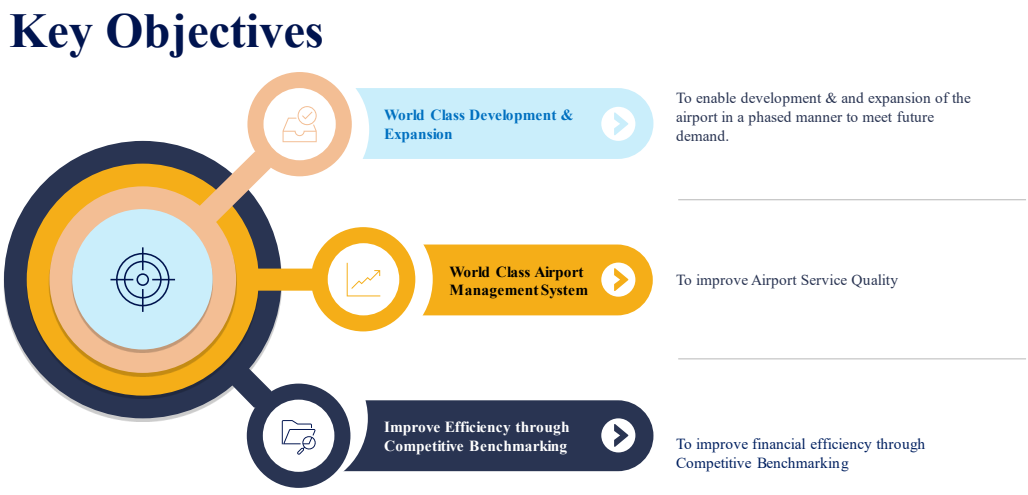


Figure 1.2: Airport Development Objectives

Source: Airports Authority of India, 2004

The adoption of the Public-Private Partnership (PPP) type for airport development resulted in significant improvements in airside and landside capacities, bringing them up to par with international standards as shown in Table 1.3. Consequently, prominent airports now feature cutting-edge infrastructure that effectively caters to the growing influx of passengers and freight, ensuring seamless operations and optimal efficiency.

Table 1.3: Four Metropolitan Airport after Expansion

| AIRPORT | Land Area | TOTAL FLOOR AREA | CUTE enabled Counters | Aircraft stands | Car Park | Passenger (2017-2018) | Cargo (2017-2018) |
|---|---|---|---|---|---|---|---|
| BIAL | 4000 acres | 150,556m² | 90 | 42 | 2000 cars | 27 million | 348,403 MT |
| DIAL - T3 | 5106 acres | 480,000m² | 168 | 78 | 4300 cars | 69.23 million | 1041 MT |
| MIAL | 1850 acres | 450,000m² | 208 | 108 | 5200 cars | 48.83 million | 906.3 MT |
| HIAL | 5495 acres | 120,000m² | 142 | 42 | 3000 cars | 21 million | 137,8 MT |

Source: Airport Website, 2021

In the context of Airport Service Quality (ASQ), a notable trend emerges among Indian airports developed through the PPP model, showcasing commendable performance, and receiving recognition for elevated service standards (Table 1.4).

Over a significant span, Rajiv Gandhi International Airport (RGIA) has consistently achieved excellence, garnering the esteemed title of the Top airport worldwide within the 5-15 million passenger per annum category, a remarkable feat sustained from 2009 to 2018. Further adding to this achievement tapestry, Delhi International Airport Ltd (DIAL) and Mumbai International Airport Ltd (MIAL) have both ascended to the zenith of service excellence, securing the distinction of the Best Airport by Size and Region in the over 40 million passengers per annum category, showcasing their commitment to delivering superlative experiences.

Additionally, Bengaluru International Airport Ltd (BIAL) has rightly earned the accolade of being the Best Airport within its class, a recognition stemming from its unwavering dedication to service quality and customer satisfaction.

Table 1.4: Awards & Accolades by Indian Metropolitan Airports

| AIRPORT | AWARD & ACCOLADES |
|---|---|
| DIAL | Delhi Airport has achieved the 2021 Airport Service Quality (ASQ) Award for being the Best Airport by Size and Region (Asia-Pacific, over 40 million passengers per year). Notably, this marks the fourth consecutive year that the airport has secured the top position. These awards, determined by travelers' assessments, reflect the airport's commitment to excellence and passenger satisfaction.<br>February 09, 2021 - GMR-run Indira Gandhi International Airport (IGIA) in New Delhi have received the ACI World's (Airports Council International) prestigious "Voice of Customer" recognition.<br>Delhi's Indira Gandhi International Airport (IGIA) emerged as the 'Best Airport by Size and Region' in Asia-Pacific for 2018, 2019 & 2020 recognized by Airports Council International (ACI) for Airport Service Quality (ASQ) awards in the category of over 40 million Passengers Per Annum (MPPA). |
| HIAL | Hyderabad, 16 March 2023: Rajiv Gandhi International Airport (RGIA) has been honored with the title of 'Best Regional Airport in India and South Asia' in the prestigious 2023 Skytrax World Airport Awards, according to the GMR Hyderabad International Airport Ltd (GHIAL). The airport also received recognition for having the 'Best Airport Staff in India and South Asia,' as voted by passengers.<br>Hyderabad, 18 May 2023: GMR Hyderabad International Airport has been recognized for its outstanding efforts in promoting sustainable and eco-friendly airport operations by winning the prestigious Airports Council International's (ACI) Green Airports Gold Recognition 2023. The airport received this award in the 15-35 Million Passengers Per Annum (MPPA) category for its commendable 'Single-Use Plastic Elimination' initiative. Notably, this marks the sixth consecutive year that GMR Hyderabad International Airport has been honored with this accolade since its inception in 2018.<br>Hyderabad, 06 March 2023: GMR Hyderabad International Airport has been recognized in the annual Airports Council |

| | |
|---|---|
| | International (ACI) Airport Service Quality (ASQ) survey, winning the title of 'Best Airport of 15 to 25 Million Passengers Per Annum (MPPA)' in the Asia-Pacific region for 2022. The ACI World's ASQ program is a globally renowned benchmarking initiative that assesses passenger satisfaction during their airport travel experience.<br>February 09, 2021 - Rajiv Gandhi International Airport (RGIA) in Hyderabad have received the ACI World's (Airports Council International) prestigious " Voice of Customer" recognition.<br>Airports Council International (ACI) Airport Service Quality (ASQ) survey. Hyderabad Airport has been adjudged as the 'Best Airport by Size and Region' in Asia-Pacific region for 2020, in its category of 15-25 Million Passengers Per Annum (MPPA).<br>CII – Green Power Performance Excellence Award 2020 |
| BIAL | Bengaluru, June 17, 2022: Kempegowda International Airport, Bengaluru (BLR Airport), has been honored with the prestigious title of Best Regional Airport in India and South Asia in the 2022 Skytrax World Airport Awards. This accolade was bestowed upon BLR Airport based on customer votes collected through a global survey that seeks to identify the airport delivering the best customer service each year.<br>Won ACI ASQ Awards in 2019, 2018 & 2017 for Service Excellence. Recognized as Best Airport by Size & Region in 25-40 Million Passengers Per Annum (MPPA)<br>BLR Airport clinched the 'Best Airport and Aviation Innovation Award' at the Wings India Awards 2022, secured the title of 'Best Airport Staff in India and Central Asia' at the 2021 Skytrax World Airport Awards, and was acknowledged for ACI's 'Voice of the Customer', showcasing its unwavering dedication to providing exceptional customer service. |
| MIAL | CSMIA has been recognized as the top airport in the size and region category for over 40 million passengers for the ASQ Awards 2022.CSMIA has been awarded the prestigious Aviation Sustainability & Environment Award at Wings India Awards 2022. |

| | |
|---|---|
| | In the category for handling "over 35 million passengers per annum," GVK Chhatrapati Shivaji Maharaj International Airport (CSMIA) achieved the esteemed Silver - Green Airports Recognition 2020. This recognition is attributed to the airport's exceptional environmental initiatives focused on "Water Management."<br>CSMIA achieved Level 2 of ACI Airport Customer Experience Accreditation 2020. |

Source: Airport Website, 2023

### 1.4 Low Performance of PPP metropolitan airports in India

Despite the considerable progress in their development, these airports encounter certain efficiency challenges when compared to leading international counterparts. The primary reason for this disparity lies in their strong emphasis on aeronautical services, which has limited their capacity to fully exploit alternative revenue streams and enhance non-aeronautical services. While their focus on core aviation operations has been essential for managing passenger and freight traffic, it has also hindered their potential to fully diversify income sources and expand services beyond aviation-related activities. As a result, these airports may not fully realize the revenue-generating potential offered by retail, hospitality, advertising, and other non-aeronautical ventures, which are crucial drivers of profitability and overall customer experience in the aviation industry. To address these challenges and achieve greater efficiency, airports may need to adopt more balanced strategies that incorporate innovative approaches to monetize their facilities and cater to the broader needs of travelers and visitors.

For instance, according to Knight Frank Research (Free, 2020), Delhi, Mumbai, and Bengaluru airports have duty-free revenue per passenger figures of approximately $11, $10, and $6, respectively (Figure 1.3). In comparison, major airports like Changi, Heathrow, and Schiphol witness significantly higher per passenger expenditures at their retail outlets, indicating their success in maximizing non-aeronautical revenue opportunities.

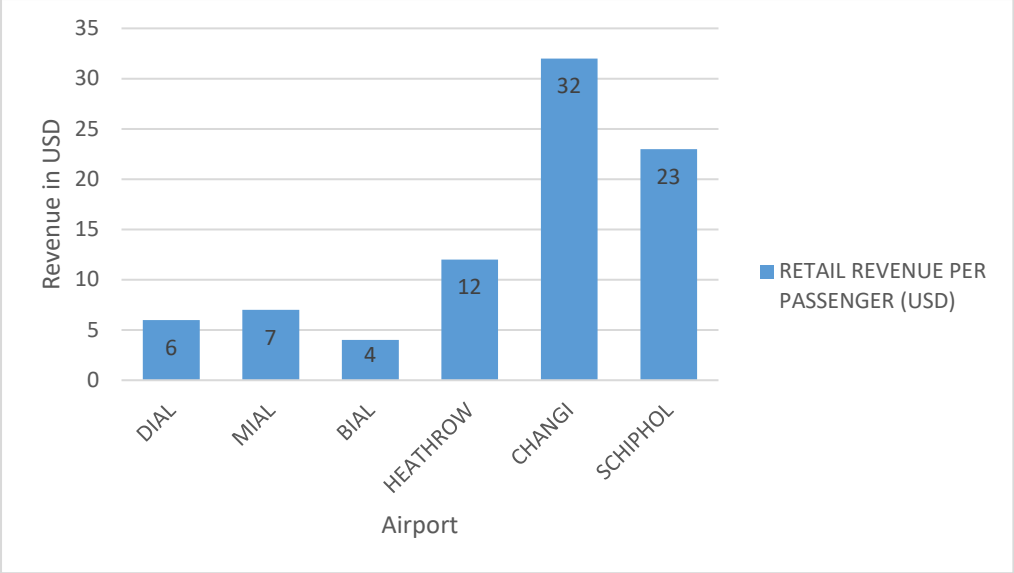


Figure 1.3: Retail Revenue Per Passenger (USD)

Source: Knight Frank Research, 2020

Hainan Island, located in China, has implemented significant changes to its offshore duty-free policy, strategically aimed at enticing high-spending Chinese travelers to make their luxury purchases domestically. As a result of these measures, the island has witnessed an impressive 127 percent increase in sales. Building upon this success, the Chinese Government is now planning to replicate this policy in other regions to tap into the potential revenue it can generate. By adopting similar strategies in different parts of the country, China aims to boost domestic spending, retain consumer spending within its borders, and capitalize on the growing trend of luxury shopping among its affluent population. This move not only supports the development of the retail sector but also strengthens China's position as a major player in the global luxury market. Additionally, the policy's expansion to other areas may help balance regional economic growth and provide a more inclusive approach to benefit various parts of the country (Royland, 2021).

In the Airport Council International (ACI) media release, it was revealed that Hong Kong airport emerged as the leading airport in terms of cargo tonnage in 2019, demonstrating its robust role in global trade and logistics. Following closely behind were Memphis International Airport and Shanghai airports, both renowned for their significant contributions to the movement of goods and

freight on an international scale. Surprisingly, none of the Indian airports made it to this prestigious list, as indicated in Figure 1.4, highlighting a potential area of concern for the Indian aviation industry. While India has experienced substantial economic growth and has been a hub for various industries, its airports seem to be lagging in terms of cargo handling capabilities when compared to their international counterparts. This absence from the top-ranking airports could be indicative of certain challenges faced by Indian airports in optimizing their cargo infrastructure and operations. Addressing this gap in cargo tonnage could present an opportunity for Indian airports to further bolster their role in the global supply chain, enhance trade facilitation, and stimulate economic growth in the country. By investing in state-of-the-art cargo handling facilities, implementing efficient logistics systems, and fostering strategic partnerships with businesses, Indian airports can position themselves competitively on the global stage and make significant strides towards maximizing their cargo handling potential in the years to come.

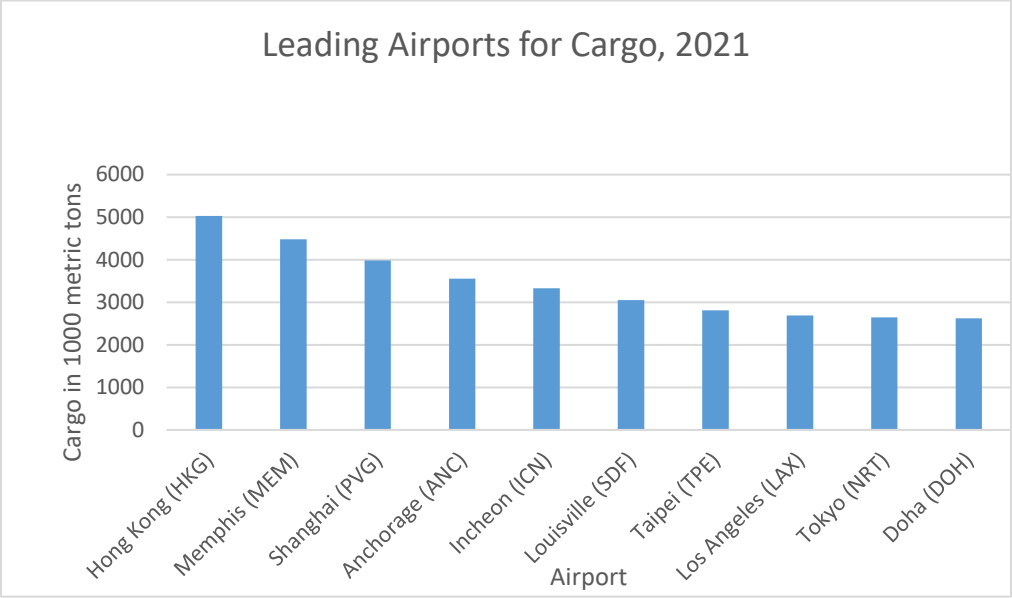


Figure 1.4: Leading 10 Airports for International Air Freight in 2021

Source: ACI, Europe, Statista, 2022

The Figure 1.5 below clearly illustrates that Indian airports need to adopt a strategic approach to remain competitive and become major hub airports in the forthcoming decades. This includes developing new routes and placing a strong

emphasis on attracting and accommodating an increased number of international carriers' operations. By proactively addressing these aspects, Indian airports can position themselves as key players in the global aviation landscape.

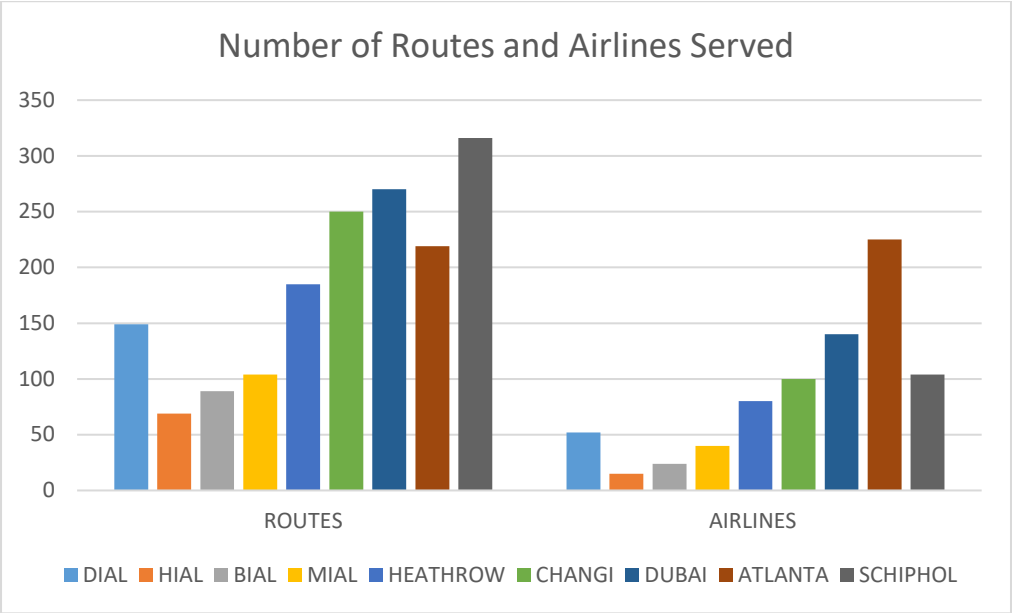


Figure 1.5: Number of Routes and Airlines Served

Source: Airport official website, 2021

According to Figure 1.6, Indian airports have failed to secure a place among the top 20 airports globally in terms of hub connectivity. This represents a significant missed opportunity for the country. A well-connected airport hub plays a crucial role in facilitating seamless travel for passengers and efficient movement of goods, creating a competitive advantage in the global aviation landscape. Major airport hubs serve as vital transit points for international travelers, offering a wide range of flight options and convenient connections between various destinations. By not making it to the top 20, Indian airports may be missing out on substantial benefits such as increased air traffic, higher revenues from transit passengers, and more opportunities for businesses and tourism to flourish. This underscores the importance of bolstering India's airport infrastructure, investing in modern facilities, and optimizing air connectivity to attract more airlines and travelers. By enhancing their hub connectivity, Indian airports can foster economic growth, attract foreign investments, and reinforce

the country's status as a regional and global aviation powerhouse. Moreover, this improvement would create a positive ripple effect on various industries, driving tourism, trade, and overall economic development in India. Policymakers and aviation authorities must collaborate to address the underlying challenges and work towards elevating Indian airports to the league of top-ranking international hubs, unlocking the untapped potential that lies within the country's aviation sector.


Figure 1.6: Hub Connectivity Worldwide as of June 2022

Source: ACI, Europe, Statista, 2022

As depicted in Figure 1.7, Atlanta airport holds the top position globally for aircraft movement, indicating its significant role as a major aviation hub. Trailing closely behind are Chicago, Dallas/Fort Worth, and Denver airports, securing the second, third, and fourth places, respectively. However, it is notable that no Indian airport has managed to secure a spot in this prestigious list. This absence highlights the disparity in aircraft movement between Indian airports and their international counterparts. The lack of representation in the top-ranked airports for aircraft movement suggests potential challenges faced by Indian airports in handling air traffic and optimizing their operational efficiency. Addressing this issue becomes crucial to accommodate the increasing air traffic demands in India and to further establish the country's

aviation infrastructure on the global stage. By investing in modern air traffic management systems, improving runway capacities, and enhancing overall airport operations, Indian airports can better position themselves to accommodate higher aircraft movements, attract more airlines, and support the growth of the aviation industry in India.

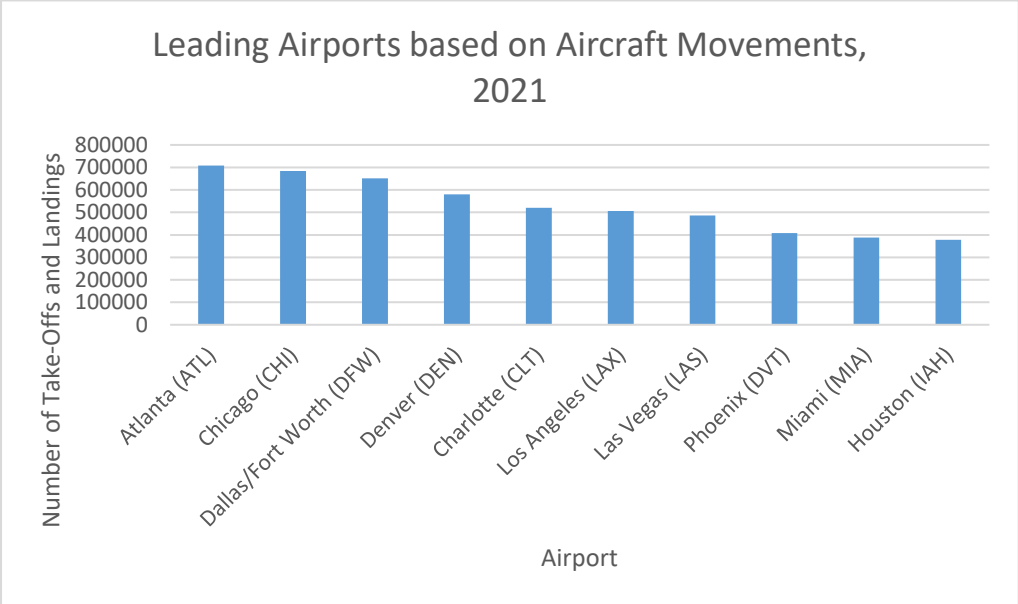


Figure 1.7: Leading Airports based on Aircraft Movements in 2021.

Source: Airport Council International, 2021

Figure 1.8 presents a comprehensive view of the global airport connectivity index, with Dallas/Fort Worth airport standing out as the top international hub, boasting exceptional connectivity scores. Trailing behind are Istanbul airport and Mexico airport, both demonstrating strong global connections in the aviation network. However, it is noteworthy that no Indian airport has secured a place on this prestigious list, indicating a significant gap in connectivity and international reach for India's airports. On the Asian front, Changi and Incheon airports have made their mark, reflecting their robust connectivity and importance in linking various destinations worldwide. This disparity in airport connectivity highlights the need for Indian airports to enhance their strategic positioning and optimize air routes to foster stronger global linkages. By adopting innovative strategies, investing in modern technologies, and forging strategic partnerships with international carriers, Indian airports can improve

their connectivity index scores, thereby stimulating economic growth, attracting more tourists and businesses, and strengthening India's position in the global aviation landscape. It is crucial for Indian authorities to prioritize the development of airport infrastructure and air connectivity to unlock the vast potential that lies within the country's aviation sector and leverage the opportunities presented by a more connected world.


Figure 1.8: Leading International Hub Worldwide in 2019, ranked by Connectivity Index Score

Source: OAG, Statista, 2019

## 1.5 Rationale for the research

By 2025, India is projected to overtake the United Kingdom, becoming the world's third-largest aviation market, as forecasted by the International Air Transport Association (IATA). This phenomenal growth is propelled by measures taken under National Civil Aviation Policy (2016), with emphasis on aviation infrastructure development enabled by FDI and Information Technology expansion (Iyer et al., 2021). Total number of operational airports in India stands at 133, out of which 23 are international airports, 100 domestic airports and 10 custom airports. Airports Authority of India (AAI) plans to build 100 more airports, heliports and waterdromes in India (Airports Authority of

India. 2022). Despite this, in India, the average number of air trips per capita is 0.08, with many Indian airports still being underserved (Das et al., 2020).

According to the comprehensive forecasts provided by Airports Council International in 2021, a compelling trajectory for the future of aviation unfolds, underscoring the ascent of emerging economic powerhouses within the Asia-Pacific realm, particularly China and India. The projections illuminate a strategic shift, positioning these two nations in the top echelons of the aviation landscape by the year 2040, alongside established players like Japan and Indonesia as shown in Figure 1.9. Impressively, this triumvirate is anticipated to collectively command the handling of nearly 40% of global passenger traffic, substantiating their pivotal roles in shaping the industry. Additionally, when considering the annual rhythm of aircraft movements, China is poised to take the lead with a robust 23%, trailed by the United States with 16%, while India carves out a notable share at 4%, embodying the expanding horizons of these aviation powerhouses on the world stage (Airports Council International, 2021).

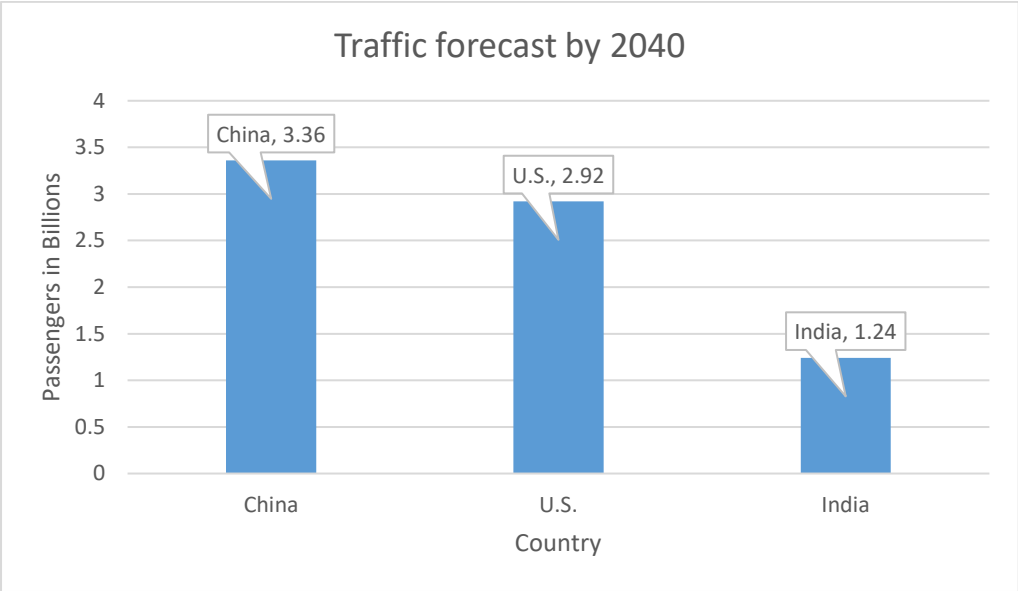


Figure 1.9: Traffic Forecast by the Year 2040

Source: ACI World, 2021.

The strategic rationale underlying the establishment of airports under the Public-Private Partnership (PPP) framework in India was rooted in the imperative of fostering augmented revenue streams through private

involvement, thereby addressing the formidable task of meeting escalating infrastructure demands, which often posed a formidable challenge for government entities. This approach aimed to not only bridge critical funding gaps but also to enhance operational efficacy and competitiveness on par with international counterparts. Effective resource allocation assumes paramount significance in this pursuit, necessitating judicious decisions to ensure optimal utilization and allocation of resources. Moreover, the trajectory toward global competitiveness hinges not just on initial development but also on an ongoing commitment to continual enhancement. Therefore, a comprehensive strategy involves the discernment and prioritization of key impediments that may impede progress. By systematically addressing these barriers, sustainable growth can be nurtured, thereby fostering heightened efficiency, operational excellence, and an elevated performance trajectory across the spectrum of airport operations.

## 1.6 Business Problem

**“**Underutilization of resources is impacting efficiency and performance of PPP metropolitan airports in India”.

The Delhi airport has immense potential to emerge as a leading aviation hub. Despite witnessing a steady increase in passenger volume, the airport's capacity has not been fully harnessed due to persistent strategic issues and constraints within the operating environment (CAPA, 2014). To unleash its true potential, a comprehensive and resilient approach is required to address these challenges effectively (CAPA, 2014).

Delhi International Airport Ltd (DIAL) Reported a deficit of INR 111.8 crore for the fiscal year concluding on March 31, 2019 (FY19), primarily attributed to a sharp reduction in aeronautical revenues (Financial Express, 2019).

As per a Times of India article published in May 2021, airport operators under Public-Private Partnership (PPP) are requesting financial assistance from the Government to cover staff salaries and maintain their operations. The airport industry has been severely impacted, with business reduced to just 10% and revenues plummeting drastically (Sinha, 2021). Despite substantial investments

and infrastructure development, none of the Indian airports have managed to achieve the status of a **Major International Hub.**

The air cargo industry is a pivotal player in the nation's supply chain, representing a significant source of employment. However, despite its importance, the air modal share contributed less than 5% to the total freight in the country in 2021. Road transportation dominated with the largest modal share at 71%, followed by rail at 17.5% of the total freight volume. In the expansive Global Air Freight Market, valued at USD 270.20 billion in 2019, India's contribution stood at a modest USD 5.75 billion, making up only 2.13% of the global air freight market.

A pressing concern across all six major international airports is the extended dwell time for import cargo, averaging between 4 to 9 days. Data collected from cargo terminals highlights that the prolonged dwell time is primarily attributed to delays in filing the bill of entry post the segregation report, accounting for 30% to 50% of the overall dwell time. It is imperative to establish a vigilant monitoring mechanism to ensure the timely filing of the bill of entry following the generation of the segregation report. India harbors untapped potential in the air cargo sector, exemplified by the total volume of approximately 2.5 million metric tons handled by all Indian airports, which pales in comparison to the volumes managed by airports like Memphis, Hong Kong, Shanghai, Incheon, Anchorage, and Paris.

A recent KPMG report shows that the average weight load factor of air cargo over the last five years was around 62%, indicating a substantial reservoir of unused capacity. Furthermore, transshipment cargo, constituting 60-70% of total volumes at some leading airports, is almost negligible for Indian airports. This underscores the significant potential for Indian airports to transform into robust transshipment hubs.

## 1.7 Research Questions

To comprehensively tackle the deficiencies within the prevailing literature on PPP airport performance, this study rigorously evaluates a set of critical research questions as outlined below:

- What are the barriers responsible for underutilization of resources of PPP metropolitan airports in India?
- What is the interrelationship of tangible and intangible airport resources with performance and efficiency of PPP metropolitan airports in India?
- What is the linkage between barriers and prospective solutions to remove the barriers?

## 1.8 Objectives of the Study

Based on these inquiries, the research endeavours to achieve the following robust objectives:

- To identify the barriers responsible for underutilization of resources of PPP metropolitan airports in India.
- To study the interrelationship of tangible and intangible airport resources with performance and efficiency of PPP metropolitan airports in India.
- To develop a linkage framework to improve the performance of PPP metropolitan airports in India.

## 1.9 Summary

Anticipated to secure the position of the third-largest aviation market globally by 2025, India's aviation sector has witnessed substantial growth propelled by the National Civil Aviation Policy (2016), emphasizing infrastructure development and technology expansion. Despite boasting 133 operational airports, including international, domestic, and customs facilities, India faces challenges such as low average air trips per capita and underserved airports. The Airports Council International projects India's ascent in the global aviation landscape by 2040, with significant passenger traffic. However, challenges persist, exemplified by Delhi International Airport Ltd.'s reported loss in FY19 and the financial struggles faced by airport operators under the Public-Private Partnership due to the COVID-19 impact. Moreover, the air cargo industry confronts hurdles, with a modest modal share and extended dwell times at major international airports. While the untapped potential exists, a KPMG report

underscores the opportunity for Indian airports to evolve into robust transshipment hubs, provided strategic measures are implemented to address existing challenges and optimize operational efficiency.

## 1.10 Structure of the Thesis

This thesis is structured into the following five chapters to present the research findings comprehensively.

Chapter 1: Introduction & Background

Chapter 2: Literature Review

Chapter 3: Research Methodology

Chapter 4: Data Analysis and Findings

Chapter 5: Conclusion and Recommendation

# CHAPTER II
# REVIEW OF LITERATURE

## 2 Overview

An examination of the literature comprises a concise exposition of data pertinent to a given context, aiding in the development of precise research inquiries. The main definition of a literature review is "a more or less systematic method of gathering and summarizing prior information" (Snyder, 2019). Research hypotheses might be developed based on an examination of prior material.

## 2.1 Literature Review Highlights

The researcher has established justification of the identified themes followed by theme wise discussion. The research gap is identified and critically analyzed to frame research problems, research questions and research objectives.

A literature review helps to identify the areas where further research is required as it refines the existing body of work (Rowley et al., 2004)**.** Literature review uncovers the areas where research is required and enables knowledge development as it is concept-centric (Webster et al., 2014)**.**

## 2.2 Theme Justification

To comprehensively address the subject area, it is essential to gather pertinent literature that caters to the specific need of the research. In this study, a thematic approach was employed to meticulously explore a variety of literary sources. This encompassed a thorough examination of industry reports, scholarly articles, newspaper narratives, and academic research papers. This systematic exploration ensured a holistic understanding of the domain, contributing to the robustness and depth of the study's findings.

The researcher conducted an exhaustive analysis to track the evolution of research in a specific domain over time. This comprehensive literature review not only underpinned the formulation of research objectives but also facilitated the development of a robust research framework, the meticulous identification and selection of variables, and the creation of a comprehensive survey

questionnaire. Central to this investigation is the pressing business concern surrounding the underutilization of resources and its adverse impact on the efficiency and performance of PPP metropolitan airports in India. Through meticulous examination of existing literature, the researcher aimed to identify gaps and delineate precise research objectives. The methodology involved discerning recurrent patterns within the literature corpus, leading to the emergence of distinct thematic categories. These categories crystallized into five essential sub-themes, encompassing aspects such as airport ownership structures, barriers impeding efficiency enhancement, resource allocation dynamics, and the intricacies of airport efficiency in the Indian context. The synthesis of literature findings not only shed light on the identification of barriers but also elucidated the complex interplay between tangible and intangible resources, illuminating their collective influence on airport performance. This meticulous approach ensured that the research outcomes are grounded in a comprehensive understanding of the subject matter, providing valuable insights into addressing the challenges faced by PPP metropolitan airports in India.

## 2.3 Literature Review on Identified Themes

A relatively small quantity of studies about the performance of PPP airports in India exist. Reviewing articles that contribute to a deeper understanding of this field and identifying pertinent research gaps becomes crucial as a result. Old and current, pertinent topics and issues are reviewed to do the subject justice. For enhanced comprehension of the substance and relevance of the research domain, the literature review took into consideration both qualitative and quantitative factors. Based on the identification of the business problem, keywords were used to identify the research themes.

**Theme I: Airport Ownership Form and Efficiency**

**Theme 2: Barrier for Low Efficiency of Private and Public Airports**

**Theme 3: Identification of Resources affecting airport performance.**

**Theme 4: Airport Efficiency in India**

**Theme 5: Past Studies on Theories**

The section delineates a coherent research progression, commencing with an examination of the present condition of PPP airports in India, succeeded by the recognition of research voids, the framing of a research query, and the relevance and suitability of the theoretical foundation. The crafting of research aims, feature identification, and the survey as a means of data gathering are all guided by the literature scrutiny. As a consequence of this assessment, primary deductions and voids are elicited. In alignment with the business predicament, a comprehensive literature scrutiny was executed across the five subtopics enumerated beneath.

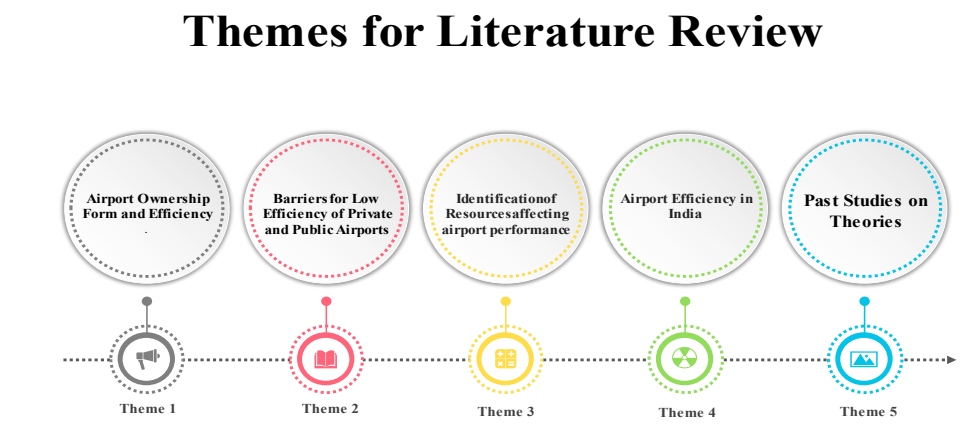


Figure 2.1: Visual depiction of the Categories for Literature Examination

Source: Author

The investigation repository employed in this examination encompassed EBSCO's Business Source Premier and Business Source Elite+, alongside Emerald and Elsevier's Business Management & Accounting Collection accessible via Science Direct. These repositories were chosen to guarantee an exhaustive and varied selection of academic sources for research scrutiny.

### 2.3.1 THEME 1: Airport Ownership Form and Efficiency

The study centers on scrutinizing airport efficacy and productivity investigations through bibliometric analysis, endeavoring to furnish a thorough comprehension of the prevailing research in this domain. The study deliberates

on the variables commonly employed in airport efficacy examinations and underscores the contentious nature of particular variables, like airport ownership structure indicating the need for further research. It also highlights the diverse research questions in this field, ranging from overall airport performance to specific topics like financial performance or technical performance (See et. al., 2023). Japan follows a distinctive airport governance system in which the airside and landside operators are different. PPP and private finance initiative (PFI) form of governance is being implemented as growth strategy. Concessions are seen as catalyst to create revenue in the form of concession fee (Sugimura et al., 2022).

The paper highlights the regional dynamics of airport governance and regulation, emphasizing the persistence of market power among major regional airports and the importance of regulatory incentives in driving efficiency improvements. The conclusions from the investigation illustrate that privatization has led to diverse motivations for effectiveness. Though rivalry has intensified at certain airports, substantial regional airports continue to wield considerable market influence, primarily owing to the absence of structural alterations accompanying privatization. As a result, the role of regulatory incentives becomes crucial in promoting efficiency (Forsyth et al., 2023).

The study elucidates the status of private involvement and economic regulation in airports across Latin America, emphasizing the common features observed and the need for stronger governance and economic regulation. The analysis explores the prevalent types of regulation and discusses alternative approaches, providing insights for policymakers and stakeholders in the region. The analysis discerns shared characteristics within these airports, encompassing concession agreements, local enterprises, airport systems, and revenue-sharing provisions with the authorities. The document underscores the significance of establishing a set of regulations to enforce oversight in the aviation industry. The study unveils that regulatory bodies in the area demonstrate diminished levels of governance and ineffective economic regulation (Valdes et al., 2023).

The objective of this study is to verify whether privatization contributes to improving the productive efficiency of Brazilian airports compared to public

airports. Based on the production process and the evaluated sample, the study concludes that the privatization of Brazilian airports did not improve their productive efficiency. It suggests a review of the contracts from the first round of concessions, as contractual obligations may result in lower productive efficiency (Toledo et al., 2021).

The study's empirical results demonstrate the varying efficiency levels between publicly and privately operated airports, with private sector airports generally exhibiting higher levels of efficiency. These findings provide insights into the potential benefits of private sector participation in airport management and underline the importance of considering the operational structure when assessing airport efficiency (Keskin et al., 2019). The investigation centers on the operational efficacy of airports managed by Infraero, the state entity tasked with overseeing Brazil's principal airports, both prior to and following the implementation of significant airport concessions in 2012. The dataset encompasses 60 primary airports administered by Infraero in 2009 and 2015, spanning three years before and after the concessions were enforced. The results suggest that the introduction of private administration through concessions did not lead to improved performance for the airports under Infraero's management. This finding illuminates the ramifications of airport privatization in Brazil and prompts inquiries regarding the efficiency of the shift from state enterprise governance to private management. (Fernandes et al., 2018).

The airports in New Zealand have shown positive productivity growth over the years, facilitating airport expansion. However, challenges remain for smaller regional airports. The relationship between efficiency and ownership is less clear-cut. While joint ownership seems to be associated with lower efficiency levels, additional investigation is necessary to comprehend the fundamental elements contributing to this association. The comparison between privately owned and publicly owned airports is inconclusive (Abbott, 2015).

The operational and financial efficiencies of airports in different countries are examined through a cross-regional analysis. The research utilizes a total factor productivity (TFP) approach to assess the efficiencies of selected airports in the United States, the United Kingdom, and several Latin American countries. The

empirical findings of the study present a mixed picture. The findings suggest that privatized airports in the United Kingdom exhibit superior operational and financial efficiency when contrasted with partially privatized, government-controlled airports in Latin America. Nonetheless, the chosen airports in the United States consistently surpass both the United Kingdom and Latin American airports throughout the scrutinized timeframe from 2000 to 2010. These results suggest that airport efficiency and productivity may be influenced more by market structure and competition rather than ownership. The performance of airports seems to be linked to the level of competition they face and the market conditions they operate in. The ambivalence of the findings implies that a comprehensive evaluation of airport efficiency should consider factors beyond ownership, such as the competitive landscape and market dynamics. This highlights the importance of creating a favorable market environment and promoting healthy competition among airports to drive efficiency and productivity improvements (Vasigh et al., 2014).

The researcher examined the impact of ownership structure on airport cost effectiveness and determined that governments should transfer airport ownership to private entities rather than government agencies. The findings revealed that difference between public owned airports compared to private owned airports is not significant in relationship to efficiency and requires further investigation (Oum et al., 2008)**.** The study highlights the evolution of airport governance and its various forms. The study additionally explores the significance of governance framework and its impact on airport economic effectiveness. There is a need to investigate the impact of airport two sided market approach on airport economics (Gillen, 2011)**.** According to the author airport efficiency is impacted by change in Governance form and regulation, hence needs mutual consideration (Assaf et al., 2012)**.**

As (lo Storto, 2018) underscore the influence of airport governance structure and economic oversight on airport efficacy and conclude that choice of airport ownership is also influenced by risk sharing and funding availability apart from efficiency alone. The scholar investigated the productive effectiveness and profitability of airports managed under diverse ownership structures and

determined that airports primarily owned by the government are notably less efficient than other ownership models. Private owned airports or airports with majority private stake are not decisively efficient as compared to public owned airports (Oum et al., 2006).

The scholar noted that airports serving as hubs for major commercial airlines tend to exhibit greater operational efficiency than airports operating as spokes. To evaluate performance airport managers should benchmark their airport with other airports having similar characteristics (Sarkis, 2000).

The study explores that airports under public owned company AENA are inefficient and there is a need for privatization to provide more autonomy to airport managers. The airport owned and operated by AENA does not provide incentives to become cost efficient. Furthermore, the size of the airport also affects efficiency level (Martín et al., 2009). The results indicate that hub and semi-private airports demonstrate greater efficiency, while airports with high WLU display relatively superior efficiency. The new model is superior and provides more accurate estimation of airport efficiency (Barros et al., 2008).

The researcher establishes that cost per landing and cost per passenger of private airports operated by BAA are higher as compared to U.S airports. Privatization does not ensure that the passengers would get the services at lower cost. Revenue per passenger is relatively higher at airports owned by private operator like BAA (Beach, 2003).

The researcher used the General Purpose Financial Reports (GPFR) to compare financial performance of airports through longitudinal and cross-sectional analysis (Aulic et al., 2013). The author underscores that studies assessing the impact of ownership on airport efficiency yield inconclusive results. Either the studies measure the changes in efficiency before and after privatization or compare public and private airport efficiency. Mostly, studies contemplate on overall airport system rather than aiming at process sub-system useful for airport managerial staff (Liebert et al., 2013). The researcher observed that private and quasi-privately owned unregulated airports charge higher aeronautical fee than public airports in a competitive market condition. However, private, regulated

airports tend to be more efficient under monopolistic environment. Their discovery revealed that airport operators with mixed ownership and a predominant public holding are not economically efficient (Adler et al., 2014).

The researchers found that privately operated airports performed better than public airports in terms of TFP (total factor productivity) growth rate. The study found that during the period from 2000 to 2007, the growth rates of private airports and publicly operated airports were 2.8% and -0.9% respectively (Perelman et al., 2012). The researcher explored the influence that regulation, ownership, and unobserved managerial skill exert on the cost structure of a set of 32 European airports through the utilization of a frontier model. The results show that ownership structure significantly affects relative efficiency of European airports. Moreover, heterogeneous variables like airport size, number of passengers and types of aircrafts influences the performance significantly (Marques et al., 2011).

The investigator discovered that effectiveness is bolstered by the influx of private funds and the nature of concession arrangements (Gitto et al., 2012). The study examines the effects of US airports' institutional arrangement on technical efficiency of airports. The results suggest that technical efficiency of authority-operated US airports is better as compared to city-operated US airports (Steven et al., 2005).

The researcher observed that there is a significant difference in profit margins of public and private airports served by airlines with strong market power. Airports handling international passengers are more profitable. The research identified an inverse correlation between airport competition and aeronautical fees (Choo et al., 2018). The researcher study and analyze the efficiency of Italian airports and factors affecting efficiency like Ownership, fleet mix and LCC operations. The findings show that LCC operations have minimal effect on the environment. Airports served by regional aircraft are more efficient due to the size of the aircraft (Martini et al., 2013). The writer examines the influence of airport diversity and ownership structure on efficiency. Airports managed by airport authorities are technically more cost-effective than publicly owned airports (Kutlu et al., 2016).

## RESEARCH GAPS IN THEME 1

- Controversial Factors: The importance of specific elements, like airport ownership structure, remains contentious in airport efficiency analyses. Additional investigation is necessary to gain deeper insights into the influence of these elements on airport efficiency and productivity.
- Regional Dynamics: The regional dynamics of airport governance and regulation play a crucial role in driving efficiency improvements. However, there is a need for more research to explore the specific mechanisms through which regional factors affect airport efficiency.
- Impact of Privatization: The effects of privatization on airport efficiency remain uncertain and varied. Additional inquiry is imperative to scrutinize the enduring ramifications of airport privatization, encompassing the influence of structural alterations and regulatory encouragements on fostering efficiency.
- Ownership Form: The impact of ownership structure on airport cost effectiveness continues to be a topic of discussion. Further investigation is warranted to ascertain the importance of ownership structure and its influence on airport efficiency, considering various factors. like risk sharing, funding availability, and the presence of regulatory mechanisms.
- Market Structure and Competition: Airport efficiency and productivity may be influenced by market structure and competition more than ownership alone. Further investigation is required to understand the relationship between market dynamics, competition, and airport efficiency.
- Benchmarking and Performance Evaluation: Comparative studies and benchmarking analysis can provide valuable insights into airport efficiency. Further research is needed to develop robust methodologies for benchmarking airports with similar characteristics and evaluating their performance.
- Financial Performance: The financial performance of airports, including revenue generation and cost management, is an important aspect of efficiency. Additional studies are required to evaluate the financial

effectiveness of airports and the determinants affecting their financial outcomes.

- Impact of Governance Structure: Further exploration is needed to delve into the influence of airport governance framework on economic effectiveness. Specifically, understanding the influence of a two-sided market approach and the implications of different governance structures on airport economics can provide valuable insights.

### 2.3.2 THEME 2: Barrier for Low Efficiency of PPP Airports

The functional effectiveness of airports relative to the degree of corruption in the nation of the airport location were found to be negatively correlated, data of twenty-six airports was collected and analyzed for the study from the duration of 2003 to the year 2019. Countries where airports were owned, managed, and operated by the corporations owned by the government showcased higher levels of corruption. Policy implications for managing projects based on large infrastructure were analyzed on their implications on reforms in region of Asia continent with an objective to identify and understand the effect of influencing factors in terms of performance of Turkish airports (both small and medium) (Randrianarisoa et al., 2023). The research sought to examine the elements impacting the efficiency of petite and moderate Turkish aerodromes. The study adopted a dual-stage method to examine endogenous and exogenous factors. The examination unveiled those inefficiencies in these airports stemmed mainly from internal factors, with runway usage and the generation of non-aeronautical revenue emerging as primary contributors. Based on the findings, several policy implications can be derived. Firstly, strategies should be developed to boost runway utilization and enhance non-aeronautical income generation in Turkish airports. These measures can help address the identified endogenous inefficiencies and improve overall performance. Furthermore, the research underscores the significance of acknowledging both internal and external factors in policy development and decision-making processes related to airport performance. By understanding the specific drivers of inefficiency, policymakers can design targeted interventions to improve the performance of Turkish airports (Güner et al., 2022).

Longitudinal desktop research to analyze the alterations in UK airport ownership form was conducted from 1986 to 2020. The findings reveal that out of 29 airports, only four were public owned, the remaining were either privately owned or had public-private ownership. There was a significant increase in passenger traffic using public-private owned airports during the period. The share of aeronautical revenue of airports may decline due to consolidation in airline sector in post Covid era. (Budd et al., 2021). Airport managers' theoretical and applied knowledge may affect an airport's overall technical efficiency. Frequent changes in top management or ownership form may cause technical inefficiency. Airport managers appointed due to political influence may negatively impact airport technical efficiency (Ripoll et al., 2021).

The research focuses on Eurasian airports and explores the relationship among structural facilities, flight streamlining effectiveness, and productivity levels. The study underscores the adverse effects of income disparity and the beneficial impact of private involvement on technological advancement within the Eurasian airport sector. The study contributes to understanding the efficiency drivers of Eurasian airports, providing insights for policymakers and stakeholders to improve airport performance and make informed decisions regarding infrastructure development and operational enhancements (Güner et al., 2021). The study found that airport efficiency is influenced more by their internal resource utilization rather than external business environment. Since 2003, the Turkish government has initiated measures to enhance the operational effectiveness of airports., including the introduction of modern equipment, the construction of new airports, and improvements in service quality. However, these efforts did not yield the expected revenue, and the analysis identified labor and financial inefficiencies as the main causes of airport inefficiencies (Özsoy et al., 2021).

The study highlights the need for deep changes in the management structure of Spanish airports to improve efficiency. These changes would involve increasing flexibility, competition, and decentralization, allowing airports to optimize their inputs and outputs, attract more airlines, and implement tailored pricing structures and decision policies. Without such changes, the inefficiencies in the

Spanish airport system are likely to persist. This could be achieved through appropriate pricing structures, but the existing centralized decision process hinders flexibility and competition. The current centralized management and price system of AENA limit competitiveness and efficiency. Additionally, infrastructure and worker choices are integrated, restricting airports' ability to optimize their inputs and outcomes. The absence of an independent regulator further hampers the situation. Without significant changes to the management structure, the Spanish airport system is likely to continue facing inefficiencies (Ripoll et al., 2020). The research paper examines airport efficiency and productivity estimation using a spatial approach. By comparing a traditional model with a spatial model, the study identifies the impact of competition on airport efficiencies. The results indicate that the impact of competition on airport efficiency varies depending on the spatial distance considered in the model. (Bergantino et al., 2020).

The study highlights the importance of understanding the determinants of airport profitability amidst increasing pressure on aeronautical revenues, financial performance focus, and stricter state aid guidelines in Europe. Unlike previous research focusing on airport efficiency, this study identifies key traffic and financial factors influencing profitability. The results underscore the notable impact of the growing proportion of transfer passengers on an airport's profit margin. Examining financial variables, the study reveals that capital cost efficiencies have a significant positive impact on profitability, especially concerning airports in the United States and small regional airfields. US airport profitability hinges largely on labor productivity, while regional O/D airports are driven by local economic development and population growth, contrasting major airports, which rely more on global economic conditions than local demand growth (Zuidberg, 2017).

The researcher noted that Enfidha Airport's inability to achieve efficiency and value for money stemmed from various external factors. First, the Tunisian government failed to develop a tourist plan that might reduce the risks of any unanticipated political or economic crises, even though the country's economy

was strongly dependent on foreign tourism, particularly from Europe (Biygautane et al., 2023).

The study concentrates on seven crucial issues, which include an unfavorable operating environment, the prevalence of government corruption, flaws in the tendering procedure, inaccurate risk assessments, hazy project objectives, the absence of contingent liability provisions, and deficiencies in performance measurement. The successful implementation of infrastructure plans across the nation is seriously impeded by these severe challenges (Putro et al., 2023).

Public-Private Partnership (PPP) initiatives have a proven track record of success around the world, which highlights the major contribution this mechanism makes to the development of numerous industries. However, despite its enormous promise, carrying out these projects faces a number of challenges. These difficulties include, among other things, aspects like market conditions and external project circumstances, government involvement, effective project planning and management, oversight and state backing, and effective project structuring. Notably, some experts believe that money is one of the most important aspects of all these criteria. As a result, it is crucial to examine the distinctive features of funding PPP projects in various nations (Irina et al., 2022).

The researcher carried out a study utilizing a fuzzy synthetic evaluation method to comprehensively evaluate and categorize risk factors in public-private partnership (PPP) water delivery initiatives in developing countries. Twenty-two crucial success factors (CSFs) were discovered, and they were categorized into three groups according to their significance in the economy, legal aspects, and societal and political implications, including any technological risks. The most serious threat, according to their findings, is posed by budgetary risks, which call for careful consideration in project management and mitigation efforts (Ameyaw et al., 2015).

The dimensions of the airport infrastructure and the nature of the management concession might also affect performance, implying that ownership isn't the sole determinant of the variability in the production function for these airports. More

research should be done on the role that scale economies and other forms of management agreements play as moderating factors in the efficiency-ownership connection (lo Storto, 2018).

Public-private partnerships (PPPs) are extensively employed in construction and infrastructure projects around the world, but they frequently have variable success and substantial challenges. To pinpoint PPP success barriers in Beijing and Hong Kong, the study uses empirical questionnaire surveys. The top three obstacles cited by respondents in Beijing and Hong Kong, which were consistent with each other's rankings, were "lengthy delays in negotiation," "lack of experience and appropriate skills," and "lengthy delays due to political debate" (Chan et al., 2010).

The researcher uncovered a direct association between aeronautical and non-aeronautical revenue regarding airport efficiency. The airports must diversify its non-aeronautical revenue stream to enhance business viability (Liu, 2016). The study found that income from non-aeronautical activities has significant impact on airport efficiency (Olfat et al., 2016). The researcher observed that for an airport to develop as a major international hub and improve financial efficiency, it is important to focus and develop commercial activities (Wang et al., 2020). Airports catering to transit passenger traffic and long haul flights were found to be less efficient although non-aviation revenue impacted airport efficiency positively (Chae et al., 2016). Airports with a relatively higher tourists footfall experienced larger level of financial efficiency due to revenue from commercial activities (Fernández et al., 2018). Stand-alone airports are more efficient than airports operating as part of a consortium and non-aviation activities helps to improve airport overall financial performance (Adler et al., 2013). While there are negative correlations between aeronautical charges and factors such as connecting traffic, the share of dominant airlines, and the number of nearby competitive airports, these relationships are not statistically significant. The authors note that previous research on governance structures in US airports, which impact productivity and efficiency performance, does not appear to influence the pricing of aeronautical fees (Choo et al., 2014).

Airlines market power has direct and significant impact on airport efficiency and financial efficiency improves by reducing congestion at airports (Zhang et al., 2010). The study found that non-hub position and lack of performance measurement system negatively influences airport efficacy. Nonetheless, minimal seasonality and big size positively impact efficiency (Paraskevi et al., 2020). The researcher observed that outsourcing some of the aeronautical activities like ground handling and focus on commercial revenue stream has a definite affect on Spanish airport productivity (Tovar et al., 2009).

Airline inefficiency in terms of low load factor has a adverse impact on overall airport efficiency. The majority of European airports are inefficient (Pels et al., 2003). Airport overall efficiency can be improved by having a holistic development that includes improving governance model, regulations, operations and management and technical efficiency of various sub-systems (Ha et al., 2010). Airports served by Low-Cost Carriers (LCC) passengers were less efficient compared to those served by full service carrier's network passengers. Moreover, airports served by a mix of LCC and FSC passenger traffic were significantly less efficient (Choo et al., 2013).

The study identified several factors that positively impact airport performance and efficiency, including tourism, regional economic development, native systems, aerodrome privatization, and low-cost carrier services. On the other hand, international networks were discovered to exert a detrimental effect on airport efficacy. These findings contribute to understanding airport efficiency determinants and offer valuable insights for policymakers and airport management in optimizing performance and making informed decisions regarding infrastructure development, network planning, and resource allocation (Ngo et al., 2020).

The scholar noted that low-cost carrier operations contribute positively to airport effectiveness. However, airports connecting international destinations tend to be relatively inefficient. In order to be efficient airports must increase regional GDP and focus on domestic passenger traffic (Ngo et al., 2019). International passenger traffic, GDP per capita of the community and hinterland population size and dominant airlines that operate at the airport, influences

efficiency of the airport. However, hub status and competition are does not affect efficiency significantly (Kan et al., 2014). LCC passenger traffic helps to maximize revenue output for airports and contributes to improve overall efficiency, hence airports must increase number of aircraft movements by having additional LCC airlines (Abbruzzo et al., 2016).

International Hub airports overall efficiency is significantly higher than regional or non-hub airport and publicly listed airports perform better than non-listed airports (Lu et al., 2019). Airports serving international destinations were less efficient, while airports having longer operating hours or with fewer regulations were efficient. The proximity of residential communities to the airport adversely affects efficiency. (Tsui et al., 2014). The researcher observed that airports located at tourist destinations and with developed hotel infrastructure were more efficient compared to airports that were serving as international gateways (Fragoudaki et al., 2016). The study establish that competition tends to negatively affect airport overall productivity (D'Alfonso et al., 2015). Yet, the researcher noted that airports facing greater competition tend to exhibit higher efficiency compared to their counterparts. Airport ownership structure and competition exerts a beneficial influence on airport efficacy (Ha et al., 2013). The size of the airport and airport public listing also affects efficiency. Furthermore, airline mergers and open skies agreements are relatively inconsequential (Chi-Lok al., 2009).

Airports demonstrating a greater proportion of air cargo operations and freight traffic exhibited notably enhanced efficiency. The management must try to develop and make their airports robust to support cargo processes (Coto-Millán et al., 2016). Yu observed that production efficiency related to airside operations does not guarantee commercial efficiency related to service process, hence airport managerial staff must focus on improving system sub-processes (Yu, 2010).

Airport size, location and functional characteristics affects technical efficiency of the airport along with seasonality of passenger demand (Tsekeris, 2011). Airport size negatively affects airport efficiency. However, airports located in remote locations may improve their efficiency by adopting best managerial

practices and forecasting environmental factors (Merkert et al., 2012). Concession agreement impact technical efficiency, especially airports supporting minimal commercial activities. Hub airport are relatively efficient and dual-till price regulation does not guarantee overall efficiency (Curi et al., 2011). International airports developed and operated as hub are able to minimize delays and function as efficient airports (Fan et al., 2014). The researcher observed that medium hub airports are least efficient as compared to major hub airports and have scope to readjust their resource utilization (Chang et al., 2016).

Regulation not set according to local airport needs may lead to inefficiency and discourage investment opportunities from stakeholder (Phang, 2016). Airport managers appointed due to political influence may negatively affect airport technical efficiency. Frequent changes in top management or ownership form may cause technical inefficiency (Ripoll et al., 2021).

Individual airports are more proactive towards market forces and external environment, making them efficient and are subsequently efficient as compared to holdings airports (Ferreira et al., 2016). The researcher observed that profit margin of inefficient airports does not improve even by providing subsidies and commercially driven airport management appears to focus more on efficiency than the less efficient airports (Merkert et al., 2014).

## RESEARCH GAPS IN THEME 2

Though there exists proof of an adverse correlation between corruption and airport efficiency, further research is needed to establish a causal relationship. Studies should explore the specific mechanisms through which corruption affects different aspects of airport operations and identify strategies to mitigate its impact.

The research papers suggest that government-owned airports are more susceptible to corruption and inefficiency. However, further investigation is required to compare different ownership models (government-owned, privately owned, and public-private partnerships) and their relative impact on airport

efficiency. This analysis can provide insights into the most effective ownership structures for promoting efficiency.

While the papers mention endogenous factors such as runway utilization and non-aeronautical revenue generation as important determinants of airport efficiency, further in-depth analysis is warranted. A more robust approach is needed to understand the specific drivers and mechanisms through which these factors influence airport efficiency. This can help identify targeted interventions to improve performance. Additional investigation is warranted to explore the dynamics and interactions between airlines and airports and how they contribute to or hinder efficiency. Understanding the interplay between these two entities can inform strategies to enhance overall system performance.

The research papers suggest that changing management structures, increasing flexibility, and decentralization can improve airport efficiency. Yet, longitudinal studies are necessary to assess the enduring impacts of such changes on efficiency. This can provide insights into the sustainability and effectiveness of different management approaches.

While non-aeronautical revenue is identified as a significant factor in airport efficiency, there is a need for research that delves into specific strategies to diversify and optimize non-aeronautical revenue streams. Understanding the most effective revenue generation approaches can help airports enhance their financial performance and overall efficiency. Further research is needed to explore these factors in greater depth and investigate the specific mechanisms through which they influence efficiency. Additionally, the negative impact of international networks on efficiency should be further examined and potential solutions explored.

While Public-Private Partnership (PPP) initiatives are recognized for their success globally, there is a gap in understanding the distinctive features of funding PPP projects in different nations. Research should delve into the financing structures and practices that contribute to PPP project success.

The research indicates that airport infrastructure size and the types of management concessions could significantly influence performance outcomes.

However, a notable research gap exists in our comprehension of the precise mechanisms by which scale economies and various management agreements act as moderating factors within the context of the efficiency-ownership relationship in airport projects. This gap necessitates a more comprehensive investigation to unravel the nuanced interplay among these critical variables, shedding light on their impact on airport project performance.

The study examining Public-Private Partnerships (PPPs) in the urban contexts of Beijing and Hong Kong has brought to light significant impediments, including prolonged negotiation delays, a dearth of expertise, and protracted political debates. Nevertheless, a conspicuous research void persists, necessitating a more exhaustive inquiry into the underlying origins and potential remedies for these multifaceted barriers. This imperative extends beyond these specific regions and industries, encompassing diverse geographical and sectoral contexts. A comprehensive exploration of these hurdles is essential to inform more effective strategies for PPP success worldwide.

### 2.3.3 THEME 3: Identification of Resources Affecting Airport Performance

#### 2.3.3.1 Tangible and Intangible Resources

Physical, human, and organizational capital resources constitute the three categories of resources (Barney, 1991)**.** The researcher discovered that resources may encompass assets, managerial practices, firm attributes, information, or knowledge under the firm's control, utilized for conceiving and executing their strategies (Mata et al., 1995)**.** Physical and abstract resources and processes within an organization offer competitive advantages to firms (Ambastha et al., 2004).

The resources of the firm can be tangible and intangible like skilled employees, equipment's, efficient process etc. (Wernerfelt, 1984)**.** Intangible resources include copyrights, patents, employees skills, culture and people dependent network (Richard, 1993) as shown in Figure 2.2.

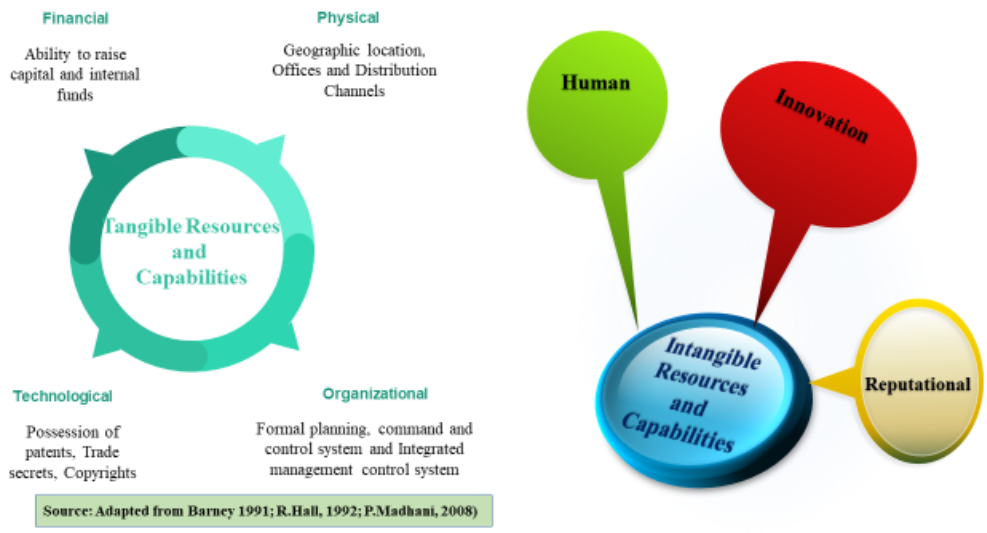


Figure 2.2: Tangible and Intangible Resources

Source: Barney, 1991.

### 2.3.3.2 Definition - Airport Resources

Resources and capabilities comprising of tangible and intangible assets like low cost terminals can be developed by airports to attain a competitive edge and deliver value to customers (Njoya et al., 2011). The researcher observed that obstacles related to human, monetary, and administrative resources impact the process of restructuring the source base (Chwiłkowska et al., 2020) depicted in Figure 2.3.

Figure 2.3: Airport Resources

Source: Chwilkowska et al., 2020.

### 2.3.3.3 Resources – Defined

**2.3.3.3.1 Financial Resources** – the resources that cover operating expenses that include employee compensation, utilities, MRO facilities, infrastructure, and other services offered (Bazargan et al., 2003). Financial includes the sources and partnership element of the airport business model (Kalakou et al., 2013) shown in Table 2.1.

**Aeronautical Revenue and Non-aeronautical Revenue**

The aeronautical income includes revenue from the aircraft movements, total passenger handled and freight volume and ground support services like warehousing while non-aeronautical revenues includes income from duty-free and retail areas, rental space inside and outside terminal, car parking, ground handling services etc. (Liu, 2016)**.**

The quality of airport services, the level of airport economic development, and the condition of the airport airside were determined to notably improve efficiency. Conversely, proximity to the city center adversely affected efficiency. Enhancing airport economic development levels by focusing on designated airport economic demonstration zones in strategic locations (Wang et al., 2023). The study reveals that inefficiency in Turkish airports is predominantly influenced by internal factors, particularly runway usage and the generation of non-aeronautical revenue, which significantly impact performance. The research emphasizes the importance of addressing internal factors to enhance airport performance. Policy implications derived from the study's findings can guide decision-makers in implementing targeted measures that promote resource optimization, output enhancement, and revenue diversification (Güner et al., 2022).

Table 2.1: Financial Resources

| RESOURCE | VARIABLE | SOURCE |
|---|---|---|
| Financial | Airport Economic Zone | Wang et al., (2020). |

| | | |
|---|---|---|
| | | Xiao et al., (2017).<br>Kalakou et al., (2013). |
| | Logistic Park & Maintenance Facilities | Kalakou et al., (2013). |
| | Aeronautical & Non-aeronautical Revenue | Güner et al., (2022).<br>Simone et al., (2012).<br>Pacheco et al., (2003).<br>Yap et al., (2013).<br>Yang., (2010).<br>Zhanwei et al., (2020).<br>lo Storto, (2018).<br>Oum et al., (2006). |
| | Route Network Development | Shin et al., (2021).<br>Halpern et al., (2015). |
| | Quantity of Flights and ATM | Gonnord et al., (2000).<br>Eric et al., (2001).<br>Young et al., (2014).<br>Tsekeris, (2011).<br>Ulku, (2015).<br>Wai et al., (2014).<br>Nicole et al., (2013).<br>Carlos et al., (2009). |
| | Operating and Labor Cost | Merkert et al., (2014).<br>Liu, (2016).<br>Chae et al., (2015).<br>Curi et al., (2010).<br>Chang et al., (2016).<br>Yu, (2010).<br>Coto et al., (2016). |
| | Cross Rail Connectivity | Kalakou et al., (2013). |

**2.3.3.3.2 Managerial Resources** - Managerial human capital encompasses the knowledge and experience acquired over time specific to the industry (Ripoll et al., 2021) depicted in Table 2.2.

The study emphasizes the pivotal role of learning processes in the dynamic capabilities of large regional airports, noting that these processes are often intuitive rather than standardized, with employees' personal involvement being significant. Benchmarking activities are also highlighted as fundamental for learning within airport organizations (Chwiłkowska, 2021). The research offers a thorough literature review on human-digital collaboration in air freight logistics. However, the emergence of advanced digital systems fundamentally

reshapes the role of human workers and collaborative processes. Adapting to this paradigm shift requires comprehensive management integration, addressing safety, security, quality, and efficiency concerns robustly. Key topics explored include security, human-technology interaction, and performance measurement in the digitalization era (Thums et al., 2023).

The study investigates the influence of organizational preparedness, innovation, and airport dimensions and ownership on the digital revolution within airport operations. The results reveal that organizational readiness directly influences digital transformation. The size of the airport directly influences digital transformation, while the effect of ownership is found to be insignificant. The findings highlight the significance of developing organizational readiness to accelerate the pace of innovation necessary for successful digital transformation (Halpern et al., 2021).

The research paper presents a concept to evaluate the potential of mixed reality systems for scrutiny and repairs processes in the aviation domain. The aim is to assess the suitability of improved and simulated reality devices for enhancing these crucial tasks. The findings of this study emphasize the need for careful consideration of process characteristics, such as complexity, precision, and safety requirements, when selecting augmented or virtual reality devices. Additionally, device-specific factors, including ergonomics, display quality, interaction methods, and mobility are significant factors to determine technology (Eschen et al., T. 2018).

Table 2.2: Managerial Resources

| **RESOURCE** | **VARIABLE** | **SOURCE** |
|---|---|---|
| **Managerial** | Human Resources | Ergün et al., (2019).<br>Di et al., (2019).<br>Chaouk et al., (2020). |
| | Aerobridge and Escort Personnel | Otamendi et al., (2008). |
| | Managerial Skills & Training | Pacheco et al., (2003).<br>Merkert et al., (2012). |
| | Operational Readiness & Airport Transfer program | Kalakou et al., (2013). |

**2.3.3.3.3 Technological Resources -** Tangible technological resources include firms R&D, manufacturing, and products while Intangible resources include network relationship and reputation for technological excellence (Zahra, 2003) shown in Table 2.3.

While blockchain technology offers various benefits for improving OM, it does not automatically guarantee the optimal performance in terms of efficacy, productivity, and resilience. The article emphasizes the importance of collaboration and trust among managers and policymakers within the airport setting. Establishing a shared ethos and cultivating reciprocal confidence among stakeholders is essential for realizing the full potential of blockchain technology and addressing sustainability issues (Di et al., 2020). Resilient airports with sustainable strategies will be better positioned to offer air travelers a wider range of goods and services. Successful airports will also learn from the current crisis by diversifying their revenue streams and exploring non-passenger sources to compensate for the decline in air traffic. Future scenarios may involve the implementation of biometric and self-service processes, contactless capabilities to minimize human interactions, and improved coordination with aviation and tourism stakeholders for information sharing and industry alignment (Serrano et al., 2020).

This study delves into the hurdles encountered by airports in the era of digitization and investigates the utilization of various concepts and technologies to enhance operations, innovation, and passenger experience. Specifically, the study focuses on the implementation of total airport management (TAM), airport collaborative decision-making (ACDM), and airport operations center (APOC), which leverage digital tools and technologies. The paper outlines the current trends in airport digitization and provides insights into the structural framework for implementing total airport management. The research highlights specific areas such as check-in, security screening, customs clearance, departure management, and passenger aid services necessitating technological enhancements (Zaharia et al., 2018).

Table 2.3: Technological Resources

| RESOURCE | VARIABLE | SOURCE |
|---|---|---|
| **Technological** | Resource Management System | Kelemen, (2005). Chiti et al., (2018). |
| | Social Media and Internet | Martin et al., (2019). |
| | CDM Program | Kalakou et al., (2013). |
| | Smart Phone Application System | Kalakou et al., (2013). |
| | Technical Efficiency/Smart Scanning Technology | Ha et al., (2013). Kalakou et al., (2013). |
| | Moving System – Signalling & Advertising | Magalhães, (2010). |

**2.3.3.3.4 Security Network –** Security network facilitate coordination and resources that include information sharing on business continuity during disruptions, system protection from cyber threats, consequence management and securing critical infrastructure (Griffiths, 2008) shown in Table 2.4.

Tech-based innovative solutions in airports are predominantly in the pilot stage, aiming to enhance passenger comfort and airport security. However, adequate training and support are necessary to foster a positive outlook on digital transformation, particularly among senior airport staff and elderly passengers. Busy and profitable airports tend to show greater interest in adopting new technological innovations (Sreenath et al., 2021).

The study examines the utilization of biometric systems, particularly facial recognition technology, as a touchless solution to reduce processing times, alleviate queues, and minimize crowded areas, particularly amidst the ongoing pandemic. The research incorporates insights from interviews conducted with industry professionals responsible for biometric programs, including the U.S. Customs and Border Protection's (CBP) entry-exit program. These interviews shed light on the challenges faced and issues encountered, such as low biometric confirmation rates and network availability issues. The importance of stakeholder collaboration and involvement is emphasized, particularly

regarding operations, staffing, funding, and maintaining pressurizing flight schedules (Khan et al., 2021).

Table 2.4: Security Network Resources

| RESOURCE | VARIABLE | SOURCE |
|---|---|---|
| **Security Network** | Security Control Points | Postorino et al., (2019). Adacher et al., (2017). |
| | Security Screening Resources | Pérez et al., (2021). Manataki et al., (2010). Zaharia et al., (2018). |
| | Cybersecurity and Protection | Di et al., (2019). |
| | Fast Track Security System | Kalakou et al., (2013). |

**2.3.3.3.5 Airside Infrastructure** – Airport airside infrastructure includes runway and hangar resources that play important role during disaster relief operations (Qin et al., 2021). Airside capacity is accessed by the number of slot allocation on an hourly basis (Knabe et al., 2016) shown in Table 2.5.

The authors propose an airport taxiway planning approach, which incorporates a conflict resolution approach that prioritizes speed and follows a First Come-First Serve (FCFS) principle. This approach efficiently maximizes the taxiway route, improves resource utilization, and avoids taxiway conflicts. Moreover, the suggested strategy for airport taxiway planning effectively maps out taxiing routes, resolves conflicts, and improves the utilization of taxiway resources (Deng et al., 2022).

The research paper focuses on the inadequacies of the current slot allocation mechanism utilized by the International Air Transport Association (IATA) and the European Union (EU) regulations, particularly in congested EU airports. The existing mechanism fails to effectively match requested slots with allocated slots for airlines, resulting in poor capacity allocation outcomes. The lack of proper decision support available to slot coordinators and the complexity of the problem contribute to inefficiencies during the initial allocation process. Consequently, these inefficiencies lead to significant slot misuse and underutilization of scarce airport resources (Zografos et al., 2012). The primary

goal of this paper is to thoroughly analyze the parking characteristics of airport parking and identify the factors contributing to parking problems. The analysis reveals that long-term parking is the primary cause of parking congestion, primarily due to the unclear functional orientations of the parking lots. The congestion in parking lots not only hampers airport operations but also affects the efficiency of the ground access system (Xiao et al., 2015).

Table 2.5: Airside Infrastructure Resources

| RESOURCE | VARIABLE | SOURCE |
|---|---|---|
| **Airside Infrastructure** | Runway and Hangar resources | Qin et al., (2021).<br>Ha et al., (2013).<br>Knabe et al., (2016).<br>Bosson et al., (2016).<br>Wanke, (2013).<br>Chi et al., (2009). |
| | Slots availability | Zografos et al., (2016).<br>Narciso et al., (2015).<br>Choi, (2021).<br>Zografos et al., (2012). |
| | Ground Transportation and Support Services | Liu et al., (2022).<br>Guimarans et al., (2022). |
| | Multi-Level Car Parking System | Kalakou et al., (2013). |
| | Dedicated Areas to Airlines | Kalakou et al., (2013). |

**2.3.3.3.5 Terminal Facilities –** Airport landside area comprise of different resources whose operations influence airport stakeholders like airlines and employees and affect customer satisfaction. By integrating optimization techniques and simulation, this research offers a valuable framework for airport operators to make data-driven decisions regarding check-in and security control resource allocation. It provides a cost-effective approach to enhance operational efficiency and improve customer satisfaction in airport terminal operations. This study's findings offer robust implications for airport management and

planning, supporting better resource utilization and service delivery at airports (Adacher et al., 2017) shown in Table 2.6.

The findings reveal that several factors positively drive sustainability disclosure in European airports. Factors encompass passenger volume, cargo volume, terminal and gate density, and social media visibility. The results contribute to the existing academic literature on sustainability disclosure and offer significant managerial implications (L'Abate et al., 2023).

The findings reveal several key determinants of aviation revenues per passenger. Factors like national income, leisure traveler percentage, and airport size influence commercial revenues per passenger. Main drivers include passenger volume, commercial revenue ratio, national income, domestic/leisure traveler share, and flight count. Business travelers negatively affect commercial revenues per passenger. Additionally, more retail space per passenger correlates with lower commercial revenues per square meter, indicating diminishing marginal revenue effects (Fuerst et al., 2011).

The research emphasizes the need to consider spatial effects in airport efficiency estimation, as ignoring these effects leads to incomplete assessments. The study suggests categorizing airports based on scale and directing future investments towards identified hotspots while ensuring overall infrastructure development for other airports. The study adds to current understanding by integrating spatial effects into the evaluation of airport efficiency, especially within developing nations. It presents a methodological framework for spatial analysis using productivity, facilities, and performance (PFP) indicators, along with spatial econometrics tools (Bansal et al., 2022).

Table 2.6: Terminal Facilities

| **RESOURCE** | **VARIABLE** | **SOURCE** |
|---|---|---|
| **Terminal Facilities** | Cargo & Business Infrastructure Facilities | Cho et al., (2020).<br>Hongwei et al., (2022).<br>Tsui et al., (2014). |
| | E-Freight System | Kalakou et al., (2013). |

| | | |
|---|---|---|
| | Terminal landscape and Functional Experience | Wattanacharoensil et al., (2017).<br>Fonseca et al., (2014).<br>Ha et al., (2013).<br>Chen et al., (2020). |
| | Gate Scheduling and Assignment | Mokhtarimousavi et al., (2018).<br>Zhang et al., (2020).<br>Cheng et al., (2012).<br>Fragoudaki et al., (2016). |
| | Baggage Handling Resources | Ascó et al., (2013).<br>Barth et al., (2021). |
| | Self-Service Kiosks<br>Self Service Boarding Kiosks | Antwi et al., (2021). |
| | Landside Access System | Wang et al., (2019).<br>Shriner et al., (1999). |
| | Rental Space Availability | Kalakou et al., (2013). |
| | Health Facilities | Kalakou et al., (2013). |
| | Innovative automatic border passage system | Kalakou et al., (2013). |
| | Lounges | Kalakou et al., (2013). |
| | Special Passenger Services | Kalakou et al., (2013). |
| | Children's Arena & Facilities | Kalakou et al., (2013). |

**2.3.3.3.6 External Environmental –** Externally imposed factors and restrictions beyond the control of airport management impact business model and operations (Kalakou et al., 2013) depicted in Table 2.7.

Elements like airport dimensions and the variety of natural surroundings contribute to the seasonal variations in domestic flights at the national level. The findings have implications for airport planning and management, as well as

route optimization strategies. Understanding the drivers of flight seasonality can aid in the development of more efficient and effective transportation systems, considering regional variations and demand fluctuations (Wang et al., 2023).

Tourism plays a significant role in airport efficiency, suggesting the need for policies and incentives to support airports in their tourism functions. One approach could be to introduce routes linking regional airports with prominent national and international tourist destinations. Airports geared towards tourism, exhibiting superior efficiency, should be encouraged, and granted round-the-clock operations, especially during peak tourist seasons. Adjusting opening hours and utilizing specific terminals, gates, or runways based on seasonal variations could enhance operational efficiency. When conceptualizing aerodrome infrastructure policies, consideration should be given to tourist flows (Cifuentes et al., 2023). In recent academic discourse, there has been a notable focus on evaluating airport efficiency and productivity. This study employs a spatial approach, utilizing a distance matrix and a shared destinations matrix tailored for various distances, to probe the impact of competition on efficiencies. It reveals that competition can exert both positive and negative effects on airport efficiency, contingent on the distance considered in the spatial model (Bergantino et al., 2020).

Table 2.7: External Environment

| RESOURCE | VARIABLE | SOURCE |
|---|---|---|
| **External Environment** | Energy resources | Baxter et al., (2018). Xiang et al., (2021). |
| | Seasonality | Tsekeris, (2011). Ulku, (2015). |
| | Competition | D'Alfonso et al., (2015). |
| | Tourism Oriented Approach | Fernández et al., (2018). Ngo et al., (2020). |

**2.3.3.3.7 Institutional Resources –** Institutional Resources like ownership form, regulations, management contracts and operational arrangements determine the building blocks for airport operations and functioning **(**Kalakou et al., 2013) shown in Table 2.8. The main objective is to determine whether the change in management model, from state control to private concession, has had a significant impact on passenger volume. The coefficient associated with the variable representing the effect of privatization indicates that, after accounting for various factors and heterogeneous trends, passenger traffic at the privatized airports saw an increase of about 30% compared to the anticipated levels under state control (Paratsiokas et al., 2022).

The study findings robustly demonstrate that group airports, managed collectively, outperform standalone airports in terms of efficiency. Moreover, the market shares of major airlines significantly contribute to enhancing airport efficiency. Notably, group airports tend to command higher market shares for the largest airlines compared to standalone airports. The findings highlight the potential benefits of airport consolidation and increased airport-airline cooperation for improving overall efficiency in the aviation industry (Park et al., 2021).

Table 2.8: Institutional Resources

| RESOURCE | VARIABLE | SOURCE |
|---|---|---|
| **Institutional** | Ownership Form | Ripoll et al., (2021).<br>Oum et al., (2004).<br>Olfat et al., (2016). |
| | Revenue Price Cap | Phang, (2016).<br>Curi et al., (2011). |
| | Operational Arrangements | Ferreira et al., (2016).<br>Gillen, (2011).<br>Vasigh et al., (2003). |
| | Management Style and Concession Agreement | Merkert et al., (2014).<br>Gitto et al., (2012).<br>Curi et al., (2010). |

**Research Gaps in theme.**

The research gap highlights an incomplete understanding of revenue sources at airports, particularly aeronautical and non-aeronautical revenues. Future research should aim to provide a comprehensive exploration of how these sources are managed, diversified, and optimized to maximize revenue streams in both categories. This could involve in-depth case studies, revenue management frameworks, and innovative strategies for revenue enhancement. Further studies should investigate the practical implementation and impact of such initiatives, offering valuable insights into successful approaches and challenges faced by airport authorities in driving economic growth.

The importance of internal factors, such as runway utilization and non-aeronautical revenue, in airport inefficiencies remains to be explored. Future research should conduct comprehensive analyses to uncover the root causes of these inefficiencies and explore strategies for improving internal operations. Case studies and benchmarking exercises could provide practical insights. Future research should delve into the development and implementation of effective policy strategies, examining their outcomes and impact on airport

operations. This research can provide actionable insights for policymakers and airport management.

Investigating how intuition, personal involvement, and benchmarking interact with standardized approaches can provide a holistic view. Researchers should conduct empirical studies within airport settings to explore these intricacies.

To enhance digital transformation in airports, research should delve deeply into the specific dimensions of organizational readiness and innovation that are critical for success. Understanding how readiness and innovation interact within airport organizations can lead to more nuanced insights. Studies should explore these factors in various airport settings. The evaluation of digital tools in airport management should encompass various operational aspects. Research should provide a comprehensive assessment of the effectiveness and challenges associated with implementing concepts like total airport management (TAM), airport collaborative decision-making (ACDM), and airport operations center (APOC) in different airport operations. Case studies and stakeholder feedback can enhance understanding.

Addressing inefficiencies in slot allocation mechanisms calls for research on innovative models and decision support tools. Future studies should explore alternative approaches to optimize slot allocation, considering factors like airline demand and airport capacity.

Investigating the drivers of domestic flight seasonality requires comprehensive analysis. Future research should delve into the complex relationships among factors like airport size, natural landscapes, and other determinants, exploring their implications for airport planning and route optimization. The influence of institutional resources on airport operations warrants in-depth research. Future studies should explore the causal relationships among factors such as ownership form, regulations, management contracts, and operational arrangements, providing insights into their impact on airport performance. The impact of privatization on passenger volume requires further analysis. Research should investigate the mechanisms through which privatization affects passenger

volume, including changes in service quality, pricing, and competition. A comprehensive understanding of these dynamics is essential.

### 2.3.4 THEME 4: Airport Efficiency in India

**Concept of Economic Efficiency**

Economic efficiency encompasses two fundamental elements: technical efficiency, which refers to the firm's capacity to achieve the highest possible output from a given set of resources, and allocative efficiency, which pertains to its capability to maximize profits by aligning the marginal revenue product with the marginal cost of inputs (Farrell, 1957). The economic efficiency of production is shaped by two pivotal factors: the levels at which inputs are applied, influencing allocative efficiency, and the methods employed to apply these inputs, impacting technical efficiency. A robust understanding of economic efficiency underscores the intricate balance between input application levels and techniques, which collectively determine production efficacy (Kalirajan, 1990). In economics, the concept of efficiency is ambiguous and has different meanings under different circumstances. It can mean productive or allocative efficiency, technical efficiency, or even process efficiency while in each case the presumption compares the analytical results with a societal optimum (Kete, 1994).

**Concept of Airport Efficiency**

The concept of efficiency and productivity have been used interchangeably to study airport performance, although the connotation is not identical. The primary distinction between efficiency and productivity resides in the idea of attaining maximum feasible outputs. While productivity considers actual outputs, efficiency revolves around the concept of achieving the highest possible output that could be generated using the existing inputs. Efficiency, therefore, often relies on comparisons with other firms. The idea that shifts in productivity result from changes in efficiency might have contributed to the perception that both terms were synonymous (Lai et al., 2016). Productivity refers to the relationship of output to input (e.g., passengers per airport employee), while cost effectiveness refers to the financial input or cost required

to produce a nonfinancial output (e.g., total cost per passenger). Financial/commercial may cover a broad range of measures, including those relating to charges, debt, profitability, and commercial revenue (Aci et al., 2012). Performance can be gauged by financial or operational efficiency. Economic efficiency minimizes the cost per unit of output for a given output rate, while technological efficiency ensures the output rate can't be achieved with fewer resources (Bazargan et al., 2003).

Airport performance associated to financial efficiency can be, measured through commercial outcomes. Airports performance measures must be designed to include customer segmentation (business or leisure) and according to their purchasing power (Humphreys et al., 2002).

Understanding the importance of location and spatial effects is crucial for enhancing airport efficiency. Therefore, comprehending the spatial correlation among airports is essential, especially considering that connectivity in India is complementary rather than competitive (Bansal et al., 2022). The study centers on the identification of factors that affect non-aeronautical sources of revenue namely regulations, business form, type of product offered and customer perspective. Focus group discussion was conducted to muster information from subject matter domain experts. The results confirmed the need to build non-aeronautical sources of income for sustainable growth (Damodaran et al., 2022). Ownership form and revenue generation approaches impact commercial revenues necessary for monetary stability and airport infrastructure development. Airport development is imperative for socio-economic long-term expansion of Indian economy (Yadav et al., 2022). The study emphasizes that mere PPPs are not sufficient for India. What is required is an effective PPP approach that considers the unique challenges and opportunities in the country. This entails strategic planning, robust governance mechanisms, clear allocation of risks and responsibilities, and appropriate regulatory frameworks. Effective PPPs can contribute significantly to India's infrastructure development and bring about substantial benefits for the government, citizens, and the economy (Kunjukunju, 2022).

The study observed the interrelationship between various factors regarded as crucial for the success of PPP air field in India. Favorable regulatory regime and commercial sustainability positively impacts process characteristics of PPP airports thereby improving consumer satisfaction and stakeholders' confidence (Chourasia et al., 2021). The results highlight the importance of annual revenue and passenger numbers as key criteria for evaluating airport performance. The findings provide valuable insights for decision-making and improvement strategies in the Indian aviation industry (Chakraborty et al., 2020).

All passenger segments' stated preferences for non-aeronautical needs are low, which suggests room for growth. The airport administration should take this into consideration when developing an effective marketing strategy for these needs to increase revenue from them. The management of the PPP airports in India will be significantly impacted by this (Gupta et al., 2016).

According to the study PPP model was one viable option to infuse necessary capital and achieve operational efficiency essential for attaining infrastructural demands of emerging economy like India (Ganguly et al., 2019). Transportation infrastructure deficiencies can be adequately managed by adopting PPP model, thereby optimizing the use of limited available resources (Ahluwalia, 2019). Indian airports must focus of non-aeronautical revenue generation and staff rationalization to improve efficiency and productivity (Kumar et al., 2018).

Although commercial revenue was included under draft OMDA scope, the bone of contention between AAI and JV was sharing of revenue generated by commercial activities under subsidiary scheme. Moreover, airport development fee was not subject to revenue share (Ajay et al., 2010). The researcher noted that airport denationalisation and regulation positively influence airport productivity, service level, and capacity optimization. Sharp increase in airport charges had adversely affected traffic growth at low cost airports (Singh et al, 2015). Regulatory, safety and environmental factors would help to improve efficiency and performance of PPP airports in India. Benchmarking Indian airports with international airports would help identify the gaps in performance. Furthermore, non-aeronautical revenue stream must be developed as Indian airports are heavily dependent on aeronautical revenues (Ohri, 2012).

Stakeholder perspective and transparency in financial accountability is important for PPP model to succeed apart from robust regulatory system. PPP model enable resource optimization and improve infrastructure and boost efficiency (Sambrani, 2014). Privatization would result in economic viability and level of service improvement in the aviation sector.

The user pay principle had enabled the PPP model airports to charge user development fee to achieve economic viability and improve service quality resulting in higher efficiency. One of the issues related to land allocated for development of real estate and subsequent revenue generation from it, was that the airport developer wanted to keep it outside regulatory till, hence not for cross subsiding aeronautical revenue (Gupta, 2015). Aeronautical activities generate majority revenue for most of the Indian airports. Developing countries must improve transparency, create regulatory authority and key performance indicators to make airport privatization process effective and successful (Chaudhuri, 2011). Tier II city airport infrastructure should be developed to meet passenger and freight traffic growth on the pattern of aerotropolis to enable economic growth opportunities (Shah et al., 2013). Regulation helps to keep a check on private airports unfair practices in terms of charging high prices. A global trade-off is evident between Single-till and Dual-till price cap regulations. Airlines prefer the former whereas airports prefer latter methodology (Damodaran et al., 2017). Efficiency of PPP airports can be increased by improving management practices and corporatization. Foreign Direct Investment (FDI) and form of regulation impact overall efficiency (Mathur, 2004).

**RESEARCH GAPS IN THEME 4**

While the literature acknowledges the importance of spatial effects and connectivity among Indian airports, a research gap exists in comprehensively analyzing these spatial correlations and their multifaceted impact on airport efficiency. There is a need to quantify and understand how spatial relationships influence various aspects of airport operations, including passenger flows, infrastructure utilization, and regional economic development.

The literature identifies factors influencing non-aeronautical revenue sources at airports, but there's a need for in-depth research to explore the interplay and relative significance of these factors. Furthermore, empirical studies and case analyses can shed light on effective strategies for optimizing non-aeronautical revenue streams in diverse Indian airport contexts.

While ownership form and revenue generation approaches are acknowledged as factors impacting commercial revenues at airports, the literature does not delve into the specific mechanisms through which different ownership structures influence revenue generation strategies. Future research should investigate how ownership models, such as public-private partnerships (PPPs), influence revenue stability, infrastructure development, and overall airport financial sustainability.

The literature underscores the importance of effective PPP approaches in India but lacks a detailed examination of what constitutes an effective PPP strategy in the Indian aviation context. Comprehensive research is needed to define the elements and strategies factors that contribute to the triumph of PPP initiatives, considering the unique challenges and opportunities inherent to the Indian market. Future research must unravel the interplay of regulatory regimes, commercial sustainability, and process characteristics on PPP airport performance.

The literature discusses the potential of PPP models for infrastructure development but lacks empirical analysis of the actual outcomes of PPP projects in terms of infrastructure expansion and socio-economic growth. Robust research should assess the tangible impact of PPPs on infrastructure development, regional economic benefits, and long-term sustainability. Future research should explore specific regulatory, safety, and environmental factors that influence PPP airport performance in the Indian context, providing actionable insights for policymakers and stakeholders. The literature suggests developing airport-centric cities in Tier II locations but does not provide specific strategies for aerotropolis development. Robust research should investigate the economic opportunities, infrastructural requirements, and challenges associated

with fostering aerotropolis development in India, with a focus on facilitating sustainable economic growth.

The trade-off between Single-till and Dual-till price cap regulations is mentioned, but there's a research gap in analyzing the specific impacts of these regulatory approaches on airport and airline stakeholders. Rigorous research should assess the advantages and disadvantages of different price cap methodologies within the Indian aviation sector, considering the interests of all relevant parties. The literature mentions the potential for increased efficiency through improved management practices and corporatization but lacks a detailed analysis. Robust research should investigate the management practices and corporate governance structures that contribute to efficiency gains in Indian airports, especially in the context of foreign direct investment (FDI) and regulatory frameworks.

Incorporating these research gaps into future studies can provide a more comprehensive understanding of airport efficiency, ownership models, regulatory dynamics, and performance evaluation in the context of India's rapidly evolving aviation sector. Addressing these gaps can offer valuable insights for policymakers, airport operators, investors, and researchers aiming to enhance the sustainability and competitiveness of Indian airports.

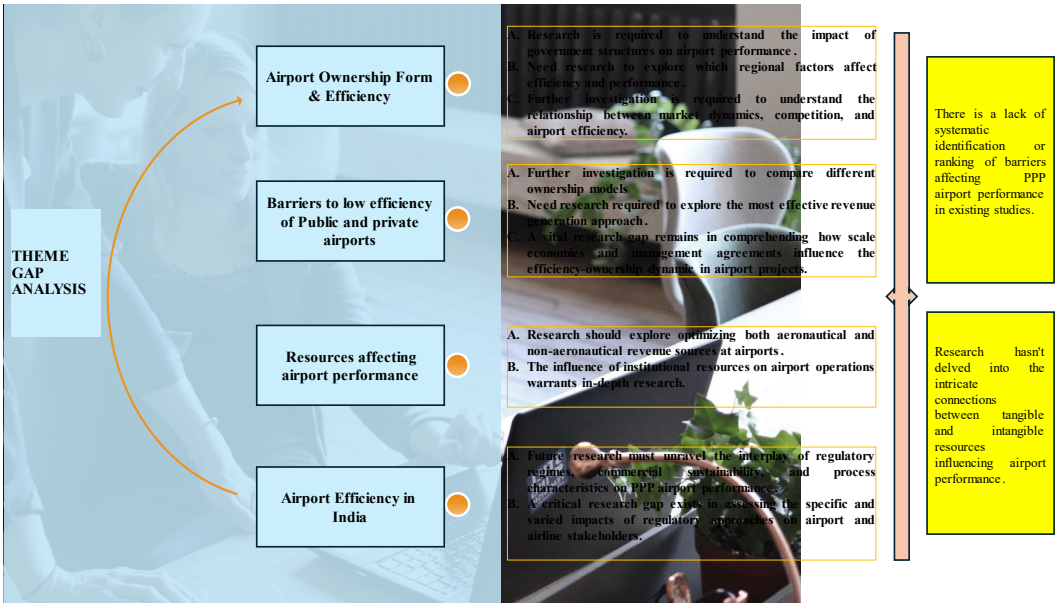


Figure 2.4: Research Gaps

### 2.3.5 Theoretical Premise of the Research

**RBV Theory**

RBV theory enables efficiency based justification of performance difference and conceptualize firms as a package of resources and capabilities (Barney, 2003). The RBV Theory takes an inside-out view to analyze how a firm gains competitive advantage by exploiting available resources.

For the last few decades there have been lots of studies had taken up by various researchers focusing on competitive advantage (CA). CA is how an organization or firm frames or acquire specific qualities and characteristics that allow it to outperform its rivals (Wang, 2014). CA has been a part of strategic management research through which researchers tried to elaborate and describe superior performance of some firms or organizations (Powell, 2001). Dominant CA theories are primarily market-based view or resource-based view.

Firms in the identical domain achieve competitive advantage over their rivals due to resources that are VRIN (valuable, rare, Inimitable, and non-substitutable). This variance in performance among firms has been the subject of inquiry and debate among scholars and establishments. The RBV Theory takes an inside-out view to analyze how a firm gains competitive advantage by exploiting existing resources. RBV theory primarily revolves around the internal environment of a firm. RBV emphasizes the resources that firms have developed to compete in the environment. RBV theory enables efficiency based justification of performance difference and conceptualize firms as a package of resources and capabilities (Barney, 2003).

The firms could develop competitive advantage by utilizing resources that are valuable, rare, inimitable, and non-substitutable. Firm's controllable resources classified as physical capital, human capital and organizational capital create value and hence enable firm to implement strategies that enhance efficiency and effectiveness (Barney, 1991).

**RBV Theory and resources**

The RBV's main prescription holds that resources possessing certain special characteristics are the critical determinants of firm success. Resources that

exhibit value, rareness, inimitability, and non-substitutability are strategic assets (Schoemaker, 1993; Michalisin et al., 1997; Coff, 1999). Table 2.9 reveals the justification for various theories.

Table 2.9: Theory Justification and Suitability

| **Theory** | **Justification** | **Suitability for study** |
|---|---|---|
| Resource Based View (RBV) | The RBV focuses on the firm as the primary unit of analysis, which suggests that firms possessing rare, valuable and inimitable resources can achieve sustainable competitive advantage by implementing fresh value-creating strategies that are difficult for competitors to duplicate | Suitable |
| Theory of Production | *The* production function is a purely technical relation which connects factor inputs and outputs. It describes the laws of proportion, that is, the transformation of factor inputs into products (outputs) at any time. The production function represents the technology of a firm of an industry, or of the economy. The production function includes all the technically efficient methods or production. | Suitable |
| Stakeholder Theory | Stakeholder Theory stresses the interconnected relationships between a firm and its stakeholders like customers, suppliers, employees, investors, communities and others. The theory argues that a firm should create value for all stakeholders | Not Suitable |
| Theory of Economic Efficiency | Economic efficiency of a firm can be, conceptualized as comprising two main components (Farrell, 1957): first, technical efficiency, which involves the firm's ability to obtain the maximum possible output from a given | Not Suitable |

| | | |
|---|---|---|
| | set of resources; second, allocative efficiency, which concerns its ability to maximize profits, by equating the marginal revenue product with the marginal cost of inputs. | |
| Industrial Organization Theory | The industrial organization theory focuses on the whole industry and market conditions of a company (Ramsey, 2001, p. 39) and the central analytical aspect can be used to identify strategic choices, which firms have in their respectively industry (Porter, 1981; Teece et al. 1997), which includes Strategic Supply Management. | Not Suitable |
| Positioning View theory of strategic management | The positioning perspective recognizes that for resources to be, leveraged for economic benefit, it requires their application in the marketplace. At the same time, it also recognizes that if that application is to be sustainable in the face of increasing competition, then competitive advantage must be built on distinctive resources and capabilities (Hamel et al., 1994; Webster, 1994). | Suitable |

Former academics have examined the utility of RBV theory from different perspectives. The author observed that traditional RBV theory misconstrues strategic leverage created through long term competitive advantage in dynamic market conditions (Eisenhardt et al., 2000). The first detailed review by (Bharadwaj, 2000) examined the relationship between IT backed resources and firms performance. The results indicate that IT provides a competitive advantage to firms resulting in increased profits and cost effectiveness.

Resources can comprise of assets, managerial procedures, firm characteristics, information, or knowledge controlled by the firm used to conceive of and implement their strategies shown in Figure 2.5. The results show that sustainability within a firm can be achieved only through managerial IT skills

(Mata et al., 1995). Furthermore, different streams emerging out of RBV theory have been developed like NRBV, Knowledge based view, and dynamic capability theory (Hart, 1995; Hart et al., 2011; Robert, 1996; Teece, 2016).

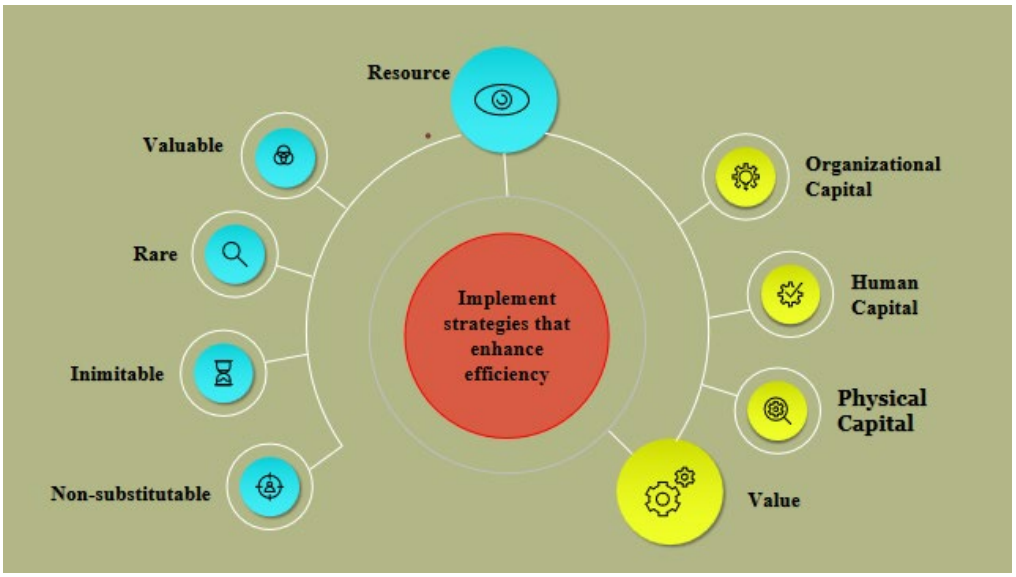


Figure 2.5: Resource Based View Theory

Source: Author

RBV theory must include capability lifecycle component to effectively interpret the sources of heterogeneity capabilities within a firm leading to market domination (Helfat et al., 2003). RBV theory provides holistic view by integrating theories from strategy research, organizational economics and different school of industrial association research (Mahoney et al., 1992). The author uses RBV theory to examine available resources divided into component and architectural competence to measure firms performance in area of pharmaceutical research (Henderson et al., 1994).

Table 2.10 represents the application of RBV theory in various studies across different contexts and regions.

Table 2.10: Resource-Based View Theory

| S. No | Author (Year) | Context | Inference | Region |
|---|---|---|---|---|
| 1 | Barros et al., 2017 | Airport | Efficiency in Nigerian airports is determined by focusing on managerial skills | Africa |
| 2 | Njoya, 2011 | Airport | This paper analyses the potential of dedicated low-cost terminals in affecting the competitive positioning of airports. | Europe |
| 3 | Hannigan, 2015 | Airlines | The study aims to explore the competitive implications of firm strategies under conditions of market commonality and shared resource pools | USA |
| 4 | Madhani, 2008 | Software Industry | The paper is to discuss the resources, including technical skills and cost competency, that have contributed to the competitive position of the Indian software industry | India |
| 5 | Yewwong, 2010 | Logistics & Supply Chain | The study identifies strategic logistics resources acquired and bundled by logistics service providers (LSPs) to achieve competitive advantage | Not country specific |
| 6 | Wei, 2014 | Medical Technology industry | This study takes the RBV as a theoretical approach to exploring the integration approaches in international acquisitions | Not country specific |

**Research Methodology for RBV Theory review!**

## 2.1. Bibliometric Analysis

Analysis of published data in a particular field by means of statistical and mathematical techniques is possible through bibliometric method (McCain, 1990; Paisley, 1990). Over the years, bibliometric analysis has caught the attention of researchers to analyze the data due to development and accessibility of multiple software (Donthu et al., 2021; Khan et al., 2021). Bibliometric analysis helps to identify the latest research trend and gaps in areas where future investigation is desirable (Gall et. al., 2015; B. Wang et. al., 2014). Research funding projects can also be identified by policy makers and agencies by scrutinizing bibliometric outcome (Ugolini et al., 2015).

CiteSpace and VOS viewer are software that facilitate the user to gauge upon progression made in a particular research field, providing a bird's eye view (Chen, 2006; Shafique, 2012; V. Singh, et. al, 2019; Zhang et. al, 2021). (Zhu et. al., 2019) have observed that keyword co-occurrence analysis facilitates identification of frequently used terms trending in more recently published articles.

Software program VOS viewer was used to show bibliometric maps to infer correlation between authors, countries and for conducting citation analysis of articles (Jan et al., 2010). Network analysis is done by combining mapping and clustering methods to comprehensibly understand advancement in specific research field within domain. Clustering is done using VOS method to separate groups represented by different color (Waltman et. al., 2010).

**Article Shortlisting through Scopus**

The articles used in this paper have been selected through use of Scopus database as it provides substantial number of scientific published articles as compared with Web of Science (Vieira et al., 2009). (Si et al., 2019) study show that Scopus has twenty percent more publication than Web of Science. The keyword used for the search for the articles was Resource-Based-View-theory. Document search was narrowed to include only journal articles. Similarly, the

subject area, which covers 20 areas, was limited to business management and accounting field. Furthermore, content analysis was carried out, to pinpoint relevant articles applying RBV theory in the business management area.

**Content Analysis**

Content analysis is a qualitative and flexible research analysis tool. It is used to interpret text data systematically, by classifying themes with the aim of preserving originality (Hsieh et. al., 2005). A technique used to make inferences of text data by replicating the authentic information (White et. al, 2006). Concepts are created during the abstraction stage when qualitative content analysis is performed, and must be supported by precise reporting (Elo et al., 2014).

Bibliometric and content analysis technique was, used to establish the results in this study as shown in Figure 2.6

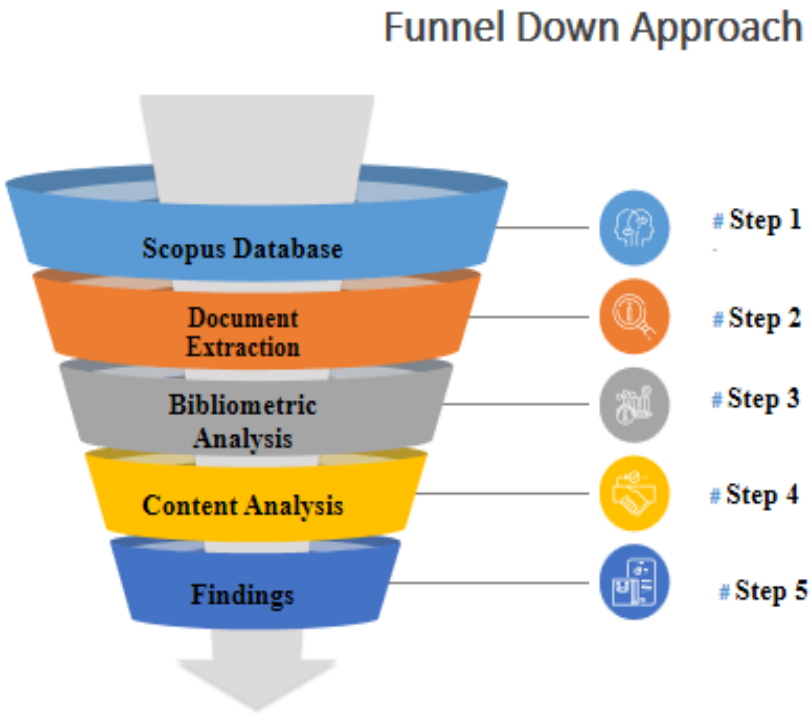


Figure 2.6: Research Framework

Source: Author

**Preliminary Literature Statistics**

Figures 2.7 & 2.8 display the number of articles published from 1983 to 2021 for RBV Theory as applied to area of business management. The first article in business management using RBV theory was published in 1983. The number has significantly increased over the last decade and has reached 339 articles in 2021 (as of 12 December 2021). The average annual growth rate of publication from 2012 to 2021 was 225.96%. The application of RBV theory in business management research will continue to gather momentum and has requires comprehensive review.

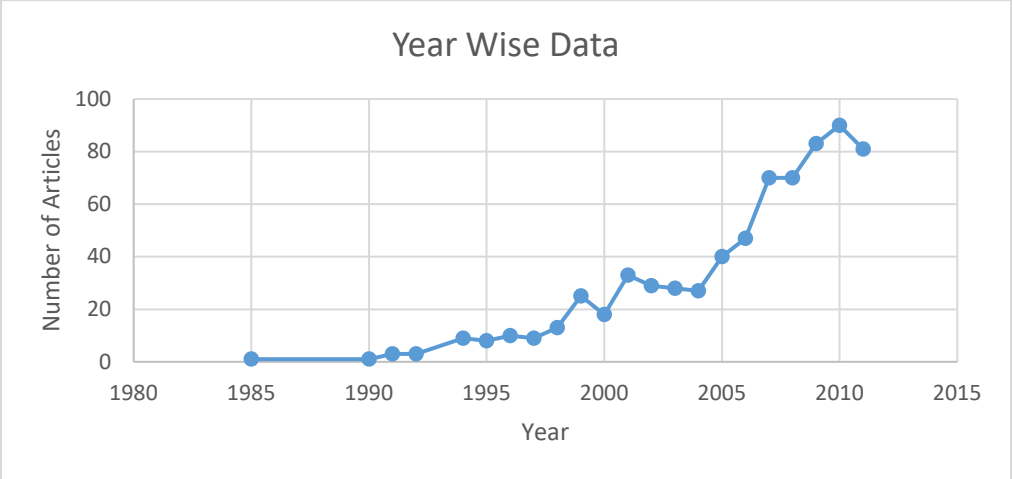


Figure 2.7: A literature review from 1983 to 2011.

Source: Author

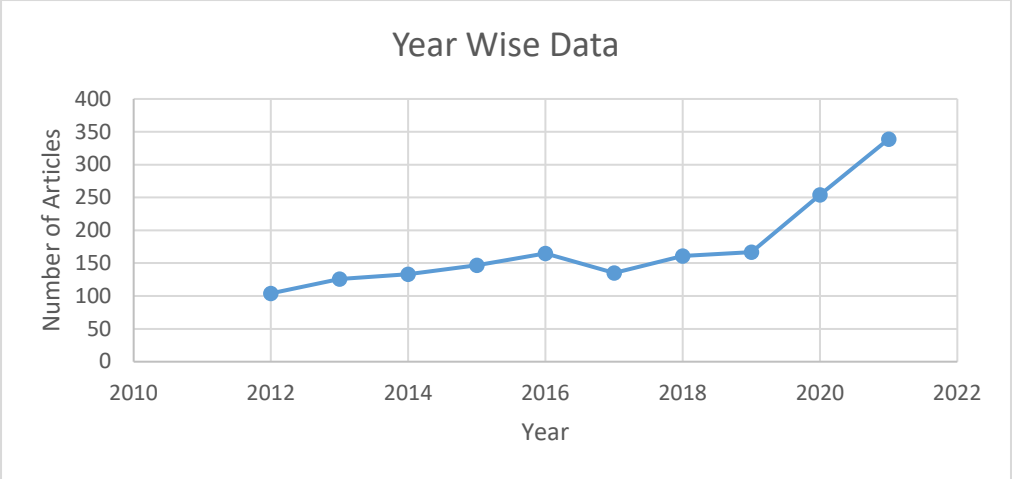


Figure 2.8: Literature review from 2012 to 2021.

Source: Author

1741 articles were searched for our research purpose and available across 516 different journals. Through Table 2.11 we tried to represent the top 15 journals with respect to number of publications, which accounted for approximately. This accounts for 21.82% of the 516 journals. Three important journals under the domain of business management where maximum number of articles were published. The journals are Journal of Cleaner Production, Journal of Business Research, and Industrial Marketing Management.

**Results and discussion**

Among the journals analysed, 52 articles (10.09%) were published in the Journal of Cleaner Production, securing the top rank based on publication numbers. The ranking was determined by the total number of articles published in each particular journal. The Journal of Business Research held the second position (refer to Table 2.14). Industrial Marketing Management, while publishing a smaller number of articles per year in comparison, ranked third in the application of the RBV Theory to business management.

Furthermore, the journals Business Strategy and the Environment, Journal of Management, and International Business Review demonstrated comparable publication numbers and were ranked fourth, fifth, and sixth, respectively. These six journals collectively account for 34% of the total number of publications. This observation underscores their significance in publishing articles applying the RBV Theory in the field of business management over the past decades.

Table 2.11: Top 15 Journals and articles published.

| Source | Percentage | Citations | Documents |
|---|---|---|---|
| International Business Review | 4.46 | 716 | 23 |
| Business Strategy and The Environment | 5.04 | 335 | 26 |
| Strategic Management Journal | 4.27 | 1214 | 22 |
| Industrial Management and Data Systems | 4.07 | 275 | 21 |
| Journal of Business and Industrial Marketing | 4.07 | 221 | 21 |

| | | | |
|---|---|---|---|
| Journal of Cleaner Production | 10.09 | 1873 | 52 |
| International Journal of Production Economics | 3.88 | 1274 | 20 |
| Management Decision | 4.46 | 350 | 23 |
| Technological Forecasting and Social Change | 3.88 | 661 | 20 |
| Journal of Management | 4.66 | 1056 | 24 |
| Journal of Business Research | 9.12 | 1269 | 47 |
| Industrial Marketing Management | 5.24 | 549 | 27 |
| Supply Chain Management | 3.3 | 736 | 17 |
| Journal of Business Ethics | 3.68 | 1007 | 19 |
| International Journal of Operations and Production Management | 3.49 | 643 | 18 |

Using statistics from the identified 1741 articles, Figure 2.9 illustrates the publication history of the top six journals in the application of RBV theory for studying business management. The first article on the application of the RBV Theory to business management was published in the Statistical Journal of the United Nations Economic Commission for Europe in 1983. However, this journal did not publish any other article or paper on the application of RBV theory in the field of business management afterward. In contrast, there has been an increasing number of relevant articles published in the Journal of Cleaner Production in the past four years, totalling 30 articles. Similarly, the number of related studies published in the Journal of Business Research and Industrial Marketing Management has gradually increased from 2018 to 2021, reaching a cumulative figure of 40 articles. The remaining three top journals, Business Strategy and Environment, Journal of Management, and International Business Review, accounted for a total of 49 articles from 2018 to 2021, contributing to a cumulative 2.81% of the total articles published since 2012 onwards in the 516 journals.

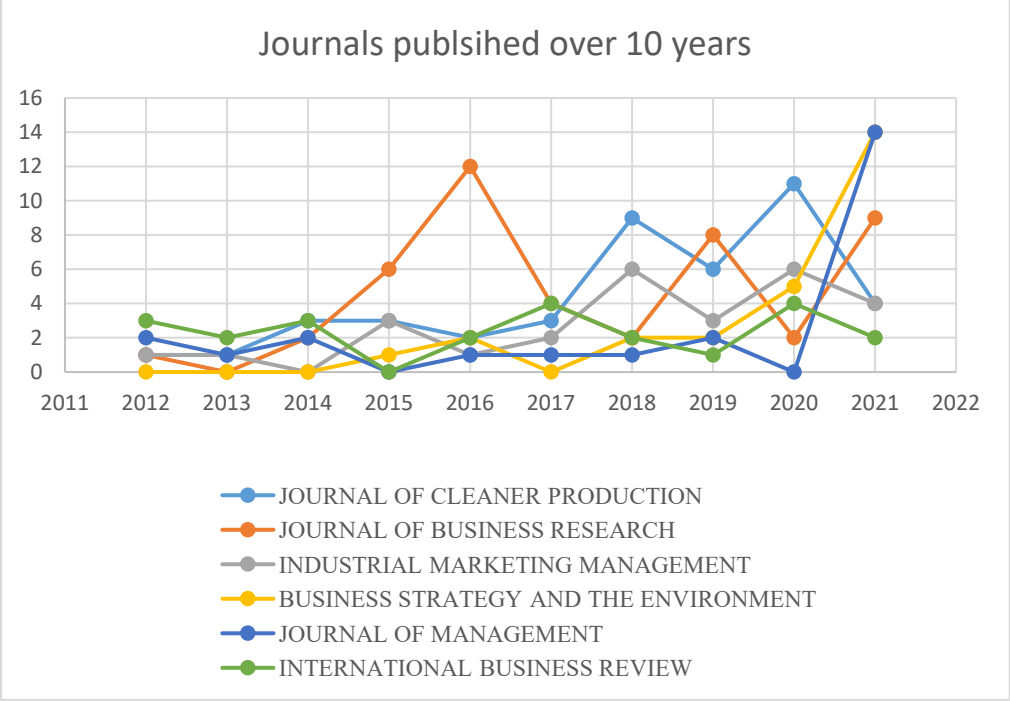


Figure 2.9: Publication statistics on the application of the RBV Theory to business management.

Source: Author

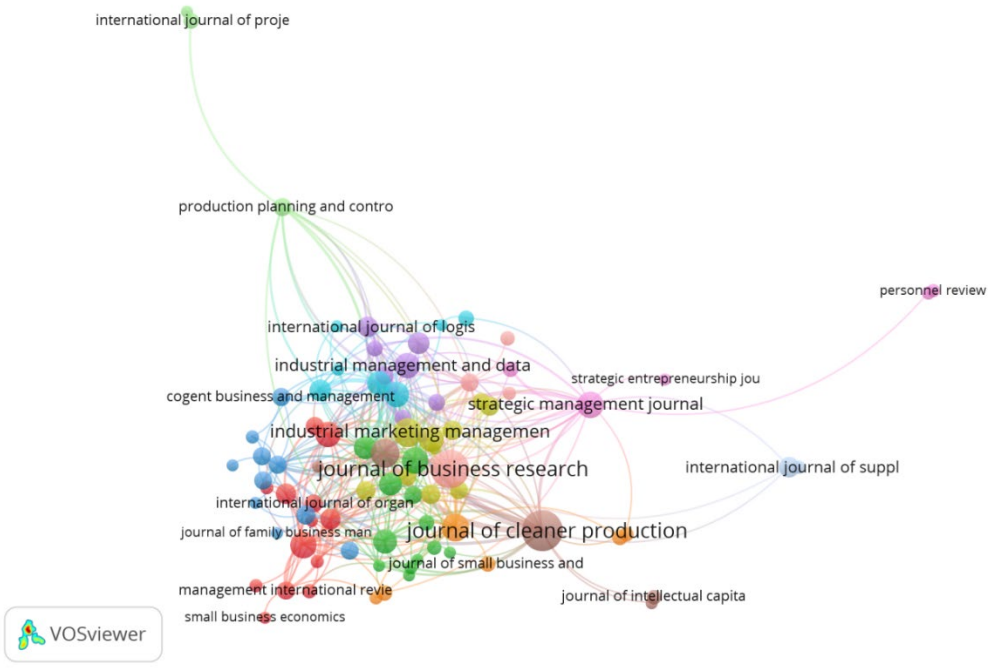


Figure 2.10: Articles published during last decade.

Source: Author

Figure 2.10 highlights significant articles published in the last decade, while Table 2.12 provides insights into the publishing characteristics of 15 countries and regions that have each published more than 10 articles. The United States leads with 376 articles, constituting 21.72% of the total, followed by the United Kingdom with 280 articles (16.17%), Mainland China with 191 articles (11.03%), and Australia with 132 articles (7.62%). These four entities emerge as the most prolific countries/regions, making substantial contributions to the application of RBV Theory in the field of business management.

Table 2.12: Publication characteristics of Top 15 productive countries and regions.

| **Country** | **Documents** | **Citations** | **Total Link Strength** | **Percentage** |
|---|---|---|---|---|
| United States | 376 | 13112 | 279 | 21.72 |
| United Kingdom | 280 | 9272 | 306 | 16.17 |
| China | 191 | 3824 | 175 | 11.03 |
| Australia | 132 | 3816 | 132 | 7.62 |
| Malaysia | 121 | 978 | 94 | 6.99 |
| France | 100 | 3033 | 130 | 5.77 |
| Spain | 98 | 2279 | 65 | 5.66 |
| India | 90 | 1393 | 66 | 5.19 |
| Taiwan | 88 | 2271 | 52 | 5.08 |
| Italy | 85 | 2540 | 69 | 4.91 |
| Canada | 84 | 2536 | 83 | 4.85 |
| Germany | 84 | 2159 | 72 | 4.85 |
| South Korea | 46 | 983 | 44 | 2.65 |
| Brazil | 45 | 589 | 34 | 2.59 |
| Finland | 42 | 978 | 34 | 2.42 |

The United States leads in terms of the number of citations with 13,112, encompassing both self-citations and other citations. It is followed by the United Kingdom with 9,272, China with 3,824, and Australia with 3,816. These countries collectively exert a significant influence on research output in the field

of business management. In terms of collaboration, the United Kingdom (307 links), the United States (279 links), and China (175 links) exhibit the most extensive network of collaborations among authors, as depicted in Figure 2.10.

**Institutions**

Table 2.13 showcases the top 10 most productive institutions engaged in publishing applications of RBV Theory in the field of business management. Remarkably, the five most productive institutions are based in the United Kingdom. The School of Business at Loughborough University emerges as the institution with the highest number of relevant publications.

Table 2.13: Top-10 of most productive institutions publishing on RBV Theory

| **Organization** | **Documents** | **Country** |
|---|---|---|
| Montpellier Business School | 4 | France |
| Montpellier Business School, Montpellier Research in Management | 4 | France |
| Leeds University Business School, University of Leeds | 4 | United Kingdom |
| Department of International Logistics, Chung ang University | 4 | South Korea |
| College of Management and Economics, Tianjin University | 4 | China |
| Coggin College of Business, University of North Florida | 4 | United States |
| Arizona State University | 4 | United States |
| School of Management, Zhejiang University | 5 | China |
| Degroote School of Business, McMaster University | 5 | Canada |
| School of Business and Economics, Loughborough University | 8 | United Kingdom |

Table 2.14 presents a list of the 15 most prolific institutions, including their respective citation counts. Notably, the paper titled "Service Innovation in The Digital Age: Key Contributions and Future Directions," authored by Barraet et al. (2015), has garnered an impressive 477 citations. Remarkably, this paper has maintained an average citation rate of 68.1 times per year since its original publication.

Table 2.14: Top-15 of most productive institutions publishing on RBV Theory

| Source Publication | Citations | Document |
|---|---|---|
| MIS Quarterly: Management Information Systems | 477 | Barrett M. (2015) |
| Strategic Management Journal | 440 | Berrone P. (2013) |
| International Journal of Production Economics | 415 | Akter S. (2016) |
| Journal of International Business Studies | 347 | Wang C. (2012a) |
| Journal of International Business Studies | 335 | Meyer K.E. (2016) |
| Journal of Operations Management | 322 | Schoenherr T. (2012b) |
| Organization and Environment | 297 | Albertini E. (2013) |
| MIS Quarterly: Management Information Systems | 293 | Wu S.P.-J. (2015) |
| Journal of Supply Chain Management | 287 | Leuschner R. (2013) |
| Journal of World Business | 280 | Gaur A.S. (2014) |
| British Accounting Review | 269 | Qiu Y. (2016) |
| Journal of Management | 258 | Terjesen S. (2016) |
| International Journal of Production Research | 239 | Blome C. (2013) |
| Journal of Small Business Management | 237 | De Massis A. (2015) |
| Journal of Cleaner Production | 231 | Cheng C.C.J. (2014) |

**Main Research Findings**

This study segregates the research article into five different categories derived from 228 keywords namely innovation, big data, emerging economies, competition, and strategic management.

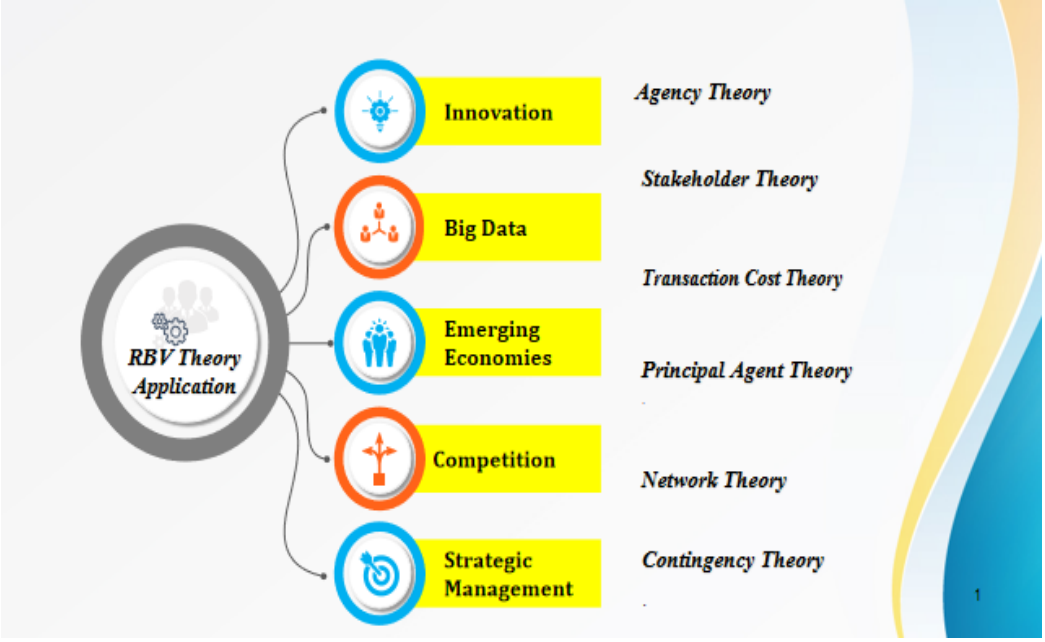


Figure 2.11: Application Framework of RBV Theory

Source: Author

Figure 2.11 illustrates how the RBV theory can be applied in a variety of contexts.

**Innovation**

(Hazen, et al., 2012) observed the need to combine complimentary resources within a firm along with technological innovations to achieve competitive advantage. The author had used RBV theory and resource-advantage theory to investigate the performance of firms after implementing IT in logistics supply chain processes. RBV theory is employed to investigate manufacturing small and medium enterprises. The result show positive correlation between innovation, promotion and learning competences (Sok et al., 2013). (Soto et al., 2014) examines how developing IT skills using innovation and web-based knowledge can enhance cooperation and information sharing among employees within a firm. An integrated model comprising of technology-organization-

environment theory and the resource-based view was, adopted for the study. (Wiengarten et al., 2013) used RBV framework to examine how integrating IT resources with other organizational resources that are rare and inimitable leads to performance enhancement. (Naqshbandi et al., 2018) building upon RBV, a model is, constructed to explain how top management can use organization culture to augment open innovation and apply it at different levels. (Liao, 2018) employs RBV and stakeholder theory to examine how novelty and creativeness affects eco innovation tactic. (Shahzad et al., 2020) examines the interrelationship of green innovation, data management process and sustainable performance of a firm, through RBV theory. (Pérez et al., 2019) study the interrelationship between innovation and knowledge. The results indicate that leadership must emphasize on moderate exchange of knowledge and combination within a firm, to minimize wastage of resources. (Adebanjo et al., 2018) investigate the relationship of product/process innovation capabilities with supply chain integration and performance of a firm, by adopting RBV and institutional theory concepts.

**Big Data**

(Shiris et al., 2018) developed a theoretical model based on RBV theory and contingency theory to study impact of big data and prognostic analytics on firm's sustainable goals. (Raguseo et al., 2018) applies RBV concept to demonstrate that investment in big data analytics leads to performance enhancement and client satisfaction. (Cosic et al., 2016) introduce a conceptual framework based on RBV principle to outline and rank resources that establish a firms business analytic initiatives. (Mikalef et al., 2020). Grounded in RBV concept and configuration theory, the author examines how big data analytics when integrated with other internal resources of a firm leads to efficiency in health care business (Wang et al., 2019). Big data analytics and state-of-the-art data security mechanism has a positive impact on services supply chain innovation competences and performance (Fernando et al., 2018). (Martinez et al., 2019) explore the resources required to build, operate and maintain block chain technology within a firm. (Wamba et al., 2019) RBV and dynamic

capability view concept is, applied to show that big data enabled analytics impacts firms' performance.

**Emerging Economies**

(Gruber et al., 2012) observe that managerial and technology endowments restraints market opportunities while management vision and entrepreneurship helps to create value for customers, based on underlying principles of resource based view. (Ohad, 2017) combines principle of behavioral theory and resource based view to observe how a firms decision to enter new market is impacted by performance feedback and existing gap between performance and institutional objective. (Tatoglu et al., 2016) explain the differences between local firms and MNE's talent management motivations by using concept of RBV and institutional theory. (Ehrgott et al., 2013) augments the resource based thinking in supply chain management to support the notion that firm gain competitive advantage by integrating supply chain partners in emerging economies. (Kamasak, 2017) examines the role of tangible and intangible resources and capabilities on a firm performance. The result indicates that intangible resources have a major and decisive impact as compared to tangible resources.

**Competition**

Integrating the internal resources of a firm has a positive impact on customer and supplier relationship leading to value creation. A conceptual model was developed by using elements from RBV theory and contingency theory (Lee et al., 2012). (Crick et al., 2020) have used resource based and relational view to examine how firms transform their business model by embracing coopetition to survive during crisis. (Huo et al., 2016) observes that competitive performance is directly proportional with customer and supplier integration achieved through the principle of human resource integration based on RBV concept. Resources and capabilities sharing among firms leads to improvement in performance, which cannot be achieved in isolation (Crick, 2018). Critical resources affecting competitiveness of open source software ventures, is investigated through a theoretical model based on RBV (Ghapanchi et al., 2014). (Crick, 2020) explores how coopetition can be harmful for a firm as there is a possibility of

intellectual resource loss and hence it is important to balance the amount of capability sharing.

**Strategic Management**

RBV theory provides the foundation to develop theoretical model to explain a firms variance in performance and subsequent success or failure in supply chain through collaboration (Fawcett et al., 2012). RBV theory and positional advantage theory is employed to study elements that affect complex relationship of supply chain integration and performance. The results indicate that SCI has a positive impact on a firms financial performance (Chang et al., 2016). (Schmidt et al., 2013) fill the prevailing gap in RBV theory by emphasizing on the significance of demand side factors and expanding managerial role to utilize available resources to create value and gain competitive advantage. RBV concept was employed to construct theoretical insights about how triple bottom line firms achieve competitive advantage by utilizing resources based on laid down principles. The results show that these firms focus on VRIN resources (Glavas et al., 2015). RBV perspective helps to analyze the relation between human resources and its subsequent green supply chain management strategies adoption within a firm (Jabbour et al., 2017). (Fayard et al., 2012) develop a conceptual model based on RBV, to forecast which in-house resource can be used to reduce inter-operational cost. (Hsu, 2013) demonstrate using microeconomic theory and RBV, how IT and enterprise resource planning integration can provide advantage to a firm. (Agarwal et al., 2012) introduces META-SWOT tool based on inside-out view of RBV, to gain competitive superiority by prioritizing available resources within a firm.

**RBV and Other Theories**

RBV Theory has been integrated with contingency theory and leadership theory to discover organizational scope and its effects (Josefy et al., 2015). The authors combines RBV theory and institutional theory to determine by what method a firm can enhance export performance by aligning market orientation capabilities with export channels (He et al., 2013). (Germann et al., 2013) employed upper echelon theory and RBV theory to observe the factors that makes a firm deploy

marketing analytics and its inclusive impact on performance. (Wagner, 2015) observed that that a firms alignment with resource based principles could have a restraining effect on commercial and environmental performance. (Hazarika et al., 2019) propose a conceptual framework integrating principle of RBV, strategic choice and institutional theory, to highlight the factors that makes a firm adopt eco-innovative practices. The results show that eco-innovation has a positive impact on the financial performance of firms involved in construction business.

**RESEARCH GAP (THEORY)**

Eisenhardt and Martin (2000) suggested that traditional RBV theory may misconstrue strategic leverage in dynamic market conditions. Future research could explore how RBV theory needs to adapt or evolve to better account for and guide strategic decision-making in rapidly changing business environments. Although Bharadwaj (2000) identified a favorable association between IT assets and corporate performance, additional investigation is warranted to explore the mechanisms by which IT resources foster competitive advantage across various sectors and environments. Additionally, understanding the limitations and potential downsides of heavy IT investment should be explored.

Mata et al. (1995) highlighted the importance of managerial IT skills for achieving sustainability within a firm. Research could delve deeper into the specific skills and competencies that managers need to effectively leverage IT resources for long-term sustainability and competitive advantage. Helfat and Peteraf (2003) introduced the concept of a capability lifecycle component. Research could investigate how this component can be practically integrated into RBV theory to better explain the sources of heterogeneity in capabilities within firms and how they lead to market domination over time. Mahoney and Pandian (1992) discussed the holistic view provided by RBV theory, integrating concepts from different fields. Further research could explore how this integration can be enhanced or refined to provide more actionable insights for firms in various industries and contexts.

Henderson and Cockburn (1994) used RBV theory to measure firm performance in pharmaceutical research. Research gaps may exist in applying similar resource measurement frameworks to other industries or in refining the measurement approaches for pharmaceutical firms.

Interdisciplinary perspectives: The examination centers on the utilization of RBV theory in the realm of business administration. However, RBV theory has the potential for interdisciplinary applications. Future research could explore the intersection of RBV theory with other disciplines, such as technology, psychology, sociology, or environmental studies, to gain a more holistic understanding of its implications.

Longitudinal analysis of research trends: The provided statistics cover the period from 1983 to 2021, indicating the growth in the number of publications over time. However, a more detailed longitudinal analysis of research trends, including shifts in focus, methodologies, and theoretical frameworks, may offer valuable perspectives into the development of RBV theory in business management research.

Qualitative research approaches: The preliminary statistics primarily focus on quantitative analysis of publication numbers, citations, and co-authorship patterns. There is a potential gap in the use of qualitative research approaches to acquire a more profound comprehension of the utilization of RBV theory in business management. Qualitative studies, such as case studies or interviews, could provide rich insights into the challenges, limitations, and practical implications of applying RBV theory in real-world contexts.

Comparative analysis of RBV theory with other theoretical frameworks: RBV theory is one of the prominent theoretical frameworks in the field of strategic management. However, there is a need for comparative analyses that explore the strengths and limitations of RBV theory compared to other theoretical frameworks, such as the resource-dependence theory, dynamic capabilities theory, or institutional theory. Such comparative studies can contribute to a more comprehensive understanding of strategic management theories. These research gaps provide potential avenues for further exploration and expansion

of the existing literature on RBV theory applied to business management. Researchers can consider these gaps to identify specific research questions and design studies that address these areas.

**Summary of ROL**

Airport efficiency, a complex interplay of factors, has been extensively explored in previous research. Achieving a delicate balance between exclusive services in private airports and the accessibility of public ones is a key challenge, requiring optimization of profitability without compromising service quality. Effective, corruption-free management is paramount, with consideration of endogenous and exogenous factors crucial for holistic resource utilization. The implementation of a process-driven policy handbook is proposed for smooth transitions in airport operations. Financial sustainability, particularly in the absence of travelers, necessitates technology-driven solutions and automation to enhance the travel experience and boost profits. Public-private partnerships offer a promising solution, contingent on addressing challenges like market conditions, government influence, and project planning. Clear boundaries and defined responsibilities are crucial for successful airport management, emphasizing a shift from subsidizing inefficient airports to focusing on factors such as tourism, regional development, and low-cost carrier services.

The study emphasizes the beneficial influence of promoting competition on airport profitability. To address efficiency challenges, aerodromes are advised to revamp through flexibility, decentralization, attracting more airlines, and implementing tailored pricing structures. Mitigating budgetary risks and combating corruption is imperative for sustained profitability, underscoring the need for careful project management. Tourist destinations with developed infrastructure prove more profitable, emphasizing the importance of enhancing overall infrastructure to attract travelers and boost airport profitability.

# CHAPTER III
# RESEARCH METHODOLOGY

## 3 Overview

In this part of the document, the advancement of the review and the methodologies utilized in data gathering and analysis are outlined. As per Murray and Hughes (2008), "methods" encompass the various techniques applied for data collection and analysis, while "methodology" delineates the broader research approach. Furthermore, there has been a comprehensive discussion about the questionnaire design and the data-gathering techniques utilized.

## 3.1 Rationale of the Study

As per the forecasts by the International Air Transport Association (IATA), India is poised to ascend to the position of the third-largest aviation market globally by 2025, surpassing even the United Kingdom. This remarkable surge in growth can be attributed to the strategic measures laid out in the National Civil Aviation Policy (2016), focusing on bolstering aviation infrastructure through Foreign Direct Investment (FDI) and the expansion of Information Technology (IT) within the sector (Iyer et al., 2021). Presently, India boasts a total of 133 operational airports, comprising 23 international, 100 domestic, and 10 custom airports. The Airports Authority of India (AAI) has ambitious plans to construct an additional 100 airports, heliports, and water dromes across the nation (Airports Authority of India, 2022). However, despite these strides, the average air trips per capita in India remain relatively low at 0.08, and several Indian airports continue to grapple with capacity constraints (Das et al., 2020).

Airports Council International's comprehensive projections for 2021 provide a compelling glimpse into the future trajectory of the aviation sector, particularly highlighting the rise of emerging economic powerhouses within the Asia-Pacific region, notably China and India. These forecasts unveil a strategic realignment that envisions both nations attaining prominent positions within the global aviation arena by 2040, alongside established players such as Japan and

Indonesia. Impressively, this coalition of aviation forces is anticipated to jointly manage nearly 40% of the worldwide passenger traffic, underscoring their pivotal influence on shaping the industry's landscape. Furthermore, when analyzing the annual rhythm of aircraft movements, China is poised to lead with a robust 23%, trailed by the United States at 16%, while India commands a notable 4%, signifying the expanding horizons of these aviation giants on the global stage (Airports Council International, 2021). This projection underscores the dynamic and transformative role that India, along with its Asian counterparts, is set to play in the evolving aviation domain.

### 3.2 Business Problem Statement

The inefficient use of resources and its consequent influence on the effectiveness and performance of public-private partnership (PPP) metropolitan airports in India have raised concerns and attracted scholarly scrutiny. Several research papers have delved into this issue, shedding light on the complexities and implications of underutilization within the aviation context.

A research conducted by (Ramadurai et al., 2017) entitled "Assessment of Indian airports' performance: An analysis using data envelopment" investigates the operational effectiveness of Indian airports, encompassing those functioning under PPP models. The study underscores the significance of resource optimization and utilization in bolstering airports' overall performance, stressing the necessity of addressing underutilization to enhance efficiency.

**“Underutilization of resources is impacting efficiency and performance of PPP metropolitan airports in India.**

Similarly, the work of (Tewari et al., 2020) in their paper "Performance Evaluation of Indian Airports Using Data Envelopment Analysis: A Comparative Study" underscores the correlation between resource utilization and airport performance. The study explores the efficiency of Indian airports, considering factors such as passenger and cargo throughput, aircraft movements, and infrastructure utilization, which are all interconnected with the issue of underutilization.

Addressing the specific context of PPP airports in India, a paper by (Ghosh et al., 2018) titled "Operational efficiency evaluation of Indian airports: An implementation of data envelopment analysis scrutinizes the operational effectiveness of diverse Indian airports, encompassing those managed under PPP agreements. The study highlights that optimal utilization of resources is crucial for achieving operational excellence, particularly in the PPP model where effective resource management is a shared responsibility.

Furthermore, research by (Singh et al., 2021) in their article "Analysis of Indian Airport Infrastructure and Its Impact on Air Traffic Management" explores the connection between airport infrastructure and air traffic management, emphasizing how underutilization of airport resources can lead to congestion and inefficiencies in the broader airspace management system.

These research papers collectively underscore the significance of addressing the underutilization of resources in PPP metropolitan airports in India. They emphasize the importance of optimizing resource allocation to enhance efficiency, operational performance, and the overall competitiveness of these airports within the global aviation landscape.

### 3.3 Research Problem

**There is a need for study to find Interrelationship of tangible and intangible resources with performance of PPP metropolitan airports in India.**

### 3.4 Research Questions

1. What are the barriers responsible for underutilization of resources of PPP metropolitan airports in India?
2. What is the interrelationship of tangible and intangible airport resources with performance and efficiency of PPP metropolitan airports in India?
3. What is the linkage between barriers and prospective solutions to remove the barriers?

### 3.5 Statement of Research Objectives

1. To identify the barriers responsible for underutilization of resources of PPP metropolitan airports in India.

2. To study the interrelationship of tangible and intangible airport resources with performance and efficiency of PPP metropolitan airports in India.
3. To develop a linkage framework to improve the performance of PPP metropolitan airports in India.

## 3.5 Research Design

The term "research" pertains to the "systematic and scientific exploration for relevant information on a specific topic." According to (Kothari, 2019), research design is defined as the "arrangement of conditions for data collection and analysis in a manner that aims to balance relevance to the research purpose with procedural efficiency." (Fagade, 2011) categorizes investigation into three types based on its aims: exploratory, illustrative, or interpretive. An exploratory examination is performed to explore and investigate problem-related domains, offering a preliminary comprehension of the topic to match the study's objectives. Illustrative research aims to illustrate and scrutinize the attributes of individuals, occurrences, or circumstances. Conversely, interpretive studies concentrate on issue resolution and establishing causal links between factors.

Investigative methodologies may be either qualitative or quantitative, contingent upon the methods employed for data gathering and analysis. Quantitative research utilizes questionnaires as data collection techniques and employs statistical analysis to handle numerical data. As per (Bell et al., 2007), quantitative research adopts a deductive approach entailing hypothesis testing. In contrast, qualitative study does not rely on statistical techniques or quantification; it is an inductive approach primarily focused on exploratory research and theory generation. Qualitative data is often gathered through contextual investigations or semi-structured interviews.

This study adopted an exploratory approach to thoroughly examine the factors hindering the optimal utilization of resources in PPP metropolitan airports in India. Furthermore, to understand the intricate connections between tangible and intangible airport resources and their impact on the performance and efficiency of PPP metropolitan airports, we employed an explanatory approach.

By combining these two approaches, we aimed to achieve a robust and comprehensive understanding of the research problem, facilitating a well-rounded exploration of the topic. Figure 3.1 and Figure 3.2 depict the research methodology.

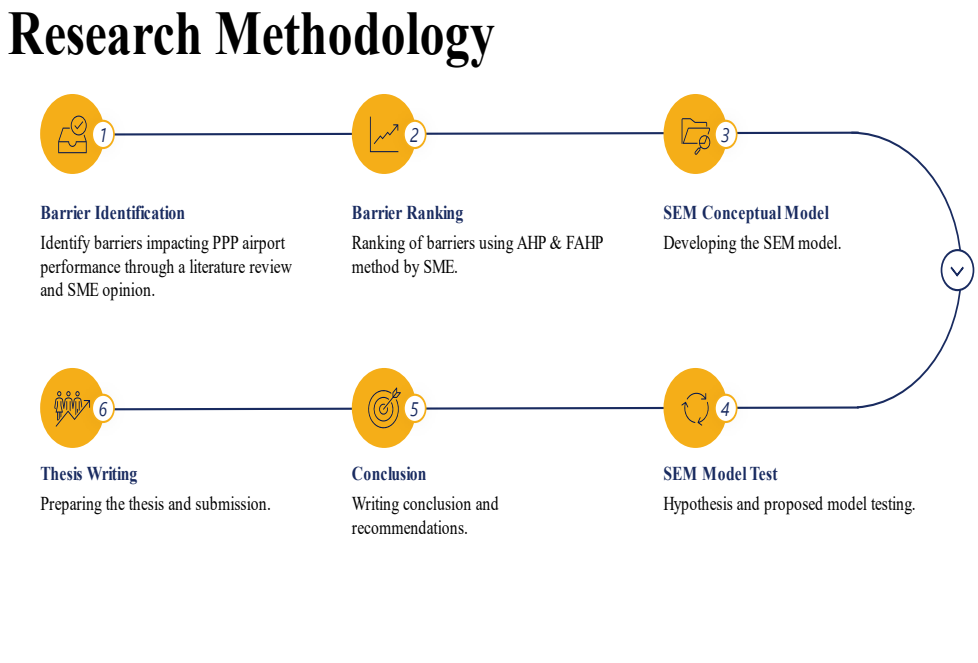


Figure 3.1: Research Process Flow

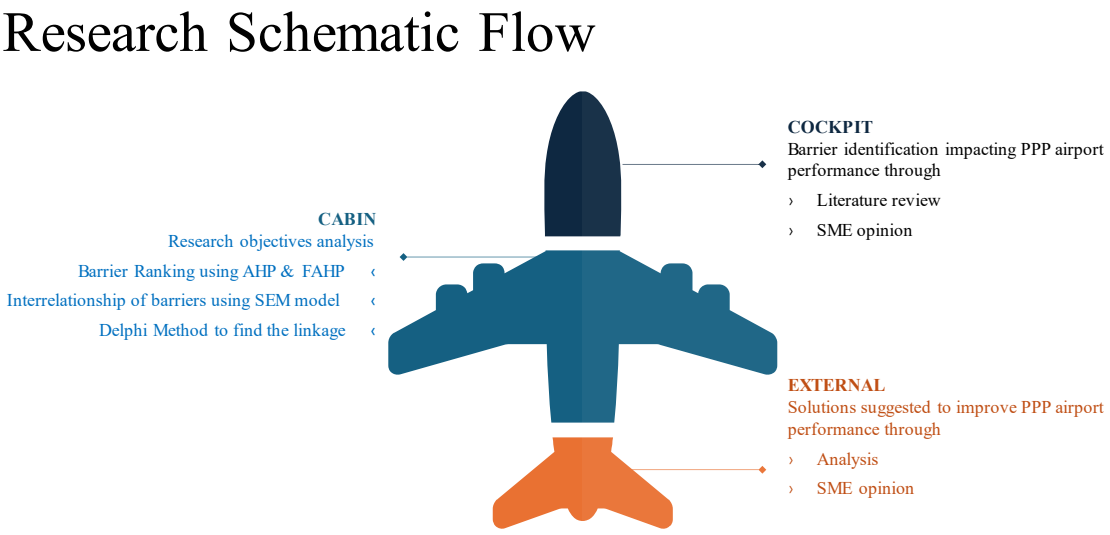


Figure 3.2: Diagrammatic Flowchart

This research significantly enhances our comprehension of the multifaceted barriers contributing to the suboptimal utilization of resources within Public-Private Partnership (PPP) metropolitan airports in India. The study delves into the intricate dynamics between tangible and intangible resources, exploring their collective impact on the performance of PPP airports. To establish a comprehensive understanding, insights from subject matter experts representing airports, airlines, and ground-handling organizations were meticulously gathered to discern and prioritize the identified barriers.

The investigative approach employed a diverse set of methodologies, encompassing expert opinion, comprehensive questionnaires, comprehensive examination of current literature and survey findings, and immersive field visits. These methodologies were strategically chosen to pinpoint and dissect the barriers that significantly affect PPP airport performance.

**Step 1**

Drawing upon the wealth of information garnered from these sources, the study meticulously categorizes the identified barriers into distinct groups, namely:

- Non-Hub Status
- Inadequate Non-Aeronautical Revenue Generation
- Congestion
- Seasonality
- Airport Location and Size
- Airport Ownership Form
- Regulatory Challenges
- Managerial Skills
- Competition
- Low-Cost Carrier Operations
- Airline Market Power & Airport-Airlines Arrangements

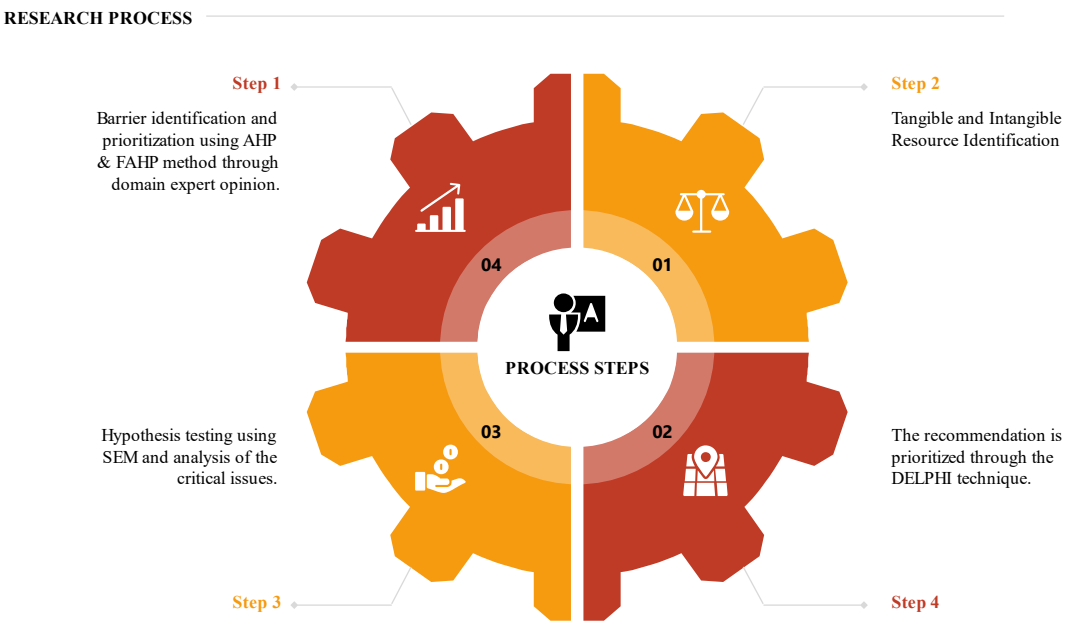


Figure 3.3: Research Process Steps

**Step 2**

The importance of various issues was assessed by subject matter experts, who evaluated their significance and impact on airport operations and management. According to experts, Airport Ownership Form and Regulatory Challenges emerge as pivotal domains demanding focused attention. It has been verified by these experts that these areas are critical, requiring prioritization to delve into the subfactors contributing to inefficiencies. Identifying and addressing these subfactors can be instrumental in enhancing the general performance of Public-Private Partnership (PPP) airports within India.

**Step 3**

Employing the robust methodology of the Structured Equation Model (SEM), a sophisticated multi-variate approach, this study meticulously examined the intricate interrelationships between tangible and intangible resources, dissecting their combined impact on the performance of Public-Private Partnership (PPP) airports in India. Rigorous testing of hypotheses using SEM not only confirmed the validity of the proposed model but also solidified the understanding of how these resources significantly shape overall performance. The testing process,

marked by a meticulous evaluation, culminated in the refinement of the final model. This refined model encapsulates the nuanced dynamics and intricate connections between tangible and intangible resources, supplying an exhaustive framework for comprehending and enhancing the effectiveness of PPP airports in India.

**Step 4**

In this phase, we proactively propose comprehensive strategies to address the intricate challenges that impact the performance of Public-Private Partnership (PPP) airports. The approach involves a thorough validation of SEM analysis outcomes through the robust application of the DELPHI technique. Experts involved in this process identify multifaceted dimensions wherein regulatory adjustments, ownership structures, operational frameworks, management methodologies, and concession agreements emerge as potent catalysts for transformative change.

The optimization of operational efficiency, a paramount consideration, is achieved through meticulous attention to infrastructure optimization, technological advancements, and the provision of state-of-the-art facilities. This strategic optimization leads to streamlined processes, the mitigation of operational bottlenecks, and an overall elevation in airport performance. Additionally, the development of tangible resources triggers a paradigm shift in passenger experiences, a crucial component for achieving success in aviation. The impact of these tangible resource enhancements plays a pivotal role in reshaping and significantly enhancing the overall passenger journey.

## 3.6 Research Methodology

Outlined below are the concise steps undertaken to accomplish Research Objectives 1 and 2:

### 3.6.1 RM for Research Objective 1

To acquire deeper perspectives into the structure of airport effectiveness and to recognize prevailing challenges, a comprehensive exploratory research

approach was employed. The data collection process involved conducting expert interviews, field visits, and extensive literature reviews.

The steps taken to achieve Research Objective 1 (RO1) are as follows:

- Detailed Literature Review: A thorough and in-depth review of relevant literature was conducted to gather comprehensive information and insights related to airport performance and associated challenges.
- Unstructured Interviews with Aviation Professionals: Informative and open-ended interviews were conducted with experts and professionals in the aviation industry. This approach allowed for the collection of valuable qualitative data and firsthand experiences.
- Questionnaire Preparation based on Literature Review and Unstructured Interviews: Drawing from the insights gathered through the literature review and unstructured interviews, a well-structured questionnaire was carefully designed.
- Utilization of a 5-point Likert Scale: We used a Likert scale with 5 points when formulating the questionnaire to ensure the effectiveness and uniformity of responses.
- Pilot Testing with Diverse Participants: Before the finalization of the questionnaire, a pilot test was conducted with a diverse group of participants, including 3 academicians and 5 aviation professionals. This test helped identify any potential issues with the questionnaire and ensured its appropriateness and relevance.
- Finalization of Questionnaire: After incorporating feedback from the pilot test, the questionnaire was refined and finalized, ready for widespread data collection.

**Fuzzy AHP**

As per traditional set theory, an element's inclusion is symbolized by binary expressions 1 or 0, indicating True or False, respectively. To address vulnerability and uncertainty in dynamic decision-making processes, Zadeh (1975) introduced Fuzzy logic. Fuzzy sets, a superset of classical sets, allow for real unit intervals between 0 and 1 to depict continuous assessments.

Fuzzy logic acknowledges that not everything can be simply classified as 1s or 0s, and there may exist values in between. Different kinds of membership functions, including triangular, sigmoid, trapezoidal, and orthogonal, are employed in fuzzy theory. However, the triangular membership function is the most used by researchers. Triangular Fuzzy Numbers (TFN) (l, m, n) represent fuzzy values, where l indicates a lower value, m represents a medium value, and n represents a higher value, hence $l \leq m \leq n$.

In the context of AHP (Analytic Hierarchy Process), its subjective nature and use of linguistic inputs introduce imprecision (Raghuvanshi, 2018). To address this imprecision, The Fuzzy AHP technique offers a more precise and logical depiction of one criterion's performance over another (Kashav, 2022), making the decision-making process more effective with expert opinions.

By combining fuzzy set theory with AHP, the Fuzzy AHP method tackles the challenge of dealing with subjective or ambiguous data sets that cannot be effectively handled by deterministic models (Hamzeh, 2019).

The Triangular Fuzzy Scale is utilized to indicate the experts' evaluation of significance levels. The FAHP technique follows the stages outlined below:

- Stage 1: The pairwise comparison matrix obtained in Step 1 of the AHP technique is employed to verify the coherence of expert assessments and guarantee robust decision-making.
- Stage 2: The values within the matrix are substituted with corresponding Triangular Fuzzy Numbers (TFNs), which offer a more nuanced representation of uncertainty and imprecision in decision-making processes.
- Stage 3: Subsequently, the geometric average of the fuzzy weights is determined, serving to amalgamate the diverse viewpoints and preferences garnered.
- Stage 4: Defuzzification is carried out to derive the relative non-fuzzy load of each model (Mi), followed by the estimation of standardized loads for each rule (Ni).

Utilizing the values of Ni, rankings are established. Mi is derived through the normalization of fuzzy numbers, while Ni is computed from the non-fuzzy Mi values. This approach facilitates a thorough and reliable analysis of the decision-making process. By adhering to these rigorous procedures, the study offers an extensive and intricate comprehension of the airport performance framework and associated challenges, thereby contributing significant insights to the domain.

### 3.6.2 RM for Research Objective 2

To ensure robustness in Research Objective 2 (RO2), a Descriptive Research approach was undertaken to thoroughly analyze the identified issues. For data collection, we distributed a Survey Questionnaire via Google Forms, utilizing purposive sampling to select a representative sample of 276 participants.

The following steps were followed to achieve RO2:

- Administering Questionnaires to the Respondents: The survey questionnaires were disseminated to the selected participants to gather relevant data.
- Expert Consultation for Collecting Responses on Issue Significance: Expert consultation was sought to collect valuable responses on the significance of issues concerning PPP airport performance, augmenting the quality and depth of insights.
- Reliability Test of Questionnaire Responses using Cronbach's Alpha: To ensure the consistency and reliability of the questionnaire responses, Cronbach's Alpha was utilized to assess the internal consistency of the data.
- Testing of Model Fit: The data was subjected to rigorous testing to assess how well the proposed model fits the observed data, providing confidence in the model's accuracy.
- Development of Final Model: Based on the analyzed data and tested model fit, the final model was developed to represent the relationship between variables accurately.

- Hypotheses Testing: The formulated hypotheses were subjected to rigorous testing to determine their validity and significance in the context of the research.

By meticulously adhering to these robust steps, the research aimed to provide comprehensive and reliable insights into the analyzed issues, thereby contributing valuable knowledge to the field of study.

### 3.7 Conceptual Model

The model-building approach in this study is grounded in a well-defined research strategy, commencing with a conceptual model that outlines the relationships under investigation. The dependent and independent concepts are precisely defined and supported through a comprehensive literature survey to establish the theoretical constructs within the conceptual model, which serves as a simplistic representation of the relationships to be studied.

To examine these structural relationships, the research employs structural equation modeling, a multivariate statistical analysis approach. After conceptual definition, the model addresses the empirical issues, employing specific multivariate techniques to fulfill the research objectives.

For this study, two key constructs, namely External Environmental and Institutional resources were identified, and data collected from an expert panel comprising executives and managers as specified in the sampling frame. The internal consistency of variables was assessed through reliability analysis, ensuring the robustness of the measurements. Additionally, validity checks were performed using factor analysis to ensure the accuracy and appropriateness of the constructs.

The conceptual model as shown in Figure 3.4 was tested using structural equation modeling (SEM) with PLS software, enabling a thorough analysis of the relationships, and providing valuable insights into the research problem. Based on the output of the analysis, pertinent suggestions and recommendations will be presented, contributing to the advancement of knowledge in this field.

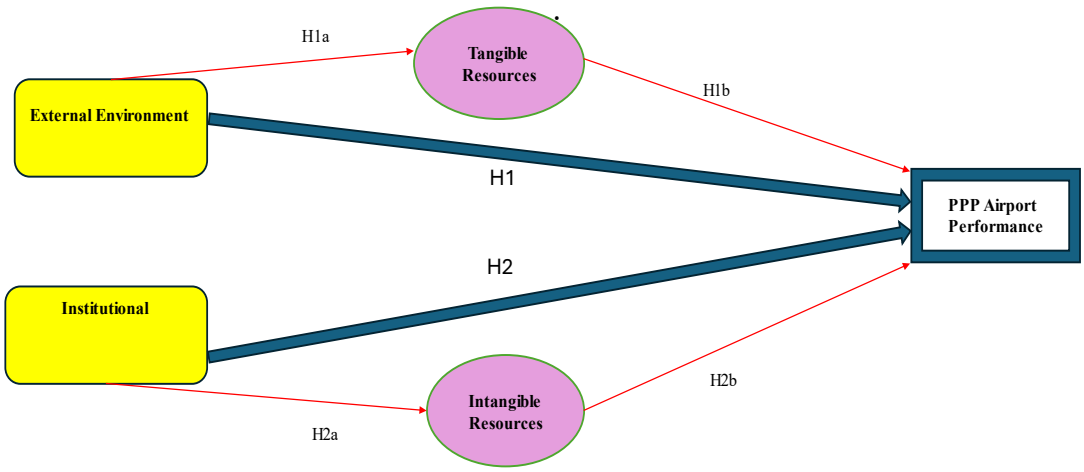


Figure 3.4: Conceptual Model and Hypothesis

Source: Author

## 3.8 Research Hypotheses

The formulation of the following hypotheses was driven by an extensive literature review (refer to chapter 2) and the identification of issues related to the efficiency and performance of PPP airports.

H1: External Environment will have a positive effect on the PPP airport performance.

H2: Institutional Resources will have a positive effect on the PPP airport performance.

H1a: External Environment will have a positive effect on the Tangible Resources

H1b: Tangible Resources will have a positive effect on the PPP airport performance.

H2a: Institutional Resources will have a positive effect on Intangible Resources

H2b: Intangible Resources will have a positive effect on the PPP airport performance.

## 3.9 Data Collection

The success or failure of research often hinges on the data and its collection, making it crucial to select an appropriate methodology for data gathering. In this study, a combination of primary and secondary sources was employed to gather information. The primary data was collected through a questionnaire that incorporated the variables identified during the literature review.

To ensure comprehensive data coverage, over 550 questionnaires were distributed, yielding 340 responses. After removing 64 surveys due to missing information, a total of 276 questionnaires were analyzed. The high response rate indicates a strong representation of the sampled population.

The primary data from the questionnaire was automatically transferred to an Excel document and then manually entered an SPSS (SPSS Inc.) database for further analysis. Standard data validation and authentication processes, including range, distribution, and handling of missing values, were diligently carried out to ensure data accuracy and reliability.

By utilizing both primary and secondary sources and employing robust data collection and validation techniques, this study aims to ensure the integrity and validity of the research findings.

## 3.10 Questionnaire as Survey Instrument

### 3.10.1 Development of Survey Questionnaire

Designing the questionnaire was a careful and considered process, aiming to achieve precision and consistency in responses. To operationalize the constructs for measurement and ensure standardized questions, the questionnaire was crafted following the guidance of (Martin, 2006). Various aspects were considered, including the sequence of questions, the phrasing of both questions and response categories, the administration technique, and the survey introduction and explanation.

In alignment with the research objectives focused on identifying issues and their implications for PPP airport performance in India, the questionnaire was developed to gather qualified feedback through a survey. To provide a broader

scope check on relevance, a five-point Likert scale (ranging from Strongly Disagree-1 to Strongly Agree-5) was employed. The use of closed-ended questions, which were succinct and easy to process, predominated, while some open-ended questions allowed for detailed responses or a wide range of feedback.

Research findings have indicated that a five-point Likert scale reduces respondent frustration and enhances response quality and rate (Babakus et al., 1992). Moreover, five-point scales have demonstrated higher reliability levels compared to seven-point scales (Jenkins et al., 1977), facilitating meaningful comparisons with other studies. Based on this evidence, the decision was made to employ the five-point scale for this research.

To ensure the questionnaire's face and content validity, feedback was sought from three academicians and five respondents from the aviation industry. Their input led to improvements in both the syntax and semantics of the questionnaire language, as well as the presentation of questions, enhancing the questionnaire's precision in eliciting responses. The questionnaire design was aligned with the formulated hypotheses and crafted to avoid biased opinions while maintaining relevance.

By taking these rigorous steps in designing the questionnaire, the research aimed to gather high-quality data that could effectively address the research objectives and contribute valuable insights to the study of PPP airport performance in India.

**Section I: General Information of the Respondents**

In this pivotal section, we meticulously gathered essential details from the respondents, including their names, gender, age, education level, area of work, and relevant experience in the field. To ensure the accuracy and relevancy of the data, we utilized a well-structured nominal category scale.

**Section II: External Environment Impact on Airport Performance**

Within this segment, we delved into responses concerning various parameters related to the external environment, employing a robust 5-point Likert scale

(ranging from 1 = Strongly Disagree to 5 = Strongly Agree). This method facilitated comprehensive feedback, offering valuable insights into how the external environment impacts airport performance.

**Section III: Institutional Resources' Impact on Airport Performance**

In this section, we gathered responses related to diverse parameters concerning institutional performance, employing the same reliable 5-point Likert scale (ranging from 1 = Strongly Disagree to 5 = Strongly Agree). Through this approach, we gained a thorough understanding of the role and significance of institutional resources in shaping airport performance.

**Section IV: The Impact of Tangible Resources on Airport Performance**

Within this vital section, we collected feedback on various tangible resources, utilizing the consistent 5-point Likert scale (ranging from 1 = Strongly Disagree to 5 = Strongly Agree). This robust approach enabled us to comprehensively assess the influence and effects of tangible resources on airport performance.

**Section V: The Impact of Intangible Resources on Airport Performance**

This segment focused on gathering responses related to the impact of various intangible resources, also utilizing the reliable 5-point Likert scale (ranging from 1 = Strongly Disagree to 5 = Strongly Agree). By adopting this scale, we gained profound insights into the influence of intangible resources on the research subject.

Through the incorporation of these comprehensive sections and the consistent use of the 5-point Likert scale for data collection, our research aims to yield robust and valuable data, effectively addressing the study's objectives and providing meaningful contributions to the field of airport performance analysis.

### 3.11 Administering of Survey Questionnaire for Collection of Responses

Creating and administering a questionnaire are both crucial steps to achieve precise research data and ensure that the survey objectives are met effectively. To maintain consistency, the questionnaire was thoughtfully designed, and reliable statistical techniques were employed for analysis.

The reliability of a measurement procedure refers to its consistency, and indices of reliability gauge the extent to which the scores obtained through estimation methods can be reproduced (Oliver, 2000). By focusing on questionnaire consistency and employing reliable statistical techniques, we aimed to enhance the quality and accuracy of the research data obtained from the survey.

### 3.12 Sampling

The sampling strategy and sample size are determined based on the research objectives and available resources. The selection of a sample, which is a subset of the population, is carried out to represent a larger population, and its representativeness relies on the sampling methodology, sample size, and response rate (Acharya, 2013). The sample design is the researcher's method for selecting items to be included in the sample and must be determined before data collection.

Sampling approaches fall into two categories: probability and non-probability sampling. In the probability approach, samples are chosen in a way that each member of the population has an equal chance of being included. On the other hand, non-probability sampling relies on the researcher's judgment, where items are selected based on subjective decisions. Non-probability samples may lack the same level of statistical regularity found in probability samples, leading to potential bias or personal elements. Therefore, careful consideration is essential to minimize errors or bias in the chosen sampling technique.

In specific research scenarios, where the researcher is interested members of the sample population or seeks respondents who can provide valuable information regarding the research objectives, non-probability sampling is utilized. Additionally, non-probability sampling can be practical in exploratory research situations where the objective is to determine the existence or absence of a problem. However, caution is necessary, as non-probability sampling can increase uncertainty and bias in representing the entire population.

Selecting a sample from the relevant sector is crucial because each sector faces unique challenges. By focusing on a sector-specific sample, the researcher can gather specific feedback and address gaps in knowledge within that sector. In

this study, respondents were drawn from various players in the aviation industry, chosen for their knowledge and experience in identifying challenges and problems within the sector. Purposive sampling was used to select respondents aligned with the research objectives and their roles in the aviation domain. This approach ensured the precise identification of critical areas requiring further exploration and resolution.

### 3.12.1 Target Population

For this study, respondents were carefully chosen based on their extensive knowledge, expertise, and competency in the aviation domain, with a particular emphasis on airport and airline operations. Given the research's focus on PPP airport performance in India, it becomes imperative to gain a comprehensive understanding of the key stakeholders involved in airport and ground operations and seek their valuable insights and opinions. By selecting respondents with relevant expertise, we aimed to gather informed and insightful perspectives on the subject matter, thus enhancing the depth and robustness of the research findings.

### 3.12.2 Sampling Unit and Techniques

In this study, a non-probability sampling strategy was employed, specifically the purposive sampling method, to collect information. Purposive sampling was chosen as the most suitable approach since the data was gathered exclusively from individuals engaged in the aviation domain. The respondents were carefully selected to ensure they have significant experience in handling airport and airline operations, including roles such as airport authority personnel, senior airline executives, airport managers, air cargo warehouse managers, senior managers, and Ground Handling managers. The criterion for selection required respondents to possess at least 3 years of experience in their respective roles. By utilizing purposive sampling and targeting individuals with extensive expertise and experience in the aviation industry, the research sought to gain valuable and nuanced insights, enhancing the overall robustness and depth of the study's findings.

### 3.13 Sample Size

The sample frame was specifically designed to target managers, senior officials, and executives involved in the aviation industry, whether directly or indirectly. These individuals were chosen because of their in-depth knowledge of their businesses' internal operations and their understanding of airport operations' impact on performance enhancement.

Given the significance of sample size in statistical techniques, careful consideration was given to determine the appropriate size (Hair, 2007). For a population of 10,000, a suggested sample size is 370, representing approximately 3.7 percent of the population (Krejcie et al., 1970). Previous studies using a similar data collection method in apparel manufacturing reported sample sizes ranging from 118 (Priyadarshi, 1996) to 246 (Lin et al., 1995), with response rates ranging from 32.5 percent to 48 percent (ZuHone et al., 1995; Kincade et al., 1993).

Following guidelines suggested by (Kline, 2005) and (Comrey, 1992) for Structural Equation Modeling (SEM), a sample size of 100 is considered small, 100-200 is medium, and 300 is considered a good sample size. According to (Malhotra, 2020), for SEM, the minimum sample requirement is 200 if the number of constructs is less than or equal to 5, each independent variable under each construct is greater than or equal to 3, and the variable commonalities are greater than 0.5. Considering these factors and the requirement of having at least 10 times the number of perceptions as the number of independent factors, the sample size for this study was estimated to be 230, which meets the requirements of the SEM technique. The actual sample size for the study is 276, which exceeds the minimum requirement of 230 and provides robustness to the SEM analysis.

The final survey questionnaires were carefully prepared, and responses were collected to assess the questionnaire's relevance on a five-point Likert scale (ranging from 1 = Strongly Disagree to 5 = Strongly Agree). This approach enabled the researchers to obtain valuable feedback and insights, ensuring the questionnaire's effectiveness and alignment with the research objectives.

## 3.14 Proposed Research Method and Techniques

The data underwent a comprehensive analysis with the objective of obtaining the desired outcomes. Various alternative techniques were employed to review and evaluate the collected data, aligning with the research goals and addressing the research questions (RQs).

**Structural Equation Modelling (SEM)**

Structural Equation Modelling is a multivariate technique which incorporates measured and latent variables (Thakkar, 2013).

SEM is an analytical tool to detect the interrelationship among variables similar to factor analysis (Weston et al., 2006)**.**

Structural Equation Modeling (SEM) is a powerful Multi-Criteria Decision Making (MCDM) technique utilized to analyze and enhance logistics distribution performance. It is a sophisticated multivariate analysis method that examines structurally related relationships. SEM involves a multi-step procedure, including Factor analysis and various Regression tests, to estimate and demonstrate relationships between latent constructs and observed variables. This analysis technique is favored by researchers due to its ability to handle multiple interconnected dependencies in a single analysis.

SEM models are categorized into two types:

1. Measurement models: These models elucidate the theory, indicating the number of factors, the relationships between various indicators and the factors, and the associations among indicator errors.
2. Structural models: These models depict the relationships between endogenous (dependent) and exogenous (independent) variables, as well as how different factors interact with each other. Establishing an acceptable measurement model is a prerequisite before estimating and interpreting the structural relationships between latent variables.

Latent variables can be either endogenous or exogenous. Endogenous variables are influenced by other variables in the model and are synonymous with dependent, criterion, or outcome variables. Exogenous variables, on the other

hand, are not influenced by other variables and are referred to as independent, predictor, or causal variables. As a result, SEM is also known as causal modeling since it tests proposed causal relationships using this technique.

Assumptions in SEM:

1. Linearity: Endogenous (dependent) and Exogenous (independent) variables have a linear relationship.
2. Outlier: Data should be free of outliers.
3. Sequence: The cause should precede the effect. Endogenous and exogenous variables should have a cause-and-effect relationship.
4. Uncorrelated Error Terms: All error terms are assumed to be uncorrelated with each other.
5. Data: SEM requires interval-level data.

Path models in SEM:

Path models visually represent the hypotheses and variable relationships examined in SEM (Hair et al., 2011; Hair et al., 2011). These models are established based on theory, with measurement theory defining how each construct is measured and structural theory specifying the relationships between constructs in the structural model (Hair et al., 2014).

**Steps in Structural Equation Modelling:**

**Step 1: Model Specification** - Developing the theoretical model defining variables and their relationships based on existing literature and theory.

**Step 2: Model Identification** - Associate measured variables with constructs and created a path diagram for the measurement model.

**Step 3: Model Estimation** - Estimating the theoretical model parameters to fit the observed covariance matrix.

**Step 4: Model Testing** - Analyzing the structural and measurement model to verify observed variables' alignment with latent variables.

**Step 5: Model Modification** - Converting the measurement model into a structural model based on the proposed theoretical model.

**Step 6: Model Validation** - Assessing the structural model's validity using goodness-of-fit indices and examining the significance, direction, and size of structural parameter estimates. If the model is valid, conclusions and recommendations can be drawn, otherwise, the model should be refined and tested with new data (Thakkar, 2013).

### 3.15 Delphi Method

The Delphi technique harmonizes insights from multiple experts who are unable to convene in person, fostering a platform for input, discussion, and critique. The initial notable application of this approach occurred during the 1950s when the Rand Corporation employed it for collaborative decision-making. Dalkey and Helmer further employed the technique to establish collective agreement on policy matters without necessitating physical committee meetings, thereby circumventing potential negative group dynamics that can impede an in-person decision-making process (Thompson et al., 2002). The Delphi methodology entails a structured group communication process that enables individual participants to comprehensively articulate their viewpoints on a complex matter. This approach ensures equitable consideration of opinions, aiming to achieve a shared consensus regarding the specific issue at hand (Rowe et al., 1991). This approach has found versatile application across various fields, encompassing disciplines such as urban system planning, the amalgamation and formulation of public policies, research and development within market contexts, strategic planning for expansive projects, and the innovative creation of novel products (Dalkey et al., 1963).

#### 3.15.1 Expert Selection Process

The process of selecting experts relied on two main channels: exhaustive desk research conducted primarily through LinkedIn, and leveraging the personal networks cultivated by the authors. The objective was to assemble a diverse panel of experts, thus mitigating potential biases and ensuring multifaceted perspectives. To achieve this diversity, experts were sought with a rigorous set of criteria. They were expected to hold academic qualifications and represent pivotal stakeholders, including the Airport Authority of India, regulatory bodies

(such as DGCA officials), senior executives from leading airlines, and department heads (Vice Presidents) of ground-handling organizations.

The collective experience of the selected experts in the aviation sector averaged 20 years, with individual experiences spanning from a minimum of 10 to over 30 years. Notably, 39% of the panelists were female, reflecting a commitment to gender diversity. For a comprehensive overview, Table 3.2 delineates the segmentation of panelists by industry segment and job level.

Table 3.1: Industry segment experts count.

| **Area/Industry Segment** | **Numbers** |
|---|---|
| Academia | 2 |
| Airport Authority of India (AAI) | 4 |
| DGCA (Regulator) | 3 |
| Airline | 2 |
| Ground Handling Organizations | 2 |
| Airport Managers | 5 |

An array of Delphi techniques has emerged alongside the traditional method, as documented by Linstone and Turoff (Rowe & Wright, 2011). In this study, we employed a two-round Delphi technique. Given that the primary research objective did not entail achieving consensus among all experts, we deliberately restricted the Delphi process to two rounds. While additional rounds, numbering three or more, were deemed unlikely to enhance the quality of findings, they could have amplified the risks associated with research fatigue and panelist dropout. Therefore, we limited the rounds to minimize potential panel turnover and ensure sustained engagement.

Experts systematically evaluated the impact of a positive External Environment, Institutional Resources, and both tangible and intangible resources on PPP airport performance in India, utilizing a 7-level Likert scale. The first round spanned from March 2023 to April 2023, with the second round taking place between July 2023 and August 2023. To optimize participation rates, at least one email reminder was dispatched to contacts for each round.

## Summary

This chapter articulates the research objectives and meticulously formulates research questions stemming from the identified problem statement. The study rigorously navigates through the logical underpinnings, encompassing philosophical assumptions, scientific paradigms, the chosen scientific approach, research methodology, and the overarching research design. Furthermore, the chapter provides an in-depth exploration of the employed data collection methods, with a specific emphasis on questionnaire administration. A comprehensive exposition is presented on the methodologies implemented to uphold the quality of the research, elucidating the sample adequacy test, reliability testing, and measures to ensure stability in the research findings.

# CHAPTER IV
# DATA ANALYSIS AND FINDINGS

## 4 Overview

This section provides a thorough and robust evaluation of the collected data, drawing insights from a diverse pool of sources. These include input from survey participants and industry experts, such as airport managers, airline station heads, ground handling operations staff, administrative managers, and academic professionals. The involvement of these individuals spans both direct and indirect roles in airport operations. The analytical process is conducted with a high level of precision and utilizes advanced statistical tools, namely SPSS 22.0, PLS-SEM, and MS Excel, with the resulting findings presented comprehensively.

The data analysis employs a suite of sophisticated statistical methods and instruments, including reliability and validity tests, and SEM with CFA, AHP, and FAHP. This ensures a robust and well-rounded examination of the information.

The structured sequence of analysis unfolds as follows:

- Identification and Ranking of Barriers: AHP and FAHP techniques are applied to systematically identify and rank barriers.
- Verification of Model Fit and Hypotheses: Structural equation modelling is utilized to rigorously verify the goodness-of-fit of the final model and test hypotheses.
- Validation and Linkage Framework Establishment: The findings undergo a robust validation process, integrating insights from the DELPHI method to create a comprehensive linkage framework. This approach adds depth and reliability to the overall analysis, ensuring that the results are both robust and nuanced.

## 4.1 Identification of Barriers impacting PPP airport performance

The investigation into barriers impacting the performance of Public-Private Partnership (PPP) airports in India was a comprehensive endeavor that entailed an in-depth examination of the existing literature. The objective was to discern and elucidate impediments that play a role in influencing the performance of airports operating under the PPP model, alongside addressing challenges within the realm of fast-moving consumer goods distribution.

Figure 4.1 serves as a visual representation of the efficiency barriers identified through a meticulous synthesis of insights gleaned from previous studies. Moreover, these barriers are enriched with valuable perspectives obtained through feedback from domain experts. This collective expertise is comprised of 276 professionals from the aviation industry, offering practical insights, and a select group of academicians providing theoretical perspectives. This amalgamation of industry expertise and academic insight ensures a robust and multifaceted understanding of the identified barriers, contributing to a more nuanced comprehension of the challenges faced in PPP airport performance in the Indian context.


Figure 4.1: Efficiency Barriers affecting PPP airport performance.

## 4.2 List of Criteria and Sub-Criteria

In pursuit of a comprehensive understanding of airport resources, insights from experts were solicited to categorize them into tangible and intangible domains. This categorization was meticulously extracted from an exhaustive literature review, ensuring a thorough and informed classification. The consensus among these experts solidifies the assertion that these two criteria stand out as exceptionally crucial factors influencing airport performance.

The experts not only acknowledged the significance of tangible and intangible resources but also emphasized their pivotal role in studying the intricate relationships that exist among the external environment, institutional resources, and the performance of airports operating under the Public-Private Partnership (PPP) framework (Figure 4.2). By identifying these criteria as paramount, the study gains depth, providing a robust foundation for exploring the multifaceted dynamics that contribute to PPP airport performance. The synergistic integration of expert perspectives not only fortifies the study's credibility but also enriches it, fostering a more robust understanding of the intricate and dynamic interplay between resources and performance in the domain of airport management.

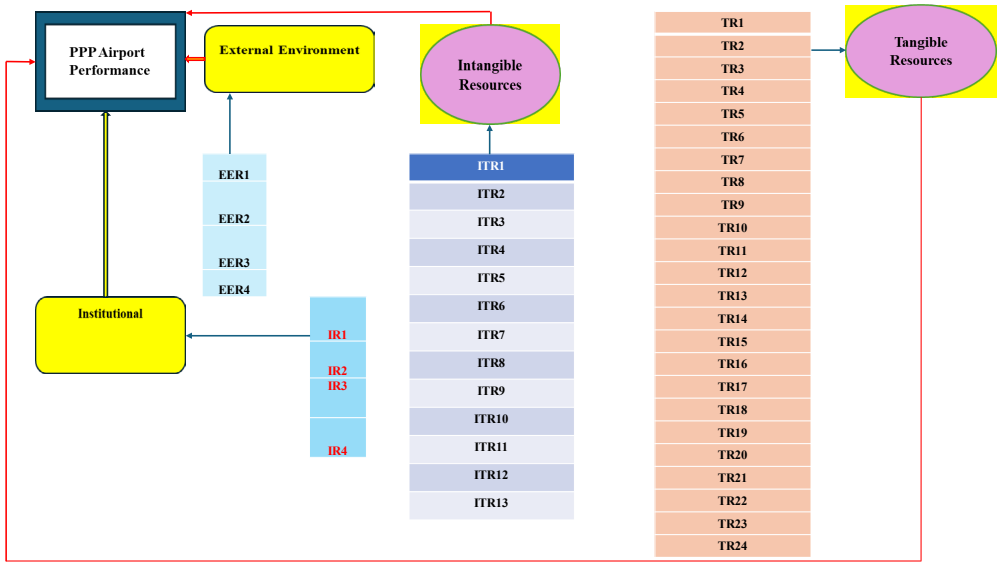


Figure 4.2: Graphical representation of constructs identified.

## 4.3 Sampling

A meticulously crafted sample frame was devised with a specific focus on individuals holding key roles in airport management, including airport managers, senior officials from the Airport Authority of India, as well as executives in the airline and ground handling sectors. This inclusive selection targeted those directly or indirectly engaged in airport operations, such as airline managers, cargo terminal executives/managers, and ramp operations staff. The rationale behind this targeted approach was to ensure a comprehensive understanding of airport flight operations, coupled with an intimate knowledge of the resources employed in managing both airport operations and flight handling.

The distribution of more than 550 questionnaires yielded a substantial response of 340, yet a discerning approach led to the exclusion of 64 surveys due to missing information. The subsequent in-depth analysis focused on 276 questionnaires, a number that not only reflects a robust dataset but also signifies a commendable response rate. This high level of engagement enhances the study's reliability and establishes it as a representative snapshot of the intended population. Data handling and validation procedures were meticulously executed. The questionnaire responses were initially automated into an Excel document and subsequently manually entered an SPSS (SPSS Inc.) database. This multi-step process ensured thorough validation, encompassing checks for data range, distribution patterns, and identification of missing values. These stringent measures contribute to the overall robustness of the dataset, affirming the integrity and accuracy of the information gathered for subsequent analysis.

### 4.3.1 Demographic Segmentation

This segment offers a thorough and robust exploration of the demographic attributes exhibited by the survey participants, presenting an intricate breakdown of this information in Table 4.1. Out of the 276 respondents, 61% identified as male, while 39% were female. The employment status of the participants revealed that a substantial majority were engaged in full-time employment. The age distribution of respondents showcased diversity, with

51% falling within the 20–40 years range, 41% in the 41–50 years bracket, and 8% in the 51–60 years category.

Significantly, most participants were affiliated with the airport and airline sectors, underscoring their intimate familiarity with the resources that impact PPP airport performance in India. It is noteworthy that the survey encompassed personnel from all four metropolitan airports, ensuring a representative sample from diverse operational settings within the airport and airline domains.

Moreover, the participants in this study are characterized by their professional standing, with extensive knowledge, expertise, and proficiency in their respective fields. This collective wealth of experience enhances the robustness of the survey data, as it is derived from individuals well-versed in the intricacies of airport and airline operations.

Table 4.1: Demographic profile of respondents

| Variable | Category | Response % |
|---|---|---|
| Gender | Male | 61 |
| | Female | 39 |
| Age Group | 20 - 40 years | 51 |
| | 41 - 50 years | 41 |
| | 51 - 60 years | 8 |
| Experience | 0 - 10 years | 49 |
| | 11 - 20 years | 33 |
| | 21+ years | 18 |

The analytical findings are robustly conveyed through graphical representations, with a deliberate emphasis on the utilization of pie charts for their efficacy in providing a nuanced examination and visual representation of the data. Figure 4.4 intricately details the demographic profile concerning age groups, ensuring a visually compelling and thorough portrayal of the respondent landscape.

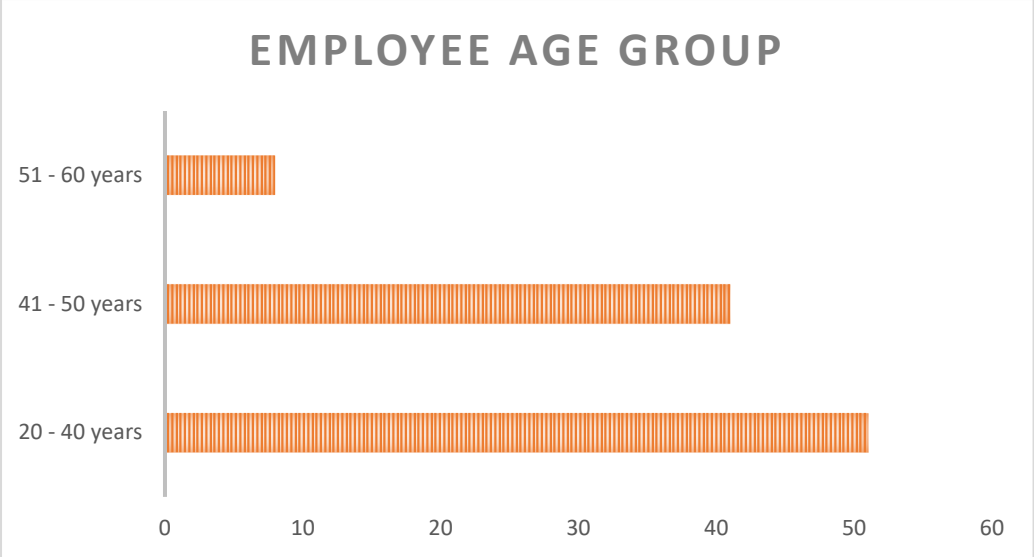


Figure 4.3: Distribution of respondents' percentages based on age categories.

A comprehensive understanding of the respondent's level of experience holds paramount importance in gauging the reliability and nature of the insights provided. The accumulated experience of the respondents serves as a valuable indicator, suggesting a level of dependability in the information contributed. To offer a detailed portrayal of the respondent landscape, Figure 4.5 meticulously delineates the respondent profile, specifically focusing on the distribution of years of experience. This visual representation not only enhances the robustness of the analysis but also provides a nuanced insight into the diverse levels of expertise within the surveyed cohort.

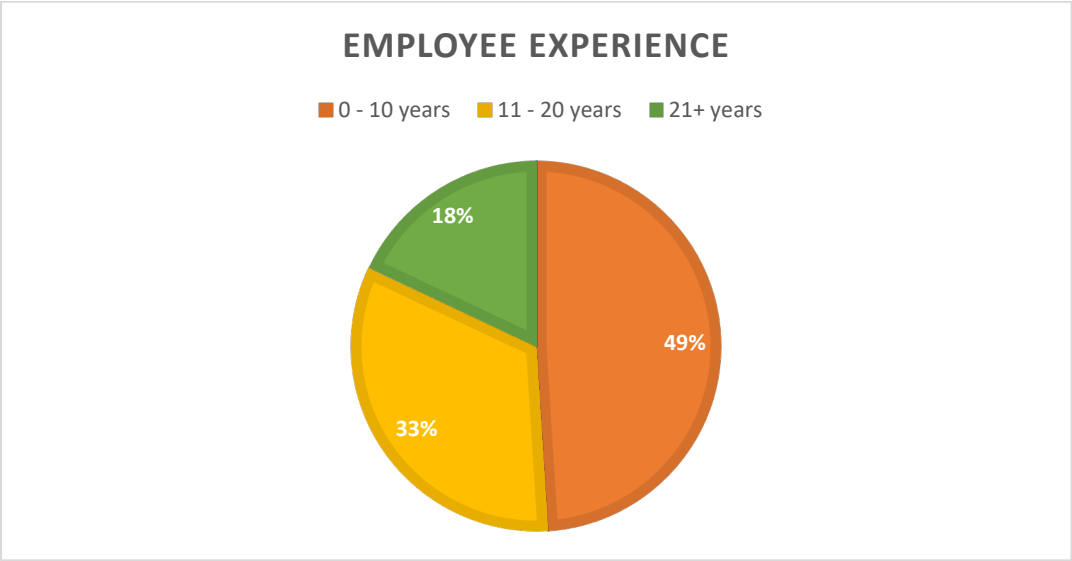


Figure 4.4: Experience Distribution Percentage

### 4.3.2 Sample Adequacy Evaluation

The determination of the sample size is a nuanced process shaped by various pivotal factors, including the intricacies of the chosen research method, the model's complexity in terms of the number of factors under consideration, temporal and resource constraints, completion rates, and insights derived from the sample sizes utilized in preceding studies (Memon, 2020). This meticulous consideration of multiple variables contributes to a robust and well-informed decision-making process regarding the appropriate sample size for the study.

It is crucial to emphasize that, in this context, the methodology employed for gathering information takes precedence. The approach is decidedly intentional, prioritizing strategic selection over the indiscriminate pursuit of a larger sample size. This deliberate strategy not only bolsters the statistical significance of the study but also ensures methodological rigor, aligning the sample size with the specific research objectives and the intricacies of the analytical model. The result is a study characterized by both statistical validity and methodological soundness, fostering confidence in the reliability of the findings.

### 4.3.3 Study Tools

The statistical analysis in this study is purposefully twofold: firstly, to robustly identify and articulate the pivotal barriers significantly influencing the operational performance of Public-Private Partnership (PPP) airports in India; secondly, to construct a comprehensive model unravelling the intricate dynamics between tangible and intangible resources and their consequential impact on PPP airport performance.

To ensure the integrity of this endeavor, the survey is meticulously structured into four distinct and strategically aligned segments, each intricately woven into one of the study's five hypotheses. The foundational segment captures essential demographic information, encompassing respondents' names, work experience, gender, age, and education. Following this, subsequent segments delve into critical aspects, involving four items each on External Environment (EER) and Institutional Resources (IR) that exert influence on airport performance.

The robustness of the survey is underscored by the stringent evaluation process applied to all items, utilizing a five-point Likert scale ranging from 1 (indicating strong disagreement) to 5 (indicating strong agreement). The formulation of survey items stems from a thorough review of pertinent literature, fortified by seeking expert input to ensure the content validity of these items. Collaborating with two industry professionals and three academic experts proved instrumental, resulting in the refinement of questionnaire items. This iterative process involved clarifying ambiguous questions, refining sentence structures, eliminating redundancies, and judiciously incorporating pertinent items to precisely align the questionnaire with the study's objectives.

The iterative feedback process significantly contributed to elevating the questionnaire's conciseness and specificity, effectively aligning it with the overarching goals of the study. The finalization of items, guided by expert-recommended revisions, now accurately captures the nuanced intricacies of the respective study concepts, thereby enhancing the overall robustness of the research methodology.

### 4.3.4 Data Collection

The data collection process was meticulously designed to shed light on the operational intricacies of four major metropolitan airports in India—namely, DIAL, MIAL, BIAL, and HIAL— collectively managing an annual traffic of approximately 147 million air passengers. Comprehensive insights were sought from a diverse spectrum of employees operating within these airport environments. Furthermore, input was actively sought from employees of the Airports Authority of India and DGCA officials directly involved in shaping aviation policies.

To visually represent the geographical distribution of responses, Figure 4.6 offers a breakdown based on regions. An extensive effort was made, involving the distribution of over 550 questionnaires. The robust response yielded 340 completed surveys; however, due to missing data, 64 surveys were excluded, leaving a meticulously analyzed set of 276 questionnaires. This curation ensures

a high-quality dataset, enhancing the survey's representativeness and reliability within the sampled population.

The data management process was thorough, involving the automated transfer of responses to an Excel document and subsequent manual entry into a database maintained by SPSS (SPSS Inc.). To ensure data integrity, standard validation procedures, including checks for range, distribution, and missing values, were rigorously executed. In this hybrid research study, the data collection instrument comprised closed-ended questions embedded within a self-administered questionnaire. The surveys were efficiently disseminated through the internal mail systems of participating organizations, ensuring a streamlined and uniform approach. Importantly, participation was entirely voluntary and without remuneration, with employees dedicating their working hours to completing the questionnaire.

To validate the proposed speculative model fit, the collected data underwent a rigorous examination using Partial Least Squares Structural Equation Modeling (PLS-SEM). This advanced analysis adds a layer of robustness to the research, ensuring a thorough and methodologically sound exploration of the study's objectives.

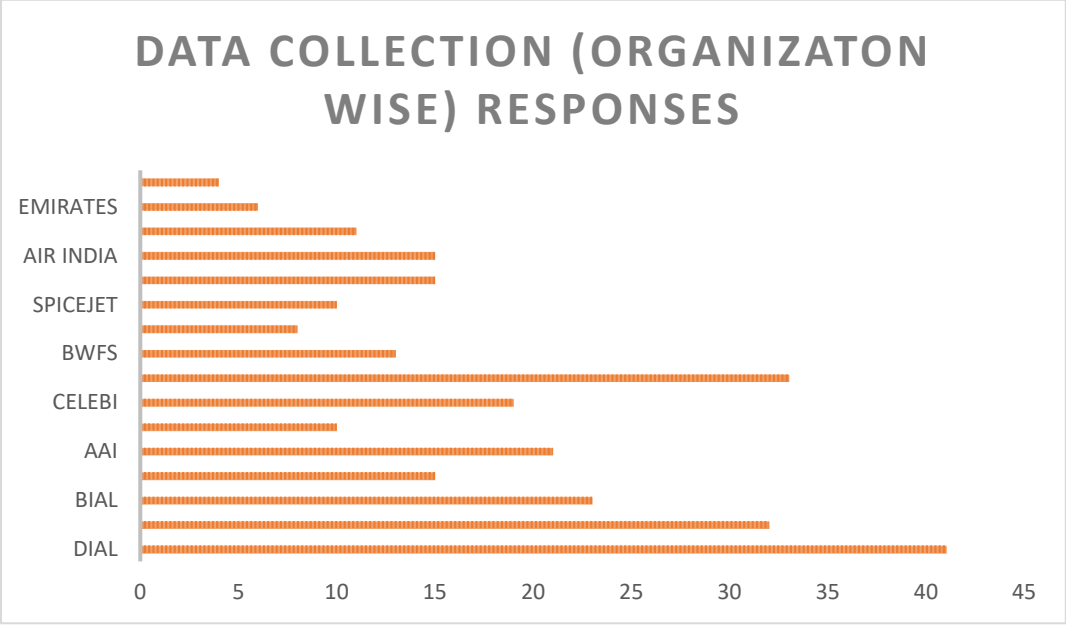


Figure 4.5: Organizational Response Breakdown

## 4.4 Data Collection & Analysis for RO1

The AHP and FAHP method was used to analyze and quantify the rank of the barriers. A fuzzy triangular scale facilitated the ranking of the barriers shown as HNS to AMP. Airport management would benefit from the study as it would ease the decision-making process within the organization.

Table 4.2 shows the efficiency barriers that impact PPP airport performance.

Table 4.2: Efficiency Barriers – PPP Airport

| Notations | Barriers | Description | Reference |
|---|---|---|---|
| HNS | Non-Hub Status | An international major hub airport is more efficient as compared to regional or non-hub airports. Such airports generally lack in terms of air traffic movements and passengers handled. Moreover, prominent airlines either consolidate their operations or relocate to efficient hub airports | Barros et al., (2008). Liu, (2016). Chang et al., (2016). Sarkis, (2000). Fan et al., (2014). |
| INA | Inadequate Non-Aeronautical Revenue Generation | Commercial revenue endeavors would determine an airport's ability to attract investors. Inability to generate viable income sources would lead to a decline in efficiency level detrimental to airport expansion. Non-aeronautical ventures are vital for executing infrastructure projects that require substantial capital essential for airport expansion. | Güner et al., (2022). Olfat et al., (2016). Adler et al., (2013). Wang et al., (2020). Chae et al., (2016). Tovar et al., (2009). |

| | | | |
|---|---|---|---|
| CNG | Congestion | Congestion or capacity constraint results in lowering aeronautical charges under a single-till approach. Delays due to congestion hurt operating profits. Congested airports tend to be monopolistic, while airlines operating at these airports compete under oligopolistic environments. | Zhang et al., (2010). Yang et al., (2011). Adler et al., (2018). Pels et al., (2004). |
| SSN | Seasonality | Traffic volume during peak or lean season drastically affects airport efficiency making it a prominent contributory factor to many studies. Disruptions arising due to unforeseen circumstances during the peak season may adversely affect airport traffic. | Tsekeris, (2011). Georgopoulos et al., (2020). Pyrialakou et al., (2012). Gitto et al., (2012). Graham et al., (2015). |
| ALS | Airport Location and Size | Airport size directly impacts efficiency and performance. Airports located in metropolitan cities are generally served by wide-body aircraft operated by popular carriers making them efficient. | Yilmaz et al., (2022). Bazargan et al., (2003). Fragoudaki et al., (2016). Merkert et al., (2012). Wanke, (2013). Martín et al., (2009). |
| AOF | Airport Ownership Form | The ownership form is critical for making an airport efficient. Airports' marginal revenues and profit | Ülkü et al., (2022). Oum et al., (2008). |

| | | | |
|---|---|---|---|
| | | maximization are significantly affected by ownership form. There is no clear consensus among scholars on the most appropriate form of the governance model. | Kutlu et al., (2016). Chwiłkowska et al., (2020). In et al., (2017). Pagliari et al., (2019). Carnis et al., (2013). Fung et al., (2008). |
| RGC | Regulatory Challenges | Regulatory framework and diverse forms of regulatory constraint impact airport efficiency. Price regulation varies from country to country. In terms of regulations, heavier-handed airports tend to be less efficient. | Cambini et al., (2022). Zhang et al., (2008). Assaf et al., (2012). Adler et al., (2014). Babatunde et al., (2015). Littlechild, (2012). |
| MGS | Managerial Skills | Dynamic managerial skills and capabilities facilitate resource allocation and improve competencies. Manager's ability to identify opportunities leads to innovation and creativity within an organization. Constantly shifting managers adversely affects airport performance and efficiency. | Pacheco et al., (2003). Ripoll et al., (2021). Helfat et al., (2015). Derwik et al., (2016). |
| CMP | Competition | The level of competition has a significant effect on the | Chi-Lok et al., (2009). |

| | | | |
|---|---|---|---|
| | | airport productivity level. The source of competition may vary to include high-speed rail and interregional coach transportation. Moreover, overlapping catchment areas generally have a positive impact on airport efficiency. | Merkert et al., (2014). D'Alfonso et al., (2015). Scotti et al., (2012). Ha et al., (2013). |
| LCC | Low-Cost Carrier Operations | Restructuring and realigning airport infrastructure to cater to LCC needs may lead to an increase in traffic volume, thereby improving airport efficiency by limited use of airport resources. LCC also helps to promote local or regional tourism. Although, there is a tradeoff between aeronautical and commercial revenue due to LCC operations. | Bottasso et al., (2013). Choo et al., (2013). Zuidberg, (2017). Graham et al., (2007). Lei et al., (2010). Ngo et al., (2019). |
| AMP | Airline Market Power & Airport-Airlines Arrangements | The airline-airport contract may take diverse forms and plays a considerable part in determining the level of efficiency. The undesirable side effects of vertical arrangements can be countered by encouraging competition among airports and airlines. | Nerja, (2022). Fu et al., (2017). D'alfonso et al., (2014). Starkie, (2012). Zhang et al., (2012). |

Source: Author

## 4.5 Research Methodology

Methodological analysis depicted for barrier identification and ranking of key elements impacting the PPP airport efficiency and performance is shown in Figure 4.6.

AHP method is often used to assist decision-making in a crisp and changing environment by analyzing qualitative and quantitative data sets proposed by Saaty, (1980). To overcome the limitations associated with the AHP method, (Garg, Sharma, & Goyal, 2017; Kumar, Tiwari, & Kansara, 2021; Prakash & Barua, 2015) recommended the use of the FAHP technique. In this study, efficiency barriers were categorized and examined using both methods.

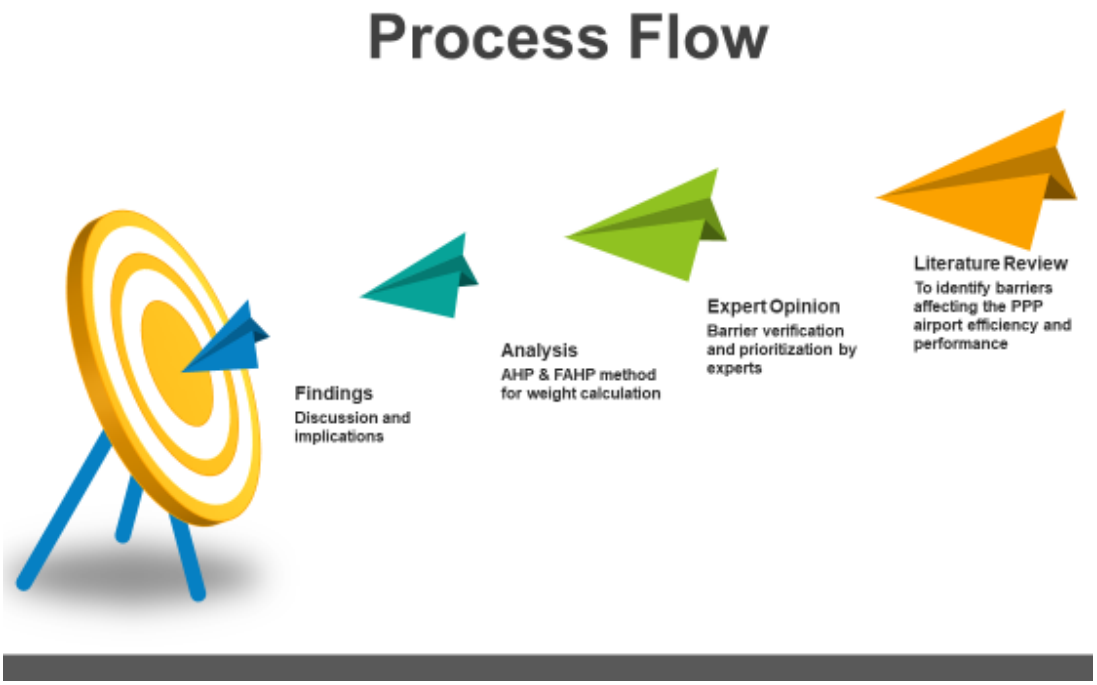


Figure 4.6: Process Flow for the Analysis

Source: Author

The convenient sampling method was undertaken to collect responses from the experts. The primary focus was on getting relevant and meaningful information from these professionals (Govindan, K., & Murugesan, 2011). To rank and compute the correlation among the identified two variables, Spearman's correlation coefficient technique was applied.

### 4.5.1 The Analysis

Table 4.3 presents the TFNs (Triangular Fuzzy Numbers) used for evaluating the criteria under the AHP and Fuzzy AHP methods.

Table 4.3: Importance level for AHP/FAHP

| **Preference rating** | **TFNs** |
|---|---|
| Equal Importance | (1,1,1) |
| Extremely Low Importance | (1,2,3) |
| Very Low Importance | (2,3,4) |
| Low Importance | (3,4,5) |
| Average Importance | (4,5,6) |
| High Importance | (5,6,7) |
| Moderately High Importance | (6,7,8) |
| Very High Importance | (7,8,9) |
| Extremely High Importance | (8,9,9) |

Source: AHP and Fuzzy AHP analysis (Kumar et al., 2018).

### 4.5.2 AHP Technique

Computing and classification of barriers were carried out using the AHP method. The steps are mentioned as follows:

Table 4.4 represents the normalized weights of the key criteria.

Table 4.4: Normalized Weights of the key criteria (AHP)

| | HNS | INA | CNG | SSN | ALS | AOF | RGC | MGS | CMP | LCC | AMP |
|---|---|---|---|---|---|---|---|---|---|---|---|
| HNS | 0.0256 | 0.0231 | 0.0160 | 0.0177 | 0.0203 | 0.0363 | 0.0268 | 0.0198 | 0.0421 | 0.0357 | 0.0179 |
| INA | 0.1538 | 0.1385 | 0.1596 | 0.1597 | 0.1627 | 0.1453 | 0.0938 | 0.1982 | 0.1474 | 0.1429 | 0.1434 |
| CNG | 0.0513 | 0.0277 | 0.0319 | 0.0266 | 0.0203 | 0.0415 | 0.0313 | 0.0248 | 0.0421 | 0.0536 | 0.0239 |
| SSN | 0.0769 | 0.0462 | 0.0638 | 0.0532 | 0.0814 | 0.0581 | 0.0469 | 0.0495 | 0.0842 | 0.0893 | 0.0358 |
| ALS | 0.0513 | 0.0346 | 0.0638 | 0.0266 | 0.0407 | 0.0484 | 0.0375 | 0.0330 | 0.0632 | 0.0714 | 0.0358 |
| AOF | 0.2051 | 0.2771 | 0.2234 | 0.2662 | 0.2441 | 0.2907 | 0.3753 | 0.2972 | 0.1895 | 0.1607 | 0.2867 |
| RGC | 0.1795 | 0.2771 | 0.1915 | 0.2130 | 0.2034 | 0.1453 | 0.1877 | 0.1982 | 0.1684 | 0.1607 | 0.2151 |
| MGS | 0.1282 | 0.0693 | 0.1277 | 0.1065 | 0.1220 | 0.0969 | 0.0938 | 0.0991 | 0.1263 | 0.1250 | 0.1434 |
| CMP | 0.0128 | 0.0198 | 0.0160 | 0.0133 | 0.0136 | 0.0323 | 0.0235 | 0.0165 | 0.0211 | 0.0357 | 0.0143 |
| LCC | 0.0128 | 0.0173 | 0.0106 | 0.0106 | 0.0102 | 0.0323 | 0.0209 | 0.0142 | 0.0105 | 0.0179 | 0.0119 |
| AMP | 0.1026 | 0.0693 | 0.0957 | 0.1065 | 0.0814 | 0.0727 | 0.0626 | 0.0495 | 0.1053 | 0.1071 | 0.0717 |

Source: AHP analysis

Step-1: Respondents' opinion was used to weigh the pairwise comparison of the criteria.

Step-2: Normalized matrix of the respective criterion is presented in Table 4.4.

Table 4.5: Criteria Weights and corresponding Ranks

| Main Criteria | Criteria Weight | Rank |
|---|---|---|
| HNS | 11.1462 | 10 |
| INA | 11.5356 | 3 |
| CNG | 11.1593 | 9 |
| SSN | 11.2947 | 6 |
| ALS | 11.2127 | 7 |
| AOF | 11.5883 | 2 |
| RGC | 11.6161 | 1 |
| MGS | 11.4795 | 4 |
| CMP | 11.1160 | 11 |
| LCC | 11.1997 | 8 |
| AMP | 11.3901 | 5 |

Source: AHP analysis

Step-3: The normalized weights for the main criteria were calculated and appropriately exhibited in Table 4.4. The table also presents the rank for each criterion. For the key criteria, λ max was estimated to be 11.34, the Consistency Index (CI) is 0.034 and the Consistency Ratio (CR) was calculated to be 0.022. As the value of CR is less than 0.10, the suitability of the data is indicated.

### 4.5.3 Applying FAHP Method

Barriers to efficiency were ranked from HNS (1) to AMP (11) using the Fuzzy AHP method. The steps are enumerated underneath:

Step-1: Computing the standard matrix for pair-wise calculation of the derived criteria.

Step-2: The technique established by (Buckley, 1985; Chang, 1996) was used to calculate the geometric mean of consequent fuzzy weights as reflected in Table 4.5.

Step-3: Fuzzy weight was calculated with the help of an equation recommended by (Ayhan, 2013).

Step-4: Subsequent computing of the comparative non-fuzzy weight (Mi), normalized weights (Ni), and corresponding position (Table 4.5).

Based on the analysis using the FAHP method presented in table 4, the final ranks are AOF>RGC>INA>MGS>AMP>SSN>ALS>CNG>HNS>CMP> LCC. Table 4.5 below presents a comparison of ranks obtained through both AHP and FAHP methods.

Table 4.6: Fuzzy Weights of Geometric Means - $w_l$, $w_m$, and $w_u$

| Criteria | $w_l$ | $w_m$ | $w_u$ | $M_i$ | $N_i$ | Rank |
|---|---|---|---|---|---|---|
| HNS | 0.0141 | 0.0252 | 0.0458 | 0.0284 | 0.0255 | **9** |
| INA | 0.0835 | 0.1434 | 0.2776 | 0.1682 | 0.1510 | **3** |
| CNG | 0.0184 | 0.0336 | 0.0636 | 0.0386 | 0.0346 | **8** |
| SSN | 0.0332 | 0.0620 | 0.1181 | 0.0711 | 0.0639 | **6** |
| ALS | 0.0245 | 0.0455 | 0.0867 | 0.0523 | 0.0469 | **7** |
| AOF | 0.1487 | 0.2583 | 0.4140 | 0.2737 | 0.2457 | **1** |
| RGC | 0.1114 | 0.1986 | 0.3390 | 0.2164 | 0.1942 | **2** |
| MGS | 0.0616 | 0.1144 | 0.2135 | 0.1298 | 0.1166 | **4** |
| CMP | 0.0116 | 0.0194 | 0.0352 | 0.0221 | 0.0198 | **10** |
| LCC | 0.0095 | 0.0149 | 0.0264 | 0.0169 | 0.0152 | **11** |
| AMP | 0.0453 | 0.0845 | 0.1599 | 0.0966 | 0.0867 | **5** |

Source: FAHP analysis

## 4.6 Results and Discussion

Barriers namely Airport Ownership Form (AOF) and Regulatory Challenges (RGC) are among the top-ranked obstacles to PPP airport efficiency in India. Both the researchers (Babatunde et al., 2015; Chwiłkowska et al., 2020) have emphasized the need to adopt a favorable regulatory regime in addition to ownership form that best complements the airport growth. Inadequate Non-aeronautical Revenue Generation (INA) practices and Managerial Skills (MGS) are ranked 3 and 4, hence must be given equal importance by the management

as shown in Table 4.6 and Table 4.7. The barriers at the bottom of the table are Non-Hub Status (HNS), Low-Cost Carriers Operations (LCC), and Competition (CMP) indicating that these were not significant in the Indian context.

Table 4.7: Criteria Weight Ranks for AHP and FAHP (comparison)

| Criteria | For AHP Method | For FAHP Method |
|---|---|---|
| HNS | 10 | **9** |
| INA | 3 | **3** |
| CNG | 9 | **8** |
| SSN | 6 | **6** |
| ALS | 7 | **7** |
| AOF | 2 | **1** |
| RGC | 1 | **2** |
| MGS | 4 | **4** |
| CMP | 11 | **10** |
| LCC | 8 | **11** |
| AMP | 5 | **5** |

Source: AHP and FAHP analysis

Table 4.8: The Potential Criteria in Sequence

| **RANKS** | **CRITERIA** |
|---|---|
| 1,2 | AOF |
| 2,1 | RGC |
| 3 | INA |
| 4 | MGS |
| 5 | AMP |
| 6 | SSN |
| 7 | ALS |
| 8,11 | CNG |
| 9,10 | HNS |
| 10,11 | CMP |
| 11,8 | AMP |

Source: AHP and Fuzzy AHP analysis

Airport Ownership Form (AOF) and Regulatory Challenges (RGC) barriers are the backbones and vital for the growth and sustainability of the Indian PPP airports. The government policy decisions should replicate global best practices to achieve holistic development.

Inadequate Non-aeronautical Revenue generation (INA) is ranked third signifying the need to focus on creating an eco-system that nurtures innovative thinking to achieve path-breaking results and bring in surplus revenues. The outbreak of the Covid 19 pandemic has proved that too much dependence on aeronautical revenues shall be disadvantageous to the airport business.

The efficiency of airports is influenced by regulatory frameworks and a variety of regulatory constraints, as noted by researchers including (Cambini et al., 2022), (Zhang et al., 2008), (Assaf et al., 2012), (Adler et al., 2014), (Babatunde et al., 2015), and (Littlechild, 2012). These studies collectively emphasize the significant impact of regulatory factors on airport operations. It's important to recognize that price regulation can differ significantly from one country to another. Moreover, research indicates that airports subjected to more stringent regulatory oversight often exhibit lower levels of efficiency.

Managerial Skills (MGS) is ranked fourth but still has an enormous impact on airport efficiency and performance. The businesses that can foster rare, inimitable, value-added skills are generally the ones that attain competitive advantage (Barros et al., 2017).

### 4.7 Sensitivity Analysis

Table 4.9: Sensitivity analysis of main criteria with "AOF" criteria weight changes from (0.2457*0.9 … 0.2457*0.1)

| **Barriers** | **Normalized AOF=.2457** | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
|---|---|---|---|---|---|---|---|---|---|---|
| AOF | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| RGC | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| INA | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| MGS | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| AMP | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| SSN | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| ALS | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| CNG | 8 | 8 | 8 | 8 | 8 | 8 | 9 | 8 | 8 | 9 |
| HNS | 9 | 9 | 9 | 9 | 9 | 9 | 8 | 9 | 10 | 8 |
| CMP | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 9 | 10 |
| LCC | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |

Source: Sensitivity Analysis

This study categorized eleven key criteria and out of these eleven, the highly prioritized criteria is the 'Airport Ownership Form (AOF). A slight fluctuation in the weightage of the highly ranked category can influence the rest of the categories (see Table 4.9). For addressing the fluctuations among variables this research applied sensitivity analysis. Therefore, highly prioritized category weightage can be changed from 0.2457 (AOF) to 0.2457*0.9, 0.2457*0.8…. 0.2457*0.1 with values taken to four decimal places.

Refer to Figure 4.7 for sensitivity analysis.

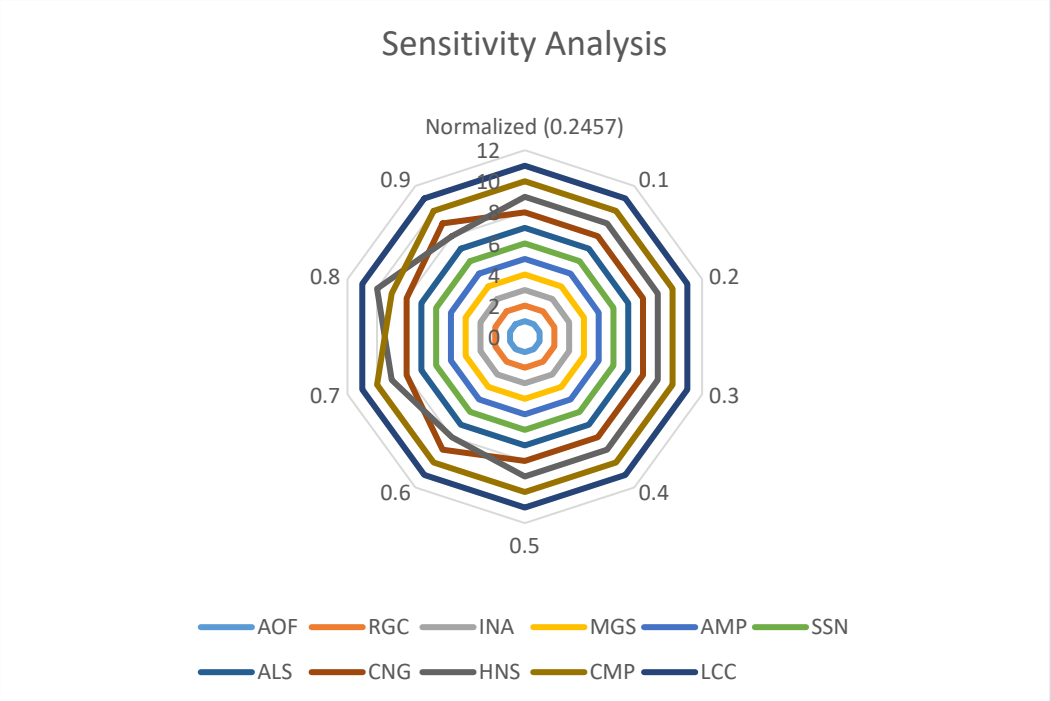


Figure 4.7: Results of sensitivity analysis for criteria

Source: Sensitivity Analysis

## 4.8 Conclusion

The notion behind developing airports under the PPP model in India was to generate additional revenue through private participation to attain growing infrastructure needs which was a challenge for any government. To compete with global airports, prudent and efficient resource allocation is critical, apart from continuous upgrading. Hence, identification and prioritization of key barriers are essential to achieve sustainable growth and improve efficiency and performance. The study adopts a pragmatic exploratory approach to dwell on possible barriers through intense literature review and domain expert opinion. A total of eleven barriers are reported and ranked in this study that must be addressed and mitigated by the airport management to improve efficiency. The results would assist policy-making decisions by the government since the issue necessitates prompt consideration. The top five ranked barriers are Airport Ownership Form (AOF), Regulatory Challenges (RGC), Inadequate Non-aeronautical Revenue Generation (INA), Managerial Skills (MGS), and Airline Market Power & Airport-Airlines Arrangements (AMP).

## 4.9 Data Collection for RO2

Confirmatory Factor Analysis (CFA) plays a pivotal role in validating the measurement model used to assess the relationships between various constructs (Park et al., 2021). The study aims to investigate the impact of the external environment, institutional resources, tangible resources, and intangible resources on the performance of Public-Private Partnership (PPP) airports. The CFA process in this study involves evaluating the extent to which the observed variables or indicators representing these constructs accurately measure the underlying theoretical concepts.

CFA helps determine whether the observed indicators, such as specific metrics or variables related to these constructs, indeed capture the essence of these theoretical concepts (Hoyle, 2000). Factor loadings indicate how strongly each indicator is associated with its respective construct (Brown et al., 2012). A substantial and consistent pattern of significant factor loadings would indicate

that the indicators effectively measure the constructs they are intended to represent (Savalei et al., 2014).

Furthermore, CFA assesses the reliability and validity of the measurement model (Sureshchandar, 2023). Construct reliability indicates whether the indicators consistently represent their corresponding constructs (Hancock et al., 2001). Convergent validity evaluates how well the indicators converge to measure the intended constructs (Carlson et al., 2012). Discriminant validity ensures that the constructs are distinct from one another and not measuring the same underlying concept (Farrell et al., 2009).

This analysis involves a first-order Confirmatory Factor Analysis (CFA) approach. In first-order CFA, each observed variable (indicator) is associated with a single latent construct (factor) (Byrne, 2005). This aligns with the way this study has described the relationships between external environment, institutional resources, tangible resources, intangible resources, and PPP airport performance. Each construct is measured by a set of observed variables, and the focus is on evaluating the measurement model and the relationships between the observed variables and their corresponding latent constructs.

To study the impact of External Environment and Institutional Resources on the PPP airport performance, following section presents the outcome of CFA analysis inclusive of Convergent validity- Outer loadings, Construct Reliability and Validity, AVE, Discriminant Validity and Path Diagram.

### 4.9.1 Outer loadings

Outer loadings play a pivotal role in reflective measurement models, representing the anticipated relationships between latent variables and their corresponding indicators (Hair et al., 2011). They provide valuable insights into the extent of an individual item's contribution to its assigned construct. Essentially, outer loadings highlight the strength of the connection from latent variables to their respective observed indicators (Wong, 2013). In essence, they help gauge how well each indicator represents the underlying construct it aims to measure.

As emphasized by (Hair Jr et al., 2017), outer loadings are essential components in reflective measurement models. These loadings are estimated relationships that showcase the absolute contribution of an item to its associated construct (Henseler et al., 2012). While they are particularly crucial for evaluating reflective measurement models, where latent constructs are measured by observed indicators, outer loadings also find relevance when dealing with formative measures (Hair Jr et al., 2020).

In the context of this analysis, Table 4.9 displays the final outer loadings for items related to first-order reflective constructs. These loadings serve as valuable indicators of the strength and quality of the relationships between latent variables and their respective observed indicators. By interpreting these loadings, you can better understand how well each indicator captures the underlying construct, thereby enhancing the overall assessment of our measurement model.

Table 4.10: Outer Loading Matrix

| **Outer loadings** | | | | | |
|---|---|---|---|---|---|
| **Matrix** | | | | | |
| | External Environment Resources(EER) | Institutional Resources (IR) | Intangible Resources (ITR) | PPP Airport Performance (PAP) | Tangible Resources(TR) |
| EER1 | 0.854 | | | | |
| EER2 | 0.826 | | | | |
| EER3 | 0.880 | | | | |
| EER4 | 0.867 | | | | |
| IR1 | | 0.759 | | | |
| IR2 | | 0.808 | | | |
| IR3 | | 0.794 | | | |
| IR4 | | 0.749 | | | |
| ITR1 | | | 0.697 | | |
| ITR10 | | | 0.698 | | |
| ITR11 | | | 0.779 | | |
| ITR12 | | | 0.789 | | |
| ITR13 | | | 0.733 | | |

| | | | | | |
|---|---|---|---|---|---|
| ITR2 | | | 0.693 | | |
| ITR3 | | | 0.702 | | |
| ITR4 | | | 0.804 | | |
| ITR5 | | | 0.802 | | |
| ITR6 | | | 0.725 | | |
| ITR7 | | | 0.768 | | |
| ITR8 | | | 0.765 | | |
| ITR9 | | | 0.679 | | |
| PAP1 | | | | 0.812 | |
| PAP2 | | | | 0.859 | |
| PAP3 | | | | 0.835 | |
| PAP4 | | | | 0.849 | |
| PAP5 | | | | 0.801 | |
| TR1 | | | | | 0.657 |
| TR10 | | | | | 0.777 |
| TR11 | | | | | 0.765 |
| TR12 | | | | | 0.788 |
| TR13 | | | | | 0.799 |
| TR14 | | | | | 0.712 |
| TR15 | | | | | 0.733 |
| TR16 | | | | | 0.747 |
| TR17 | | | | | 0.733 |
| TR18 | | | | | 0.775 |
| TR19 | | | | | 0.799 |
| TR20 | | | | | 0.754 |
| TR21 | | | | | 0.767 |
| TR22 | | | | | 0.801 |
| TR23 | | | | | 0.689 |
| TR24 | | | | | 0.751 |
| TR3 | | | | | 0.760 |
| TR4 | | | | | 0.785 |
| TR5 | | | | | 0.771 |
| TR6 | | | | | 0.743 |
| TR7 | | | | | 0.814 |
| TR8 | | | | | 0.822 |
| TR9 | | | | | 0.807 |

The presented table demonstrates the outer loadings for various latent constructs within the research model. Outer loadings reflect the strength of the relationships between latent variables and their corresponding observed indicators (Chin et al., 1998). These loadings are crucial for assessing the extent to which each indicator contributes to its assigned latent construct (Götz et al., 2009).

It is evident that several indicators exhibit strong relationships with their respective latent constructs. For instance, in the "External Environment Resources (EER)" construct, indicators such as EER1 (0.854), EER2 (0.826), EER3 (0.880), and EER4 (0.867) display substantial outer loadings, signifying robust connections with the latent variable. Similarly, within the "Institutional Resources (IR)" construct, indicators like IR1 (0.759), IR2 (0.808), IR3 (0.794), and IR4 (0.749) showcase notable loadings, indicating significant relationships with the latent variable. The "Intangible Resources (ITR)" construct demonstrates a range of outer loadings across indicators, suggesting varying degrees of association with the latent variable. Moving to the "PPP Airport Performance (PAP)" construct, indicators such as PAP1 (0.812), PAP2 (0.859), PAP3 (0.835), PAP4 (0.849), and PAP5 (0.801) exhibit considerable outer loadings, denoting substantial connections with the latent variable. Lastly, for the "Tangible Resources (TR)" construct, indicators display diverse loadings, reflecting differing degrees of relationship with the latent variable.

It's important to note that these outer loadings should be evaluated in relation to benchmark values and thresholds typically used in Structural Equation Modeling (SEM). While there isn't a universally defined benchmark value for outer loadings, scholars often suggest considering values above 0.6 or 0.7 as strong indicators of a robust relationship between the indicator and its latent construct (Hindardjo et al., 2022). In summary, these outer loadings provide insights into the strength and significance of relationships between observed indicators and their latent constructs within the research model. These findings contribute to the assessment of the measurement model's validity and reliability (Hair Jr et al., 2020).

The analysis of outer loadings contributes significantly to the understanding of the measurement model's validity and reliability. By revealing the strength of relationships between indicators and latent constructs, this analysis aids researchers in making informed decisions about construct representation and the overall quality of the measurement model. In conclusion, the presented findings demonstrate the importance of outer loadings in assessing the strength of relationships between latent constructs and observed indicators, providing a foundational step in evaluating the measurement model's effectiveness and contributing to the overall robustness of the research framework.

Table 4.11: Outer Loading (Mean/STDEV, T & P Values)

| **Outer loadings** | | | | | |
|---|---|---|---|---|---|
| **Mean, STDEV, T values, p values** | | | | | |
| | Original sample (O) | Sample mean (M) | Standard deviation (STDEV) | T statistics (\|O/STDEV\|) | P values |
| EER1 <- External Environment Resources(EER) | 0.854 | 0.853 | 0.020 | 41.973 | 0.000 |
| EER2 <- External Environment Resources(EER) | 0.826 | 0.825 | 0.025 | 32.632 | 0.000 |
| EER3 <- External Environment Resources(EER) | 0.880 | 0.880 | 0.016 | 55.831 | 0.000 |
| EER4 <- External Environment Resources(EER) | 0.867 | 0.866 | 0.018 | 46.952 | 0.000 |
| IR1 <- Institutional Resources (IR) | 0.759 | 0.755 | 0.042 | 17.989 | 0.000 |
| IR2 <- Institutional Resources (IR) | 0.808 | 0.805 | 0.034 | 23.771 | 0.000 |
| IR3 <- Institutional Resources (IR) | 0.794 | 0.790 | 0.043 | 18.424 | 0.000 |
| IR4 <- Institutional Resources (IR) | 0.749 | 0.754 | 0.022 | 33.887 | 0.000 |
| ITR1 <- Intangible Resources (ITR) | 0.697 | 0.695 | 0.039 | 17.983 | 0.000 |
| ITR10 <- Intangible Resources (ITR) | 0.698 | 0.696 | 0.042 | 16.475 | 0.000 |

| | | | | | |
|---|---|---|---|---|---|
| ITR11 <- Intangible Resources (ITR) | 0.779 | 0.778 | 0.027 | 28.677 | 0.000 |
| ITR12 <- Intangible Resources (ITR) | 0.789 | 0.788 | 0.023 | 34.847 | 0.000 |
| ITR13 <- Intangible Resources (ITR) | 0.733 | 0.732 | 0.035 | 21.201 | 0.000 |
| ITR2 <- Intangible Resources (ITR) | 0.693 | 0.691 | 0.038 | 18.198 | 0.000 |
| ITR3 <- Intangible Resources (ITR) | 0.702 | 0.700 | 0.044 | 16.058 | 0.000 |
| ITR4 <- Intangible Resources (ITR) | 0.804 | 0.803 | 0.029 | 27.884 | 0.000 |
| ITR5 <- Intangible Resources (ITR) | 0.802 | 0.801 | 0.022 | 36.451 | 0.000 |
| ITR6 <- Intangible Resources (ITR) | 0.725 | 0.723 | 0.035 | 20.992 | 0.000 |
| ITR7 <- Intangible Resources (ITR) | 0.768 | 0.767 | 0.025 | 30.901 | 0.000 |
| ITR8 <- Intangible Resources (ITR) | 0.765 | 0.764 | 0.032 | 24.277 | 0.000 |
| ITR9 <- Intangible Resources (ITR) | 0.679 | 0.678 | 0.041 | 16.511 | 0.000 |
| PAP1 <- PPP Airport Performance (PAP) | 0.812 | 0.811 | 0.024 | 33.602 | 0.000 |
| PAP2 <- PPP Airport Performance (PAP) | 0.859 | 0.859 | 0.017 | 49.671 | 0.000 |
| PAP3 <- PPP Airport Performance (PAP) | 0.835 | 0.835 | 0.021 | 40.025 | 0.000 |
| PAP4 <- PPP Airport Performance (PAP) | 0.849 | 0.849 | 0.019 | 44.837 | 0.000 |
| PAP5 <- PPP Airport Performance (PAP) | 0.801 | 0.801 | 0.024 | 33.565 | 0.000 |
| TR1 <- Tangible Resources(TR) | 0.657 | 0.657 | 0.044 | 15.045 | 0.000 |
| TR10 <- Tangible Resources(TR) | 0.777 | 0.776 | 0.028 | 28.029 | 0.000 |
| TR11 <- Tangible Resources(TR) | 0.765 | 0.765 | 0.025 | 31.121 | 0.000 |

| | | | | | |
|---|---|---|---|---|---|
| TR12 <- Tangible Resources(TR) | 0.788 | 0.787 | 0.027 | 29.338 | 0.000 |
| TR13 <- Tangible Resources(TR) | 0.799 | 0.799 | 0.024 | 33.056 | 0.000 |
| TR14 <- Tangible Resources(TR) | 0.712 | 0.712 | 0.034 | 20.903 | 0.000 |
| TR15 <- Tangible Resources(TR) | 0.733 | 0.733 | 0.028 | 26.364 | 0.000 |
| TR16 <- Tangible Resources(TR) | 0.747 | 0.747 | 0.033 | 22.878 | 0.000 |
| TR17 <- Tangible Resources(TR) | 0.733 | 0.732 | 0.033 | 22.427 | 0.000 |
| TR18 <- Tangible Resources(TR) | 0.775 | 0.774 | 0.024 | 31.904 | 0.000 |
| TR19 <- Tangible Resources(TR) | 0.799 | 0.799 | 0.021 | 37.733 | 0.000 |
| TR20 <- Tangible Resources(TR) | 0.754 | 0.753 | 0.029 | 25.567 | 0.000 |
| TR21 <- Tangible Resources(TR) | 0.767 | 0.766 | 0.026 | 29.494 | 0.000 |
| TR22 <- Tangible Resources(TR) | 0.801 | 0.800 | 0.023 | 34.551 | 0.000 |
| TR23 <- Tangible Resources(TR) | 0.689 | 0.688 | 0.037 | 18.753 | 0.000 |
| TR24 <- Tangible Resources(TR) | 0.751 | 0.750 | 0.028 | 27.161 | 0.000 |
| TR3 <- Tangible Resources(TR) | 0.760 | 0.760 | 0.024 | 31.370 | 0.000 |
| TR4 <- Tangible Resources(TR) | 0.785 | 0.784 | 0.026 | 30.264 | 0.000 |
| TR5 <- Tangible Resources(TR) | 0.771 | 0.772 | 0.022 | 35.034 | 0.000 |
| TR6 <- Tangible Resources(TR) | 0.743 | 0.743 | 0.031 | 23.933 | 0.000 |
| TR7 <- Tangible Resources(TR) | 0.814 | 0.814 | 0.020 | 40.894 | 0.000 |
| TR8 <- Tangible Resources(TR) | 0.822 | 0.822 | 0.023 | 35.734 | 0.000 |
| TR9 <- Tangible Resources(TR) | 0.807 | 0.806 | 0.024 | 33.925 | 0.000 |

Table 4.11 above presents the results of various statistical measures for the outer loadings of indicators related to different constructs in the study. These measures include the original sample values (O), the sample mean values (M), the standard deviation (STDEV), the T statistics (|O/STDEV|), and the associated p-values.

The T statistic, calculated as the absolute value of the original sample value divided by the standard deviation, is used to assess the significance of the outer loading (Garson, 2012). A larger T statistic suggests a more significant relationship between the latent construct and its corresponding indicator (Bollen et al., 2000).

*External Environment Resources (EER):*

The outer loading analysis reveals high T statistics and very low p-values for all indicators associated with External Environment Resources. These findings strongly suggest a significant relationship between the latent construct of External Environment Resources and its observed indicators. This aligns with the theoretical expectation that external environmental factors play a crucial role in influencing various aspects of the study.

*Institutional Resources (IR):*

Similarly, the indicators for Institutional Resources exhibit high T statistics and exceptionally low p-values, underscoring the significance of the relationship between Institutional Resources and their observable measures. This outcome is in accordance with the theoretical understanding that institutional factors significantly impact the constructs under investigation.

*Intangible Resources (ITR):*

The outer loading analysis for Intangible Resources also reflects remarkable T statistics and remarkably low p-values across all indicators. This outcome provides strong evidence for the connection between Intangible Resources and their corresponding measures, aligning with the study's theoretical framework emphasizing the role of intangible assets.

*PPP Airport Performance (PAP):*

The findings for PPP Airport Performance are consistent with the other constructs, showing high T statistics and very low p-values. This suggests a robust relationship between PPP Airport Performance and its indicators. It substantiates the notion that the chosen indicators adequately represent the latent construct related to airport performance.

*Tangible Resources (TR):*

Lastly, the indicators associated with Tangible Resources exhibit high T statistics and exceptionally low p-values, which is consistent with the other constructs. This outcome reaffirms the strong relationship between Tangible Resources and their observable indicators. It corroborates the theoretical understanding that tangible assets play a significant role in the context of the study.

Furthermore, all the p-values associated with the T statistics are reported as 0.000, which indicates that all the outer loadings are statistically significant at a very high level of significance. This suggests strong support for the relationships between the latent constructs and their respective indicators. These statistical measures provide evidence of the significance and robustness of the relationships between the latent constructs and their indicators in the measurement model.

### 4.9.2 Construct Reliability and Validity:

The reliability and validity of a research measurement model plays a pivotal role in ensuring the accuracy and credibility of study outcomes. Within this context, the presented Table 4.12 showcases key indicators of the measurement model's reliability and internal consistency. These indicators, including Cronbach's alpha, Composite Reliability, Composite Reliability, and Average Variance Extracted (AVE), offer a comprehensive assessment of the latent constructs and their observed indicators (Hair et al., 2019).

Table 4.12: Construct Reliability and Validity

| CONSTRUCT RELIABILITY AND VALIDITY | | | | |
|---|---|---|---|---|
| | | | | |
| | Cronbach's alpha | Composite reliability (rho_a) | Composite reliability (rho_c) | Average variance extracted (AVE) |
| External Environment Resources(EER) | 0.879 | 0.886 | 0.917 | 0.734 |
| Institutional Resources (IR) | 0.804 | 0.857 | 0.860 | 0.606 |
| Intangible Resources (ITR) | 0.932 | 0.933 | 0.941 | 0.551 |
| PPP Airport Performance (PAP) | 0.888 | 0.890 | 0.918 | 0.691 |
| Tangible Resources(TR) | 0.967 | 0.968 | 0.970 | 0.584 |

- **External Environment Resources (EER):**

The construct "External Environment Resources (EER)" demonstrates strong reliability and validity in this study. The Cronbach's alpha value of 0.879 indicates high internal consistency among the items related to external environment resources. This suggests that the items reliably measure the latent construct of external environment resources. The composite reliability values (rho_a and rho_c) of 0.886 and 0.917, respectively, reinforce the overall reliability of this construct (Hair et al., 2019). Additionally, the Average Variance Extracted (AVE) value of 0.734 indicates that a significant portion of variance is captured by the construct's indicators, supporting convergent validity.

- **Institutional Resources (IR):**

The construct "Institutional Resources (IR)" also demonstrates strong psychometric properties. The Cronbach's alpha value of 0.804 indicates satisfactory internal consistency among the items representing institutional resources. The composite reliability values (rho_a and rho_c) of 0.857 and 0.860 further confirm the construct's reliability (Hair et al., 2019). The AVE value of 0.606 indicates that a substantial portion of variance is explained by the construct's indicators, suggesting convergent validity.

- **Intangible Resources (ITR):**

The construct "Intangible Resources (ITR)" exhibits excellent reliability and validity. The very high Cronbach's alpha value of 0.932 reflects exceptional internal consistency among the items related to intangible resources. The composite reliability values (rho_a and rho_c) of 0.933 and 0.941 signify robust reliability, providing confidence in the construct's measurement (Hair et al., 2019). Despite the lower Average Variance Extracted (AVE) value of 0.551, the construct's strong Cronbach's alpha and composite reliability values indicate convergent validity.

- **PPP Airport Performance (PAP):**

The construct "PPP Airport Performance (PAP)" demonstrates solid psychometric properties. The Cronbach's alpha value of 0.888 indicates good internal consistency among the items representing airport performance. The composite reliability values (rho_a and rho_c) of 0.890 and 0.918 suggest strong reliability of the construct's measurement (Hair et al., 2019). The AVE value of 0.691 indicates reasonable convergent validity, with a substantial amount of variance explained by the construct's indicators.

- **Tangible Resources (TR):**

The construct "Tangible Resources (TR)" showcases exceptional reliability and validity. The very high Cronbach's alpha value of 0.967 highlights remarkable internal consistency among the items related to tangible resources. The composite reliability values (rho_a and rho_c) of 0.968 and 0.970 further

underscore the construct's robust measurement (Hair et al., 2019). Despite the moderate Average Variance Extracted (AVE) value of 0.584, the high Cronbach's alpha and composite reliability values contribute to convergent validity.

In summary, the analysis of Cronbach's alpha, composite reliability, and Average Variance Extracted (AVE) values reveals that the measurement model for all constructs in the study exhibits high internal consistency, reliability, and convergent validity. These psychometric properties enhance the credibility of the study's findings and provide a solid foundation for subsequent analyses and interpretations.

### 4.9.3 Discriminant Validity

Table 4.13: Heterotrait-Monotrait Ratio Matrix

Heterotrait-monotrait ratio (HTMT) - Matrix

| | External Environment Resources(EER) | Institutional Resources (IR) | Intangible Resources (ITR) | PPP Airport Performance (PAP) | Tangible Resources(TR) |
|---|---|---|---|---|---|
| External Environment Resources(EER) | | | | | |
| Institutional Resources (IR) | 0.876 | | | | |
| Intangible Resources (ITR) | 0.587 | 0.659 | | | |
| PPP Airport Performance (PAP) | 0.560 | 0.675 | 0.789 | | |
| Tangible Resources(TR) | 0.624 | 0.764 | 0.862 | 0.775 | |

❖ **Heterotrait-Monotrait Ratio (HTMT) matrix**

The Heterotrait-Monotrait Ratio (HTMT) matrix Table 4.13 is a critical tool for evaluating the discriminant validity of constructs within a study (Henseler, 2017). It accomplishes this by comparing the correlations between constructs (Heterotrait correlations) to the correlations within a single construct (Monotrait correlations). This assessment is crucial in ensuring that the measured constructs are distinct and accurately capture different underlying concepts.

**Analyzing the provided HTMT matrix:**

- The HTMT value between "Institutional Resources (IR)" and "External Environment Resources (EER)" is 0.876, confirming a robust level of discriminant validity (Henseler et al., 2016).
- For "Intangible Resources (ITR)," the HTMT values are 0.587 with "External Environment Resources (EER)," 0.659 with "Institutional Resources (IR)," and 0.789 with "PPP Airport Performance (PAP)." These values are indicative of sound discriminant validity.
- Similarly, for "PPP Airport Performance (PAP)," the HTMT values are 0.560 with "External Environment Resources (EER)," 0.675 with "Institutional Resources (IR)," and 0.862 with "Intangible Resources (ITR)," reflecting sufficient discriminant validity.
- For "Tangible Resources (TR)," the HTMT values are 0.624 with "External Environment Resources (EER)," 0.764 with "Institutional Resources (IR)," 0.862 with "Intangible Resources (ITR)," and 0.775 with "PPP Airport Performance (PAP)," reinforcing the notion of adequate discriminant validity.

These HTMT values align well with the commonly used threshold of 0.85, recommended for assessing discriminant validity (Henseler et al., 2016). The results suggest that the constructs within this study exhibit satisfactory discriminant validity, underscoring their ability to accurately capture distinct underlying concepts.

### 4.9.4 Fornell-Larcker Criterion

Table 4.14: Fornell-Larcker Criterion

| Fornell-Larcker criterion | | | | | |
|---|---|---|---|---|---|
| | External Environment Resources(EER) | Institutional Resources (IR) | Intangible Resources (ITR) | PPP Airport Performance (PAP) | Tangible Resources(TR) |
| External Environment Resources(EER) | 0.857 | | | | |
| Institutional Resources (IR) | 0.800 | 0.778 | | | |
| Intangible Resources (ITR) | 0.536 | 0.625 | 0.742 | | |
| PPP Airport Performance (PAP) | 0.498 | 0.677 | 0.719 | 0.832 | |
| Tangible Resources(TR) | 0.581 | 0.715 | 0.823 | 0.724 | 0.764 |

The Fornell-Larcker criterion serves as a key tool in assessing the discriminant validity of constructs within a structural equation model (SEM) (Hilkenmeier et al., 2020). According to this criterion, the square root of the average variance extracted (AVE) for each construct should be greater than the correlations between that construct and other constructs in the model (Ab Hamid et al., 2017). This ensures that each construct is more strongly related to its own indicators than to other constructs, indicating distinctiveness.

In the provided Fornell-Larcker criterion matrix, (Table 4.14) the benchmark value for discriminant validity is met when the square root of the AVE for a construct is greater than its correlations with other constructs (Fornell & Larcker, 1981). This implies that the construct adequately captures its unique underlying concept and is not overly influenced by other constructs. The benchmark value helps researchers evaluate whether the measurement model's constructs are indeed distinct and separate from one another.

**Upon examining the provided Fornell-Larcker criterion matrix:**

- The square root of the AVE for "External Environment Resources (EER)" is 0.857. This value is greater than the correlations between EER and other constructs, meeting the benchmark for discriminant validity.
- "Institutional Resources (IR)" has a square root of AVE equal to 0.778, which also surpasses its correlations with other constructs, satisfying the Fornell-Larcker criterion.
- For "Intangible Resources (ITR)," the square root of the AVE is 0.742, which is higher than its correlations with other constructs, confirming its distinctiveness.
- "PPP Airport Performance (PAP)" demonstrates a square root of AVE at 0.832, and its correlations with other constructs are lower, meeting the benchmark for discriminant validity.
- The square root of the AVE for "Tangible Resources (TR)" is 0.764. Similarly, its correlations with other constructs are lower, indicating that it fulfills the Fornell-Larcker criterion.

### 4.9.5 Establishment of relationship between External Environment and Institutional Resources & PPP airport performance using Structural equation modelling:

Structural equation modeling is a multivariate statistical analysis technique that is used to analyze structural relationships. This technique is the combination of factor analysis and multiple regression analysis.

In this study PLS-SEM is used in accordance to the study done by Hair et al. (2019) that quotes use PLS-SEM when the structural model is complex and includes many constructs, indicators and/or model relationships, the research objective is to better understand increasing complexity by exploring theoretical extensions of established theories (exploratory research for theory development), distribution issues are a concern, such as lack of normality and also when research requires latent variable scores for follow-up analyses. Since all the aforementioned conditions exist in the current study hence the researcher has used PLS SEM for further analysis. Here PLS SEM has been used to

determine collinearity (VIF value), $R^2$ value, $Q^2$ value to check impact of independent variable (External Environment and Institutional Resources) on dependent variable (PPP airport performance).

The following is the Path diagram showing the relationship between External Environment and Institutional Resources on PPP airport performance.

**Outer VIF Values**

Following Table 4.15 represents Outer VIF values for different constructs. Variance inflation factor (VIF) spots multi-collinearity in regression analysis (O'brien, 2007). Multi-collinearity takes place when there is an association among predictors (i.e., independent variables) in any model; which can adversely affect regression results (Morrissey & Ruxton, 2018).

Table 4.15: Collinearity Statistics (VIF)

| **COLLINEARITY STATISTICS (VIF)** | |
|---|---|
| **OUTER MODEL – LIST** | |
| | VIF |
| EER1 | 2.327 |
| EER2 | 2.010 |
| EER3 | 2.464 |
| EER4 | 2.294 |
| IR1 | 2.121 |
| IR2 | 2.635 |
| IR3 | 3.047 |
| IR4 | 1.143 |
| ITR1 | 2.263 |
| ITR10 | 2.100 |
| ITR11 | 3.565 |
| ITR12 | 2.681 |
| ITR13 | 2.390 |
| ITR2 | 2.058 |
| ITR3 | 2.403 |
| ITR4 | 2.821 |
| ITR5 | 2.747 |
| ITR6 | 2.103 |

| | |
|---|---|
| ITR7 | 3.295 |
| ITR8 | 2.856 |
| ITR9 | 1.877 |
| PAP1 | 1.988 |
| PAP2 | 2.432 |
| PAP3 | 2.379 |
| PAP4 | 2.552 |
| PAP5 | 2.049 |
| TR1 | 2.462 |
| TR10 | 2.865 |
| TR11 | 2.678 |
| TR12 | 3.327 |
| TR13 | 3.580 |
| TR14 | 2.734 |
| TR15 | 2.862 |
| TR16 | 2.880 |
| TR17 | 3.029 |
| TR18 | 3.790 |
| TR19 | 4.313 |
| TR20 | 3.485 |
| TR21 | 3.002 |
| TR22 | 3.299 |
| TR23 | 2.177 |
| TR24 | 2.711 |
| TR3 | 2.534 |
| TR4 | 3.635 |
| TR5 | 3.890 |
| TR6 | 3.492 |
| TR7 | 3.441 |
| TR8 | 3.589 |
| TR9 | 3.324 |

The presented table provides Collinearity Statistics, specifically Variance Inflation Factors (VIF), for the outer model's indicators. VIF is a measure used to assess the degree of multicollinearity among predictor variables in a regression analysis. Here's an interpretation of the table:

VIF values are calculated for each indicator to determine the extent of multicollinearity in the model. Multicollinearity refers to the situation where predictor variables in a regression model are highly correlated with each other, which can lead to issues in interpreting the relationships between variables. Generally, a VIF value greater than 10 is considered a cause for concern, as it suggests high multicollinearity.

In the provided table:

- Most indicators have VIF values well below 10, indicating a relatively low degree of multicollinearity. This suggests that these indicators are relatively independent and do not excessively influence each other.
- Some indicators, however, have VIF values slightly above 3, which might indicate moderate multicollinearity. While these values are not extremely high, researchers should be cautious when interpreting the relationships involving these variables.

Thus, VIF values in the table suggest that the model's indicators have a reasonable level of independence from each other, with most indicators having VIF values that do not raise significant concerns about multicollinearity. Researchers should carefully consider the potential impact of multicollinearity on their analysis and interpretation, especially for indicators with higher VIF values.

### 4.9.6 Model Fit

Table 4.16: Fit Summary

| **FIT SUMMARY** | | |
|---|---|---|
| | Saturated model | Estimated model |
| SRMR | 0.077 | 0.078 |
| Chi-square | 4348.365 | 4546.061 |
| NFI | 0.897 | 0.896 |

The fit summary Table 4.16 provides an assessment of the goodness-of-fit for both the saturated model (a model with perfect fit) and the estimated model (the actual model being evaluated) (Marsh & Balla, 1994). Here's an interpretation of the provided fit summary:

*SRMR (Standardized Root Mean Square Residual):*

Saturated Model: SRMR = 0.077

Estimated Model: SRMR = 0.078

The SRMR measures the discrepancy between the observed correlations and the correlations predicted by the model. A lower SRMR indicates better fit. In this case, both the saturated and estimated models have similar SRMR values, suggesting that the estimated model's fit is relatively close to that of the saturated model (Taasoobshirazi & Wang, 2016).

*Chi-square:*

Saturated Model: Chi-square = 4348.365

Estimated Model: Chi-square = 4546.061

The chi-square test assesses the difference between the observed covariance matrix and the model-implied covariance matrix (Garson, 2013). A lower chi-square value indicates better fit (Moshagen, 2012). In this case, the estimated model has a slightly higher chi-square value compared to the saturated model, indicating that the estimated model's fit is not as good as the perfect fit of the saturated model.

*NFI (Normed Fit Index):*

Saturated Model: NFI = 0.897

Estimated Model: NFI = 0.896

The NFI measures the proportion of the improvement in fit achieved by the estimated model compared to a null model (Moss, 2009). A higher NFI indicates better fit. In this case, both the saturated and estimated models have similar NFI

values, suggesting that the estimated model's fit is comparable to that of the saturated model (Singh, 2009).

Hence, the fit summary indicates that the estimated model's fit is reasonably close to that of the saturated model, as suggested by similar values in SRMR and NFI. However, the chi-square value is slightly higher for the estimated model, indicating that there is room for improvement in capturing the covariance patterns. Researchers should consider these fit indices collectively and in the context of their research goals to determine the adequacy of the model fit.

**R Square value of dependent variables in measurement model:**

Data in Table 4.17 below presents standardized construct of model, R-square and adjusted R-square values. With a regression-based estimated latent variable, the Path approach maximizes $R^2$ in an existing model of dependent latent variables (Agarwal & Chen, 2009). This approach has been reinforced by (Henseler et al., 2012), (Hair Jr et al., 2014). (Lohmöller & Lohmöller, 1989) had introduced it first. By default, this feature exists in SmartPLS.

Table 4.17: R-Square and R-Square Adjusted

| | R-square | R-square adjusted |
|---|---|---|
| Intangible Resources (ITR) | 0.391 | 0.389 |
| PPP Airport Performance (PAP) | 0.624 | 0.618 |
| Tangible Resources(TR) | 0.338 | 0.335 |

The R-square and R-square adjusted values provide insights into the proportion of variance explained by a particular dependent variable (response variable) in relation to the independent variables (predictor variables) in a regression model (Sinnakaudan et al., 2006). Here's how to interpret the provided values:

*Intangible Resources (ITR):*

R-square: 0.391

R-square adjusted: 0.389

The R-square value of 0.391 indicates that approximately 39.1% of the variance in the dependent variable "Intangible Resources" can be explained by the independent variables included in the model. The R-square adjusted value of 0.389 considers the number of predictors and penalizes for model complexity, providing a more conservative estimate of explained variance.

*PPP Airport Performance (PAP):*

R-square: 0.624

R-square adjusted: 0.618

The R-square value of 0.624 indicates that about 62.4% of the variance in the dependent variable "PPP Airport Performance" can be explained by the independent variables in the model. The R-square adjusted value of 0.618 is a slightly lower estimate that considers model complexity.

*Tangible Resources (TR):*

R-square: 0.338

R-square adjusted: 0.335

The R-square value of 0.338 indicates that around 33.8% of the variance in the dependent variable "Tangible Resources" is explained by the independent variables. The R-square adjusted value of 0.335 accounts for the number of predictors and provides a more conservative estimate of the explained variance.

Hence, these R-square values tell us the proportion of variability in each dependent variable that is accounted for by the independent variables in the model. Higher R-square values generally suggest that the model is better at explaining the variance in the dependent variable (Kumari, 2008). However, the R-square adjusted values are useful for considering model complexity and avoiding overfitting, as they account for the number of predictors in the model (Hertzog, 2018).

**Results of f square values:**

f-square is effect size of IDV on DV (Sum et al., 2007). F-Square is the change in R-Square when an independent variable is removed from the model

(Purwanto, 2021). f-square measured variance explained by each independent variable in the model (Hassan et al., 2019).

Table 4.18: F-Square Matrix

| **f-square** | | | | | |
|---|---|---|---|---|---|
| **MATRIX** | | | | | |
| | External Environment Resources (EER) | Institutional Resources (IR) | Intangible Resources (ITR) | PPP Airport Performance (PAP) | Tangible Resources (TR) |
| External Environment Resources (EER) | | | | 0.025 | 0.510 |
| Institutional Resources (IR) | | | 0.642 | 0.128 | |
| Intangible Resources (ITR) | | | | 0.112 | |
| PPP Airport Performance (PAP) | | | | | |
| Tangible Resources (TR) | | | | 0.031 | |

The f-square values in the above Table 4.18 are related to the squared multiple correlations (SMC) for each indicator with its assigned latent construct. The f-square indicates the proportion of the variance in an indicator that is explained by its latent construct (Kusuma et al., 2021). Here's how to interpret the provided values:

*External Environment Resources (EER):*

f-square values: Not provided for any specific construct.

The proportion of variance in the indicator items of External Environment Resources (EER) that is explained by any of the latent constructs is not specified in the provided table.

*Institutional Resources (IR):*

f-square values: 0.642 with Intangible Resources (ITR), 0.128 with PPP Airport Performance (PAP)

For the indicator items of Institutional Resources (IR), approximately 64.2% of the variance is explained by Intangible Resources (ITR), and about 12.8% is explained by PPP Airport Performance (PAP).

*Intangible Resources (ITR):*

f-square values: 0.112 with Institutional Resources (IR)

For the indicator items of Intangible Resources (ITR), around 11.2% of the variance is explained by Institutional Resources (IR).

*PPP Airport Performance (PAP):*

f-square values: Not provided for any specific construct.

The proportion of variance in the indicator items of PPP Airport Performance (PAP) that is explained by any of the latent constructs is not specified in the provided table.

*Tangible Resources (TR):*

f-square values: 0.031 with External Environment Resources (EER)

For the indicator items of Tangible Resources (TR), about 3.1% of the variance is explained by External Environment Resources (EER).

Hence, the f-square values indicate the proportion of variance in indicator items that can be explained by their assigned latent constructs. These values provide insights into the strength of the relationships between indicators and their latent constructs, helping to assess the adequacy of the measurement model.

### 4.9.7 Path Coefficients

Table 4.19: Path Coefficients Matrix

| Path coefficients Matrix | External Environment Resources(EER) | Institutional Resources (IR) | Intangible Resources (ITR) | PPP Airport Performance (PAP) | Tangible Resources(TR) |
|---|---|---|---|---|---|
| External Environment Resources(EER) | | | | 0.161 | -0.581 |
| Institutional Resources (IR) | | | 0.625 | 0.426 | |
| Intangible Resources (ITR) | | | | 0.364 | |
| PPP Airport Performance (PAP) | | | | | |
| Tangible Resources(TR) | | | | 0.213 | |

The provided path coefficients Table 4.19 represent the strength and direction of the relationships between latent constructs in our model. Following is the interpretation:

*External Environment Resources (EER) to Intangible Resources (ITR):*

Path coefficient: 0.161

The relationship between External Environment Resources (EER) and Intangible Resources (ITR) is positive and has a strength of 0.161. This suggests that an increase in External Environment Resources is associated with a positive impact on Intangible Resources.

*External Environment Resources (EER) to PPP Airport Performance (PAP):*

Path coefficient: -0.581

The relationship between External Environment Resources (EER) and PPP Airport Performance (PAP) is negative and has a strength of -0.581. This indicates that higher levels of External Environment Resources are associated with lower levels of PPP Airport Performance.

*Institutional Resources (IR) to Intangible Resources (ITR):*

Path coefficient: 0.625

The relationship between Institutional Resources (IR) and Intangible Resources (ITR) is positive and strong, with a coefficient of 0.625. This suggests that an increase in Institutional Resources is associated with a significant positive impact on Intangible Resources.

*Institutional Resources (IR) to PPP Airport Performance (PAP):*

Path coefficient: 0.426

The relationship between Institutional Resources (IR) and PPP Airport Performance (PAP) is positive, with a coefficient of 0.426. This indicates that higher levels of Institutional Resources are associated with better PPP Airport Performance.

*Intangible Resources (ITR) to Tangible Resources (TR):*

Path coefficient: 0.364

The relationship between Intangible Resources (ITR) and Tangible Resources (TR) is positive, with a strength of 0.364. This suggests that an increase in Intangible Resources is associated with a positive impact on Tangible Resources.

*Tangible Resources (TR) to PPP Airport Performance (PAP):*

Path coefficient: 0.213

The relationship between Tangible Resources (TR) and PPP Airport Performance (PAP) is positive, with a coefficient of 0.213. This indicates that higher levels of Tangible Resources are associated with better PPP Airport Performance.

Therefore, these path coefficients provide insights into the relationships between different latent constructs in our model, helping to understand how changes in one construct can impact another construct. The positive and negative coefficients suggest the direction and strength of these relationships.

- **Significance of Path Coefficients**

The significance of path coefficients in a structural equation model (SEM) holds substantial importance as it indicates the strength and direction of relationships between variables. Path coefficients represent the direct effects of independent variables (IVs) on dependent variables (DVs) or the intermediary effects of mediator variables (MVs) in a mediation analysis. They are crucial for understanding the magnitude and statistical significance of these relationships.

Table 4.20: Path Coefficients Matrix (Mean, STDEV, p values)

| | Original sample (O) | Sample mean (M) | Standard deviation (STDEV) | P values |
|---|---|---|---|---|
| External Environment Resources (EER) -> PPP Airport Performance (PAP) | 0.161 | 0.158 | 0.078 | 0.038 |
| External Environment Resources (EER) -> Tangible Resources (TR) | -0.581 | -0.584 | 0.042 | 0.000 |
| Institutional Resources (IR) -> Intangible Resources (ITR) | 0.625 | 0.629 | 0.037 | 0.000 |
| Institutional Resources (IR) -> PPP Airport Performance (PAP) | 0.426 | 0.416 | 0.110 | 0.000 |
| Intangible Resources (ITR) -> PPP Airport Performance (PAP) | 0.364 | 0.367 | 0.080 | 0.000 |
| Tangible Resources(TR) -> PPP Airport Performance (PAP) | 0.213 | 0.218 | 0.089 | 0.017 |

The path coefficient value Table 4.20 signifies the extent of change in the dependent variable for a one-unit change in the independent variable while holding other variables constant. The T statistic assesses whether the path coefficient is significantly different from zero. Higher T values suggest more robust evidence of a significant relationship. The p-value associated with the T statistic indicates the probability of observing the observed relationship due to random chance. A lower p-value (usually below the conventional threshold of 0.05) suggests that the relationship is statistically significant.

*External Environment Resources (EER) -> PPP Airport Performance (PAP):*

Interpretation: The path from External Environment Resources (EER) to PPP Airport Performance (PAP) has a positive coefficient of 0.161. The calculated T statistic (2.075) indicates that this coefficient is statistically significant (p-value = 0.038), suggesting that there is a significant relationship between EER and PAP.

*External Environment Resources (EER) -> Tangible Resources (TR):*

Interpretation: The path from External Environment Resources (EER) to Tangible Resources (TR) has a negative coefficient of -0.581. The calculated T statistic (13.819) indicates that this coefficient is highly statistically significant (p-value = 0.000), suggesting a strong negative relationship between EER and TR.

*Institutional Resources (IR) -> Intangible Resources (ITR):*

Interpretation: The path from Institutional Resources (IR) to Intangible Resources (ITR) has a positive coefficient of 0.625. The calculated T statistic (16.799) indicates that this coefficient is highly statistically significant (p-value = 0.000), suggesting a strong positive relationship between IR and ITR.

*Institutional Resources (IR) -> PPP Airport Performance (PAP):*

Interpretation: The path from Institutional Resources (IR) to PPP Airport Performance (PAP) has a positive coefficient of 0.426. The calculated T statistic (3.853) indicates that this coefficient is statistically significant (p-value = 0.000), suggesting a significant positive relationship between IR and PAP.

*Intangible Resources (ITR) -> PPP Airport Performance (PAP):*

Interpretation: The path from Intangible Resources (ITR) to PPP Airport Performance (PAP) has a positive coefficient of 0.364. The calculated T statistic (4.535) indicates that this coefficient is statistically significant (p-value = 0.000), suggesting a significant positive relationship between ITR and PAP.

*Tangible Resources (TR) -> PPP Airport Performance (PAP):*

Interpretation: The path from Tangible Resources (TR) to PPP Airport Performance (PAP) has a positive coefficient of 0.213. The calculated T statistic (2.384) indicates that this coefficient is statistically significant (p-value = 0.017), suggesting a significant positive relationship between TR and PAP.

Hence, the path coefficients represent the relationships between constructs in your model. The T statistics and p-values help determine whether these relationships are statistically significant.

### 4.9.8 Total Direct and Indirect effect of constructs:

Table 4.21: Total indirect effects

| | Original sample (O) | Sample mean (M) | Standard deviation (STDEV) | P values |
|---|---|---|---|---|
| External Environment Resources(EER) -> PPP Airport Performance (PAP) | -0.124 | -0.128 | 0.055 | 0.024 |
| Institutional Resources (IR) -> PPP Airport Performance (PAP) | 0.228 | 0.232 | 0.057 | 0.000 |

The provided Table 4.21 contains information about the total indirect effects, including the mean, standard deviation, T statistics, and p-values. Following is the interpretation of the values in this table:

*External Environment Resources (EER) -> PPP Airport Performance (PAP):*

Interpretation: The total indirect effect from External Environment Resources (EER) to PPP Airport Performance (PAP) is -0.124. The calculated T statistic (2.263) indicates that this effect is statistically significant (p-value = 0.024), suggesting that there is a significant indirect relationship between EER and PAP mediated by other constructs.

*Institutional Resources (IR) -> PPP Airport Performance (PAP):*

Interpretation: The total indirect effect from Institutional Resources (IR) to PPP Airport Performance (PAP) is 0.228. The calculated T statistic (3.975) indicates that this effect is highly statistically significant (p-value = 0.000), suggesting a significant indirect relationship between IR and PAP mediated by other constructs.

Hence, the total indirect effects represent the combined influence of multiple paths between constructs. The T statistics and p-values help determine the statistical significance of these indirect effects.

Table 4.22: Specific indirect effects

| | Original sample (O) | Sample mean (M) | Standard deviation (STDEV) | P values |
|---|---|---|---|---|
| Institutional Resources (IR) -> Intangible Resources (ITR) -> PPP Airport Performance (PAP) | 0.228 | 0.232 | 0.057 | 0.000 |
| External Environment Resources(EER) -> Tangible Resources(TR) -> PPP Airport Performance (PAP) | -0.124 | -0.128 | 0.055 | 0.024 |

Table 4.22 presents specific indirect effects along with their mean, standard deviation, T statistics, and p-values. Following is the interpretation of the provided information:

*Institutional Resources (IR) -> Intangible Resources (ITR) -> PPP Airport Performance (PAP):*

Interpretation: The mean specific indirect effect from Institutional Resources (IR) to Intangible Resources (ITR) and then to PPP Airport Performance (PAP) is 0.228. The calculated T statistic (3.975) indicates that this effect is highly statistically significant (p-value = 0.000), suggesting a significant indirect relationship between IR, ITR, and PAP.

*External Environment Resources (EER) -> Tangible Resources (TR) -> PPP Airport Performance (PAP):*

Interpretation: The mean specific indirect effect from External Environment Resources (EER) to Tangible Resources (TR) and then to PPP Airport Performance (PAP) is -0.124. The calculated T statistic (2.263) suggests that this effect is statistically significant (p-value = 0.024), indicating a significant indirect relationship between EER, TR, and PAP.

These specific indirect effects help to understand the combined influence of two consecutive paths on a target variable. The T statistics and p-values provide insights into the statistical significance of these specific indirect effects, indicating whether the observed relationships are likely to be meaningful or due to chance.

**Total effects**

H1: External Environment will have a positive effect on the PPP airport performance.

H2: Institutional Resources will have a positive effect on the PPP airport performance.

H1a: External Environment will have a positive effect on the Tangible Resources

H1b: Tangible Resources will have a positive effect on the PPP airport performance.

H2a: Institutional Resources will have a positive effect on Intangible Resources

H2b: Intangible Resources will have a positive effect on the PPP airport performance.

Table 4.23: Total Effects

| | Original sample (O) | Sample mean (M) | Standard deviation (STDEV) | P values |
|---|---|---|---|---|
| External Environment Resources(EER) -> PPP Airport Performance (PAP) | 0.037 | 0.030 | 0.115 | 0.744 |
| External Environment Resources(EER) -> Tangible Resources(TR) | -0.581 | -0.584 | 0.042 | 0.000 |
| Institutional Resources (IR) -> Intangible Resources (ITR) | 0.625 | 0.629 | 0.037 | 0.000 |
| Institutional Resources (IR) -> PPP Airport Performance (PAP) | 0.653 | 0.648 | 0.111 | 0.000 |
| Intangible Resources (ITR) -> PPP Airport Performance (PAP) | 0.364 | 0.367 | 0.080 | 0.000 |
| Tangible Resources(TR) -> PPP Airport Performance (PAP) | 0.213 | 0.218 | 0.089 | 0.017 |

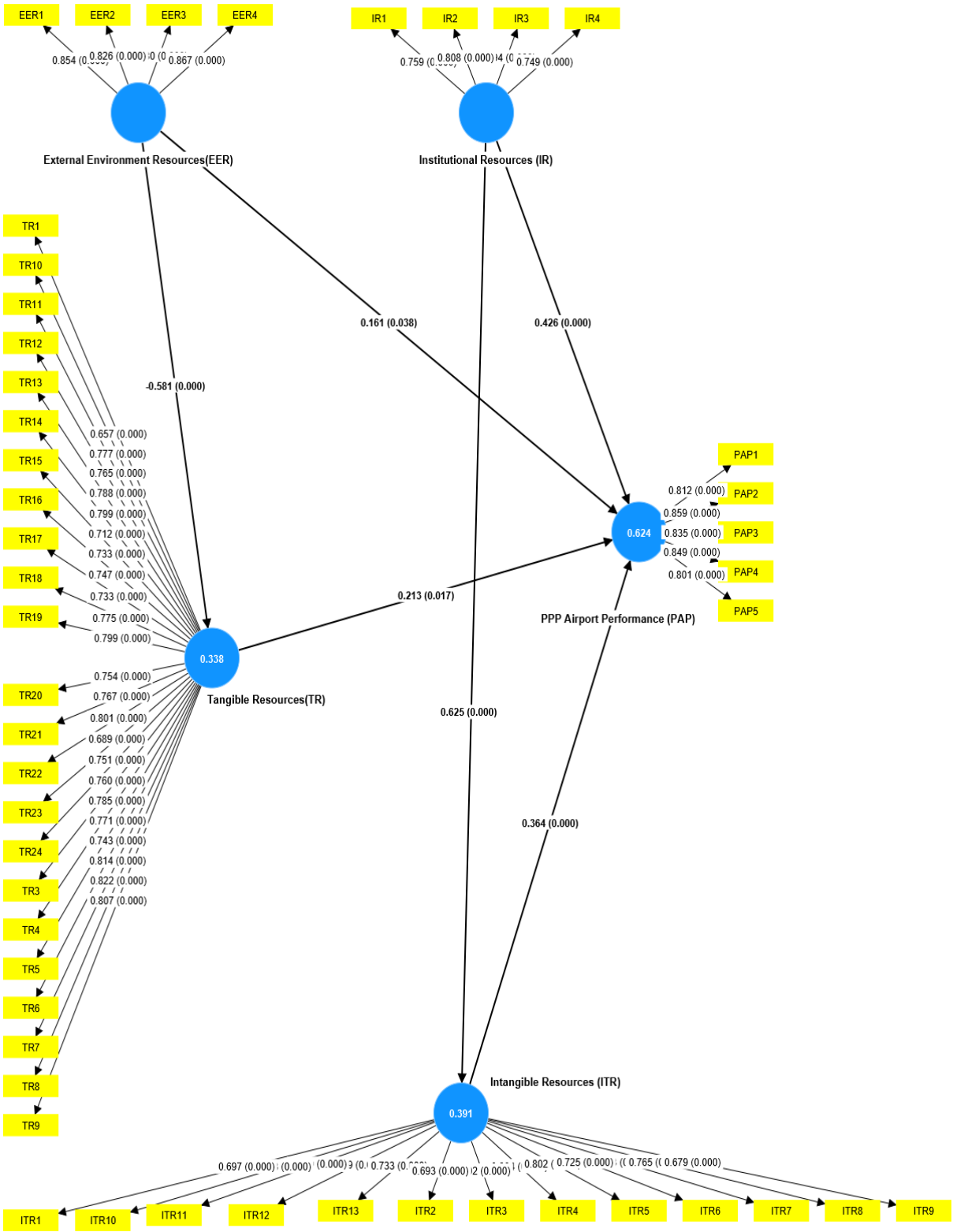


Figure 4.8: SEM Model

Source: Author

The Table 4.23 provides information about total effects, including their mean, standard deviation, T statistics, and p-values. Following is the interpretation of the provided data:

### 4.9.9 Mediation Analysis

Mediation is a statistical concept and analytical technique used to understand the underlying mechanisms through which an independent variable influences a dependent variable. In other words, it helps explain why or how a particular relationship between two variables occurs by introducing a third variable called the mediator.

The basic idea behind mediation is that the relationship between the IV and DV is not direct, but rather it is mediated through the mediator variable. In other words, the IV affects the mediator, and in turn, the mediator affects the DV. This can be understood in terms of a causal chain or pathway:

**IV (EER, IR, ITR, TR) -> MV (Mediator) -> DV (PAP)**

Mediation analysis is crucial for understanding the underlying processes that drive relationships between variables. It helps researchers identify mechanisms, understand why certain relationships exist, and provides a more nuanced understanding of the relationships between variables. Here Mediation analysis is conducted using structural equation modelling (SEM). Researchers typically assess the significance of the indirect effect to determine if mediation is present and the extent to which the mediator explains the relationship between the IV and DV. In this context, mediation analysis aims to answer whether the effects of EER, IR, ITR, and TR on PAP are mediated by other factors. This involves assessing whether the introduction of mediators changes the strength and significance of relationships.

The relationship between Institutional Resources (IV) and PPP Airport Performance (DV) is being studied, with Intangible Resources (MV) as the mediator. The values provided for mediation effects could be:

1. **Institutional Resources (IV) -> Intangible Resources (MV) Mediation:**

    - The path coefficient of 0.625 signifies the effect of Institutional Resources (IV) on Intangible Resources (MV).
    - The T statistic of 16.799 and a p-value of 0.000 indicate that this effect is statistically significant, implying that higher levels of Institutional Resources are associated with increased Intangible Resources.

2. **Intangible Resources (MV) -> PPP Airport Performance (DV) Mediation:**

    - The path coefficient of 0.364 represents the impact of Intangible Resources (MV) on PPP Airport Performance (DV).
    - The T statistic of 4.535 and a p-value of 0.000 suggest that this effect is also statistically significant. This implies that higher levels of Intangible Resources are associated with improved PPP Airport Performance.

Considering both mediation paths together, it can be inferred that the relationship between Institutional Resources and PPP Airport Performance is partially mediated by Intangible Resources. This suggests that the influence of Institutional Resources on PPP Airport Performance is, at least in part, explained by the presence of Intangible Resources.

Hence, mediation analysis enriches the interpretation of the study's results by revealing the intricate interplay between variables and shedding light on the underlying processes through which they influence each other. It offers valuable insights into potential mechanisms, helping researchers and decision-makers make more informed and targeted interventions to enhance PPP Airport Performance.

*H1: External Environment Resources (EER) -> PPP Airport Performance (PAP)*

Interpretation: The mean total effect from External Environment Resources (EER) to PPP Airport Performance (PAP) is 0.037. The calculated T statistic (0.326) indicates that this effect is not statistically significant (p-value = 0.744), suggesting that the observed relationship between EER and PAP might be due to chance.

*H1a: External Environment Resources (EER) -> Tangible Resources (TR)*

Interpretation: The mean total effect from External Environment Resources (EER) to Tangible Resources (TR) is -0.581. The calculated T statistic (13.819) indicates that this effect is highly statistically significant (p-value = 0.000), suggesting a significant direct relationship between EER and TR.

*H2a: Institutional Resources (IR) -> Intangible Resources (ITR)*

Interpretation: The mean total effect from Institutional Resources (IR) to Intangible Resources (ITR) is 0.625. The calculated T statistic (16.799) indicates that this effect is highly statistically significant (p-value = 0.000), indicating a significant direct relationship between IR and ITR.

*H2: Institutional Resources (IR) -> PPP Airport Performance (PAP):*

Interpretation: The mean total effect from Institutional Resources (IR) to PPP Airport Performance (PAP) is 0.653. The calculated T statistic (5.880) indicates that this effect is highly statistically significant (p-value = 0.000), suggesting a significant direct relationship between IR and PAP.

*H2b: Intangible Resources (ITR) -> PPP Airport Performance (PAP):*

Interpretation: The mean total effect from Intangible Resources (ITR) to PPP Airport Performance (PAP) is 0.364. The calculated T statistic (4.535) indicates that this effect is highly statistically significant (p-value = 0.000), suggesting a significant direct relationship between ITR and PAP.

*H1b: Tangible Resources (TR) -> PPP Airport Performance (PAP):*

Interpretation: The mean total effect from Tangible Resources (TR) to PPP Airport Performance (PAP) is 0.213. The calculated T statistic (2.384) indicates that this effect is statistically significant (p-value = 0.017), suggesting a significant direct relationship between TR and PAP.

These total effects provide insights into the direct relationships between predictor variables and the outcome variable (PPP Airport Performance in this case). The T statistics and p-values help determine the statistical significance of

these direct effects, indicating whether they are likely to be meaningful or due to chance.

**Summary**

The Structural Equation Modeling (SEM) analysis conducted in this study explored the intricate relationships and dynamics among key variables within the context of a complex research framework. The analysis encompassed multiple stages, each revealing insights into various aspects of the research hypotheses. Here is an overarching summary of the SEM analysis:

1. **Measurement Model and Reliability Analysis:** The initial stage involved assessing the measurement model's validity and reliability. Constructs like "External Environment Resources (EER)," "Institutional Resources (IR)," "Intangible Resources (ITR)," "PPP Airport Performance (PAP)," and "Tangible Resources (TR)" were evaluated based on their reflective and formative nature. Reliability metrics such as Cronbach's alpha, composite reliability (rho_a), and average variance extracted (AVE) were used to determine the internal consistency and convergent validity of the constructs. The obtained values, ranging from 0.800 to 0.932, indicated high reliability and validity, thus affirming the suitability of the measurement model.

2. **Discriminant Validity:** The examination of discriminant validity ensured that the constructs were distinct and not merely measuring the same underlying concept. The square root of AVE and the correlation matrix were compared, revealing that the constructs' AVE values were greater than their correlations with other constructs. This supported the discriminant validity, reinforcing the robustness of the measurement model.

3. **Outer Loadings and Benchmark Values:** The outer loadings depicted the relationships between latent constructs and their respective indicators. These values indicated the strength of each indicator's contribution to its assigned construct. The outer loadings were compared against benchmark values, demonstrating that the indicators adequately reflected the latent constructs they were meant to represent.

4. **Path Coefficients and Mediation Analysis:** The analysis of path coefficients elucidated the direct and indirect effects between variables in the research framework. Significant relationships were identified through T statistics and p-values. Mediation analyses unveiled how certain variables, such as "IR" mediating the relationship between "EER" and "ITR," influenced each other. Total and specific indirect effects were assessed, providing insights into the pathways through which variables influenced each other.

5. **Fit Summary and Model Evaluation:** The fit summary provided essential information about the adequacy of the model. Fit indices such as the SRMR, NFI, and Chi-square compared the estimated model against a saturated model. The close fit between the estimated model's fit indices and those of the saturated model indicated a good model fit.

In conclusion, the SEM analysis shed light on the complex web of relationships among constructs like "EER," "IR," "ITR," "PAP," and "TR." The reliability of measurements, the discriminant validity, and the significant path coefficients collectively validated the theoretical framework. The mediation analyses illuminated the mediating roles of certain variables in influencing others. Overall, this comprehensive SEM analysis provided a thorough understanding of the underlying dynamics and implications of the research variables, contributing to a deeper comprehension of the research phenomenon.

### 4.10 Data Analysis for RO3

When forming a panel of experts to engage in a survey based on questionnaires, it becomes crucial to consider their distinct levels of expertise, previous encounters, and grasp of the topic being studied. In the specific context of this research undertaking, the individuals selected as authorities from varied sectors like industry, the Airport Authority of India (AAI), airlines, and Ground Handling Organizations exhibit a commendable comprehension of airport operations. Concerning the structure of the expert panel regarding its magnitude, it's a fact that necessitates meticulous evaluation (Chao et al., 2013). Regarding the dimensions of the panel, (Okoli et al., 2004) proposed that opting

for a more compact assembly is preferable over a larger one when employing the Delphi method, as it facilitates swifter and smoother alignment of opinions. The optimal count of specialists typically falls within the span of 10 to 18 individuals.

For our study, a sum of 18 experts was selected for participation: five from the airline industry, four from the Airport Authority of India (AAI), and the remaining five from Ground Handling Organizations backgrounds. These individuals were extended invitations to engage in the survey, and the tailored questionnaires were disseminated through electronic mail.

In the rapidly evolving aviation industry, the intricate interplay between the external environment, institutional resources, and their collective influence on Public-Private Partnership (PPP) airport performance is of paramount significance. This extended theoretical model aims to unravel the multifaceted relationships among these variables by integrating the principles of the Delphi method. By engaging the perspectives of 18 seasoned aviation professionals, this model delves deeper into the hypotheses proposed and their implications for the aviation industry.

**Introduction**

The aviation industry serves as a dynamic ecosystem where numerous factors converge to shape the performance of airports. Among these factors, the external environment and institutional resources stand out as crucial determinants of success, particularly in the context of PPP-operated airports. This theoretical model aims to decipher the complex interactions between these variables, further enriched by the insights of industry experts through the Delphi method.

### 4.10.1 Delphi Method Integration

The Delphi method, renowned for fostering consensus among experts through a structured iterative process, forms the bedrock of this comprehensive model. The chosen approach involves soliciting insights from 18 esteemed aviation professionals, carefully selected for their extensive experience and in-depth

expertise. Through multiple rounds of questionnaire-based interactions, these experts engage in a collaborative dialogue, refining their viewpoints based on collective feedback and discussions.

**Delphi Questionnaire Validation**

Following best practices outlined in the literature (Belton et al., 2019; Frewer et al., 2011), the draft questionnaire underwent rigorous pre-testing with two qualified experts who were external to the expert panel. This process aimed to ensure the questionnaire's plausibility, comprehensibility, and internal consistency. Incorporating feedback from the pre-test, minor modifications were implemented to refine the questionnaire. To optimize participant engagement and minimize attrition, the final questionnaire was streamlined to encompass only fifteen key projections. This strategic approach aimed to uphold the quality and relevance of responses while mitigating the risk of respondent fatigue.

Table 4.24: Projections

**Quantitative Results**

| | | Round 1 (N = 18) | | | | Round 2 (N = 15) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Items** | **IQR** | **Median** | **Mean** | **SD** | **IQR** | **Median** | **Mean** | **SD** | **SD (% Change)** |
| 1 | Route Network Development | 0.75 | 6 | 5.38 | 1.41 | 1 | 7 | 6.20 | 1.32 | -6.38 |
| 2 | Airport Economic Zone | 2.75 | 5 | 4.6 | 1.37 | 2 | 5 | 4.90 | 1.27 | -7.29 |
| 3 | Cargo & Business Infrastructure | 1 | 4 | 3.66 | 0.97 | 1.5 | 5 | 5.00 | 0.92 | -5.15 |
| 4 | Logistics Park & Maintenance Facilities | 2 | 5 | 4.77 | 1.26 | 1.5 | 5 | 5.06 | 1.33 | 5.55 |
| 5 | Ownership Form | 2 | 5 | 5.11 | 0.96 | 1 | 6 | 5.60 | 0.97 | 1.04 |
| 6 | Price Cap Regulations | 1 | 4 | 4.72 | 1.07 | 2 | 5 | 5.20 | 1.08 | 0.93 |
| 7 | Concession Agreements | 2 | 5 | 5.11 | 1.07 | 2 | 5 | 5.06 | 1.09 | 1.86 |
| 8 | Managerial Skills & Training | 2 | 6 | 5.94 | 0.89 | 1.5 | 7 | 6.20 | 0.88 | -1.12 |
| 9 | Resource Management System | 2 | 3 | 3.5 | 1.20 | 1 | 4 | 4.00 | 1.19 | -0.83 |
| 10 | Technology | 1.75 | 5 | 5.11 | 1.02 | 1.5 | 5 | 5.13 | 1.06 | 3.92 |
| 11 | Operational Arrangements | 1 | 4 | 3.7 | 1.31 | 1.5 | 4 | 3.80 | 1.26 | -3.81 |
| 12 | E-Freight Systems | 1 | 5 | 4.55 | 1.09 | 1.5 | 5 | 4.50 | 1.12 | 2.75 |
| 13 | Competition | 1 | 3 | 3.64 | 1.05 | 1 | 4 | 3.93 | 1.03 | -1.90 |
| 14 | Seasonality | 1.75 | 3 | 3.72 | 1.31 | 1 | 3 | 3.53 | 1.24 | -5.34 |
| 15 | Multi-Level Car Parking System | 1 | 3 | 2.77 | 1.00 | 1 | 3 | 2.93 | 0.96 | -4.00 |

Before proceeding with analysis, a meticulous error check was performed on the data from both rounds, following the methodology outlined by Häder (2009). Descriptive statistics, including mean values, medians, and standard deviations (SD), were computed to provide insights into the dataset. The interquartile range (IQR) was utilized as a reliable measure of consensus, while changes in standard deviation between rounds were employed to assess convergence.

Since all estimations were assessed using the seven-point Likert scale, data standardization was deemed unnecessary. Following the second round, a noticeable decrease in the standard deviation (% SD change) of probability was observed across eight projections, indicating a convergence of expert estimations. Notably, the most substantial convergence was evident for projection 2 (Airport Economic Zone), manifesting a 7.29% decrease in SD, followed by projection 1 (Route Network Development) with a 6.38% decrease, projection 3 (Cargo & Business Development) with a 5.15% decrease, and projection 14 (Seasonality) with a 5.34% decrease.

The assessment of consensus holds paramount importance in Delphi analysis, with the interquartile range (IQR) serving as a widely accepted and utilized metric for this purpose (von der Gracht, 2012). A smaller IQR indicates a higher degree of consensus among panelists. Consistent with other Delphi studies employing a seven-point Likert scale (Vet et al., 2005), the threshold for consensus, set at IQR $\leq$ 1, was applied. In the initial round, consensus was reached for projection 3 (Cargo & Business Infrastructure), projection 6 (Price Cap Regulations), projection 11 (Operational Arrangements), projection 12 (E-Freight Systems), projection 13 (Competition), and projection 15 (Multi-level Car Parking System). Despite the diverse composition of the panel, consensus was achieved for four additional projections (1, 5, 9, and 14) after the second round. Notably, all projections meet the threshold pertained to institutional resources, the external environment, and tangible and intangible factors impacting PPP airport performance. A substantial proportion, surpassing 45% of the projections, fell short of meeting the IQR threshold. This suggests the

possibility of enduring high levels of uncertainty among the participating experts.

The integration of the Delphi method not only enriches the theoretical framework shown in Figure 4.9 but also harnesses the collective wisdom of professionals to create a robust and multifaceted perspective on the subject matter.

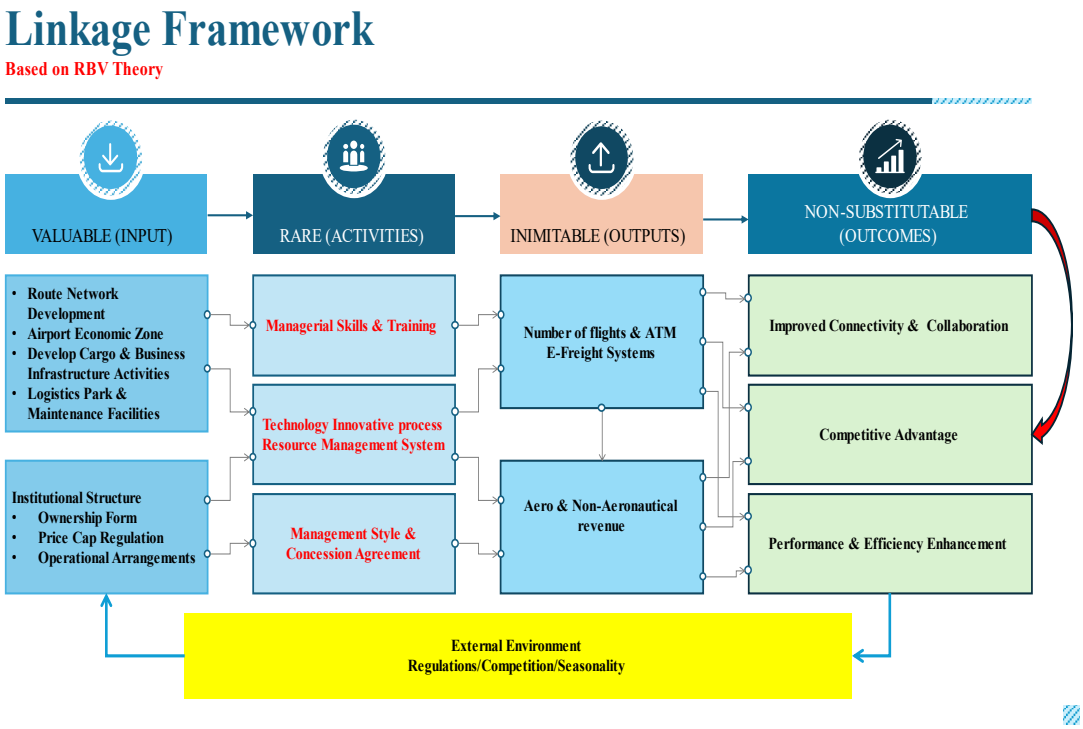


Figure 4.9: Linkage Framework to improve the performance of PPP airports.

Source: Author

Utilizing the VRIN (Value, Rarity, Inimitability, Non-substitutability) framework, enriched by insights from the Delphi method, unveils the substantial contributions of expert participants in comprehending PPP-operated airport environments. The Delphi discussions illuminate critical factors influencing airport dynamics. Experts converge on the idea that cutting-edge infrastructure, state-of-the-art facilities, and modern equipment transcend mere value and rarity; they possess attributes of inimitability and non-substitutability, profoundly shaping airport performance. The establishment of a robust airport economic zone, strategic expansion of route networks, and innovative revenue

strategies underscore the unique value proposition these resources offer, reinforcing their pivotal role in enhancing operational efficiency. Moreover, experts underscore the intrinsic link between tangible resources and airport performance, emphasizing their indispensable and distinctive qualities, which confer a competitive edge to PPP-operated airports. The focus on institutional resources, including ownership structures, leadership practices, and strategic frameworks, underscores their central role in nurturing intangible assets such as managerial skills and innovation. These resources contribute to the airport's intellectual capital, resilience, and competitive advantage, seamlessly aligning with the VRIN principles. Ultimately, insights drawn from expert engagement in the Delphi method highlight the strategic importance of institutional resources in shaping organizational culture, driving operational excellence, and amplifying stakeholder satisfaction, thereby reinforcing their irreplaceable and unique nature within PPP-operated airport environments.

## 4.11 Key Findings and Implications

Drawing upon the insightful perspectives provided by subject matter experts, this study proposes specific recommendations aimed at enhancing the operational efficacy of PPP airports in India (shown in Figure 4.9).

- Prioritizing technology-driven process enhancements can significantly bolster air traffic movement and route expansion. The implementation of an E-Freight system stands to substantially reduce cargo dwell time at Indian airports, thereby enhancing throughput capacity and revenue generation. These measures promise a more robust optimization of available resources across the board.
- Cultivating an environment conducive to the growth of intangible resources can foster the accumulation of specialized knowledge, ultimately leading to a competitive edge. Prioritizing enhanced training programs aimed at nurturing managerial skills contributes to the development of human capital, a scarce resource according to the Resource-Based View (RBV) theory.

- Proactive strategic planning, coupled with adaptive management styles and renegotiated concession agreements, has the potential to boost both aeronautical and non-aeronautical revenues, positioning Indian airports closer to the top 10 within the competitive landscape.
- Considering evolving regulations and competitive dynamics, a comprehensive review and revision of airport ownership structures, price cap regulations, and operational arrangements are essential steps toward fortifying performance.

Implementing this framework holistically is poised to foster heightened collaboration among diverse stakeholders, thereby stimulating innovation. Consequently, airports would witness a surge in connections to various destinations, evolving into convenient hubs for their esteemed clientele.

# CHAPTER V
# RECOMMENDATION AND CONCLUSION

## 5 Overview

This chapter encapsulates the research outcomes, underscoring the pivotal role of both tangible and intangible resources in shaping the performance of PPP airports in India. The comprehensive analysis encompasses the identification and prioritization of obstacles that exert influence on airport performance. Furthermore, the chapter candidly addresses the study's limitations, proffers avenues for future exploration, and furnishes actionable recommendations. The conclusive discussion emphasizes the research's substantial contribution to tackling pertinent business challenges and its noteworthy impact on the current body of literature.

## 5.1 Restating the research objectives

As delineated in the preceding sections, the objectives of this study underwent a dynamic evolution during the stages of data collection and analysis. Commencing with the identification of impediments affecting the performance of PPP airports in India, the discerned findings underscore the imperative nature of addressing airport ownership structures, regulatory complexities, inadequate non-aeronautical revenue generation, and managerial proficiency as pivotal barriers to enhancing overall efficiency and performance. Employing the robust Structural Equation Modelling (SEM) methodology, the study delved into the intricate interplay between tangible and intangible resources, elucidating the influence of institutional resources and external dynamics, including regulatory frameworks, on airport efficiency and performance. In the final analysis, the research trajectory homed in on a nuanced objective, aiming to comprehensively grasp and devise a framework that seamlessly incorporates the Valuable, Rare, Inimitable, and Non-substitutable (VRIN) principles within the contours of the Resource-Based View (RBV) theory. This tailored framework (shown in Chapter 4) is intended to serve as a strategic guide for policymakers and airport operators alike.

## 5.2 Recommendations

- Attain optimization by upgrading technology and refining processes.
- Cultivating resilient intangible assets to elevate specialized knowledge within the staff.
- Establish a competitive landscape through proactive strategic planning.
- A dynamic and flexible environment designed to readily embrace and navigate change.
- Facilitate robust collaboration and policy alignment among regulatory bodies, considering factors such as ownership form, management style, concession agreements, as well as the impacts of seasonality and competition.
- Revitalize the airport landscape to position it as centers of convenience, surpassing other global airports.
- Boost operational resilience by expanding non-aeronautical revenue initiatives to effectively navigate unexpected disruptions.
- Strengthen and streamline the route development network for optimal performance.

## 5.3 Conclusion: Implications and Synthesis

This study's extensive Structural Equation Modeling (SEM) analysis has yielded profound implications that resonate across both research and practical dimensions. The intricate web of relationships among the central variables—"External Environment Resources (EER)," "Institutional Resources (IR)," "Intangible Resources (ITR)," "PPP Airport Performance (PAP)," and "Tangible Resources (TR)"—has been not only validated but also comprehensively illuminated. The meticulous validation process, including the assessment of measurement model reliability, the verification of discriminant validity, and the scrutiny of significant path coefficients, lends robustness and credibility to the underlying theoretical framework. Notably, the mediation analyses' revelations regarding the mediating roles of specific variables provide nuanced insights into the interconnectedness of the constructs and their impacts. The alignment of fit indices underscores the model's fidelity to empirical data, further solidifying the foundation on which these findings rest. From a research

perspective, this analysis equips scholars with an enriched understanding of the intricate dynamics at play in airport performance, guiding future investigations toward more encompassing approaches. Practically, the discerned relationships offer valuable strategic insights for enhancing airport operational efficiency and effectiveness. As this study navigates the intersection of theory and application, its implications transcend the confines of its immediate scope, leaving an indelible mark on the trajectory of airport performance research and practice, steering both toward more informed and impactful directions.

At the core of this model lies the intricate dance between the external environment and PPP airport performance. Economic fluctuations, regulatory shifts, and market trends cease to be abstract concepts; they transform into driving forces that shape infrastructure development, technological integration, and service quality within PPP-operated airports. The model not only captures this relationship but also unveils the ripple effects that resonate across operational efficiencies, passenger experiences, and stakeholder engagements.

The theoretical model unveiled here emerges as a beacon of enlightenment, casting a radiant light upon the complex interplay between the external environment, institutional resources, and the multifaceted tapestry of PPP airport performance. The model transcends the boundaries of theoretical abstraction, embarking on a transformative journey that seamlessly intertwines academic discourse with the pragmatic pulse of the aviation industry. This process, characterized by the iterative exchange of insights, challenges, and perspectives, breathes life into the proposed hypotheses. It imbues them with a layer of context and relevance that extends far beyond theoretical constructs. The rich dialogue among professionals, fueled by their wealth of experience and diverse viewpoints, enriches the model with depth and substance, elevating it from a mere framework to a dynamic representation of the intricate realities that govern PPP-operated airports.

Equally illuminated within this model is the symbiotic relationship between institutional resources and intangible assets. The collaborative dialogues of experts magnify the pivotal role of robust institutional support in cultivating an environment where intangible assets flourish. This nurturing ecosystem fosters specialized knowledge, innovative practices, and a strong organizational culture

– intangible assets that define excellence within PPP-operated airports. The model doesn't merely acknowledge these assets; it showcases their transformative power, unveiling how they amplify operational efficiencies, enhance passenger satisfaction, and heighten the airport's competitive edge. In summation, the theoretical model, a product of Delphi-driven discourse and expert perspectives, stands as a bridge that spans the chasm between theoretical conjecture and practical industry dynamics. Its enriched perspective redefines the discourse surrounding PPP airport performance, propelling it into a realm where theoretical constructs are intrinsically tied to real-world complexities. The collaborative foundation of the Delphi method infuses it with authenticity and resonance, breathing life into hypotheses and shaping a holistic view of the aviation landscape. In the intersection of academia and industry, this model finds its purpose, offering a guiding light to stakeholders navigating the intricate pathways of PPP-operated airports.

## 5.4 Contribution to the theory

Mata et al. (1995) underscored the pivotal role of managerial IT skills in fostering sustainability within a firm. There is a need for deeper exploration into the precise skills and competencies that managers must possess to adeptly leverage IT resources, ensuring long-term sustainability and a competitive edge. While prevailing literature on airport performance primarily delves into regulatory, operational, or financial aspects, with a focus on variables impacting efficiency, a significant gap exists regarding the barriers influencing airport performance and the intricate interplay of resources. This study addresses this gap by employing RBV theory to identify resources that significantly impact PPP airport performance, drawing on VRIN principles for a comprehensive understanding.

Furthermore, in alignment with the Resource-Based View (RBV), the strategic trajectories of enterprises are intricately forged by the cognitive prowess exhibited by their managerial cadre (Wright et al., 2005). The impediments to seamless strategic restructuring extend beyond the palpable constraints tethered to organizational resource scarcity; they encompass a palpable deficit in managerial adeptness to deftly navigate transformative changes (Mahoney,

1995). The realization of strategic flexibility crystallizes as a synergistic outcome of a company's reservoir of resources and its acumen in deftly coordinating and deploying these assets. The pivotal obligations entrusted to managers, encapsulating their adaptability in orchestrating reconfigurations, fostering developmental initiatives, and judiciously leveraging resources, stand out as the linchpin distinguishing thriving enterprises from their less prosperous counterparts in the dynamic landscapes of emerging economies (Uhlenbruck et al., 2003).

The RBV framework provides a comprehensive lens to discern two crucial dimensions of business strategy, integral to our study. Firstly, it involves the discernment of the firm's existing resources and capabilities, and secondly, the identification of resources essential for fostering the firm's growth. The fact that certain firms not only survive but thrive amidst fierce competition implies the possession of distinctive and advantageous resources and capabilities (Bruton et al., 2000). The discernment of these resources and capabilities equips the firm's managers to not only preserve but fortify their current competitive advantage. In the dynamic landscape of a competitive market, the imperative of cultivating new resources gains heightened significance (Hoskisson et al., 2000). The strategic development of fresh resources empowers managers to not only augment the competitive prowess of their firm but also to seize and expand upon emerging business opportunities, thus fostering a robust and adaptable business strategy.

The research outcomes significantly enhance the RBV (Resource-Based View) theory by intricately linking tangible and intangible resources with construct variables, thereby proposing nuanced and well-suited management approaches. This groundbreaking contribution empowers PPP (Public-Private Partnership) airport operators to meticulously devise strategies tailored to the unique nature and scope of their operations, fostering the development of robust approaches to secure a sustainable competitive advantage. The study articulates a comprehensive three-step process:

- Rigorous identification and prioritization of barriers impeding the performance of PPP airports.
- Strategic alignment with RBV theory constructs (Valuable, Rare, Inimitable, and Non-substitutable), is visually depicted in Figure 4.9.
- Systematic identification of resources is pivotal for gaining and sustaining a competitive advantage.

A pivotal theoretical contribution of this study lies in establishing a profound and intricate connection between the core themes of RBV theory and both tangible and intangible airport resources. This linkage emerges as a critical factor influencing the performance of PPP airports in India and offers invaluable insights for effectively navigating unforeseen events. The robust findings compellingly illustrate that the embrace of distinct management styles can be thoroughly elucidated by applying the foundational VRIN principles (Valuable, Rare, Inimitable, Non-substitutable) outlined in RBV Theory. This implies that airport operators can craft intricate business strategies, while government institutions and regulatory bodies wield the authority to instigate policy changes, thereby fostering an environment conducive to heightened growth.

## 5.5 Potential limitations of the study

While the present study has diligently focused its metrics on the pivotal variables encapsulated within each discerned factor of inefficiency, it is important to acknowledge that there exist certain limitations which warrant consideration. The concentration on the most critical variables, while essential for targeted analysis, may potentially omit a comprehensive understanding of the multifaceted nature of airport performance. The decision to emphasize these key aspects might inadvertently neglect other secondary but nonetheless influential factors that contribute to the intricate dynamics of airport operations. Consequently, future research undertakings in this domain could substantially benefit from a broader scope that encompasses a wider array of variables, allowing for a more holistic evaluation of airport performance. This expansion of focus could potentially reveal intricate relationships and interdependencies among various factors, offering deeper insights into the underlying mechanisms

that drive inefficiencies within the airport ecosystem. By acknowledging and addressing these limitations, subsequent studies can enrich the understanding of airport performance and contribute to the formulation of more comprehensive and effective strategies for enhancing overall operational efficiency.

### 5.6 The potential scope for future research

The research undertaken has unveiled new prospects for future investigations into measuring the performance of PPP airports in India. While the current study's metrics are concentrated on the most crucial variables within each identified inefficiency factor, upcoming research endeavors could extend to encompass additional factors. Additionally, similar analyses could be conducted in different geographical regions or in comparison with the PPP airport model in more developed countries.

Similarly, a comparative analysis could be conducted for proximate sectors directly linked to PPP airports in India. This approach would contribute to a deeper understanding of the factors that impact the airport performance matrix, shedding light on potential areas for improvement.

# CHAPTER VI
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# APPENDIX A

<table>
<tr><th colspan="6">Questionnaire</th></tr>
<tr><td colspan="6">Dear respondent,<br><br>My name is Mohit Rishi, and I am conducting academic research for my Ph.D. (doctorate) degree on " Developing A Framework for Improving The Performance Of PPP Metropolitan Airports In India". Hence, you are kindly requested to give the necessary information for the research questions. Please be assured that the information acquired shall be used purely for academic purposes only and kept strictly confidential. Please indicate your level of agreement or disagreement by using the (√) mark on the appropriate box corresponding to each statement. Your co-operation and assistance will be highly appreciated. If you need any clarification or information:<br><br>Mobile. 8860380190<br><br>E-mail – mohit.rishi@ddn.upes.ac.in</td></tr>
<tr><td>Section I: General Information</td><td colspan="5">Please read each question carefully and make a tick under each value</td></tr>
<tr><td>Sex</td><td colspan="2">Male</td><td colspan="3">Female</td></tr>
<tr><td></td><td colspan="2"></td><td colspan="3"></td></tr>
<tr><td rowspan="2">Age (Years)</td><td>Under 25</td><td>26-35</td><td>36-45</td><td>46-55</td><td>Above 55</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">Respondent’s position:</td><td>AAI Director/Senior Manager</td><td>Airport Manager</td><td>Airlines Manager</td><td>VP/Manager Ground Handling Organization</td><td>Other</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Organization (Name)</td><td colspan="5"></td></tr>
<tr><td rowspan="2">Relevant Work Experience (Yrs.)</td><td colspan="2">Below 10 years</td><td colspan="2">11 to 20 years</td><td>21 & above</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td><td></td></tr>
</table>

# APPENDIX B

## SECTION I: Barriers responsible for underutilization of resources of PPP Airports in India

The presence of the following barriers is responsible for the underutilization of resources of PPP metropolitan airports in India: Please rate as per given below:

1. Strongly Disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly Agree

| **Efficiency Barriers influencing PPP Airport performance** | **Checking Agreement** | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| 1. Non-Hub Status | | | | | |
| 2. Inadequate Non-Aeronautical Revenue Generation | | | | | |
| 3. Congestion | | | | | |
| 4. Seasonality | | | | | |
| 5. Airport Locations and Size | | | | | |
| 6. Airport Ownership Form | | | | | |
| 7. Regulatory Challenges | | | | | |
| 8. Managerial Skills | | | | | |
| 9. Competition | | | | | |
| 10. Low-Cost Carrier Operations | | | | | |
| 11. Airline Market Power & Airport-Airlines Arrangements | | | | | |

# APPENDIX C

| Section I | **Factors affecting the performance of PPP airports** | | | | |
|---|---|---|---|---|---|
| **External Environmental Resources** | To what magnitude will External Environmental Resources impact the performance of PPP airports in India? Please rate the following; Please put the (√) sign for each of the following | | | | |
| | 1 (Strongly Disagree) | 2 (Disagree) | 3 (Neutral) | 4 (Agree) | 5 (Strongly Agree) |
| Efficient Energy resources positively impact performance | | | | | |
| Seasonality positively impacts performance | | | | | |
| Competition positively impacts performance | | | | | |
| Tourism Oriented Approach improves performance | | | | | |
| | | | | | |
| **Institutional Resources** | To what magnitude will Institutional Resources impact the performance of PPP airports in India? Please rate the following; Please put the (√) sign for each of the following | | | | |
| | 1 (Strongly Disagree) | 2 (Disagree) | 3 (Neutral) | 4 (Agree) | 5 (Strongly Agree) |

| | | | | | |
|---|---|---|---|---|---|
| Ownership Form positively affects the performance of PPP airport | | | | | |
| Price-Cap regulation positively impacts PPP airport performance | | | | | |
| Operational Arrangements positively impact PPP airport performance | | | | | |
| Management Style and Concession Agreement positively impacts PPP performance | | | | | |
| | | | | | |
| **PPP Airport Performance** | To what degree do the below factors have in relation to the performance of PPP airports in India? Please rate the following; Please put the (√) sign for each of the following | | | | |
| | 1 (Strongly Disagree) | 2 (Disagree) | 3 (Neutral) | 4 (Agree) | 5 (Strongly Agree) |
| External Environment and Institutional Structure improves passenger services | | | | | |
| External Environment and Institutional Structure positively impacts airside standards | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| External Environment and Institutional Structure improves financial prospects | | | | | |
| External Environment and Institutional Structure improves security & safety | | | | | |
| External Environment and Institutional Structure positively impacts the community near airport vicinity | | | | | |
| | | | | | |
| **Tangible Resources** | To what magnitude will Tangible Resources impact the performance of PPP airports in India? Please rate the following; Please put the (√) sign for each of the following | | | | |
| | 1 (Strongly Disagree) | 2 (Disagree) | 3 (Neutral) | 4 (Agree) | 5 (Strongly Agree) |
| Airport Economic Zone | | | | | |
| Logistic Park & Maintenance Facilities | | | | | |
| Aeronautical and Non-Aeronautical Revenue | | | | | |
| Route Network Development | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Number of Flights and ATM | | | | | |
| Cross Rail Connectivity | | | | | |
| Aerobridge and Escort Personnel | | | | | |
| Security Control Points | | | | | |
| Security Screening Resources | | | | | |
| Runway and Hangar Resources | | | | | |
| Ground Transportation and Support Services | | | | | |
| Multi-Level Car Parking System | | | | | |
| Dedicated Areas to Airlines | | | | | |
| Cargo & Business Infrastructure Facilities | | | | | |
| Terminal Landscape and Functional Experience | | | | | |
| Gate Scheduling and Assignment | | | | | |
| Baggage Handling Resources | | | | | |
| Self-Service and Self-Security Kiosks | | | | | |
| Landside Access System | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Rental Space Availability | | | | | |
| Health Facilities | | | | | |
| Lounges | | | | | |
| Special Passenger Services | | | | | |
| Children's Arena & Facilities | | | | | |
| | | | | | |
| **Intangible Resources** | To what magnitude will Intangible Resources impact the performance of PPP airports in India? Please rate the following; Please put the (√) sign for each of the following | | | | |
| | 1 (Strongly Disagree) | 2 (Disagree) | 3 (Neutral) | 4 (Agree) | 5 (Strongly Agree) |
| Human Resources | | | | | |
| Managerial Skills and Training | | | | | |
| Operational Readiness & Airport Transfer program | | | | | |
| Resource Management System | | | | | |
| Social- Media and the Internet | | | | | |
| CDM Program | | | | | |
| Smart Phone Application System | | | | | |
| Technical Efficiency/Smart Scanning Technology | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Moving System – Signaling & Advertising | | | | | |
| Cybersecurity and Protection | | | | | |
| Fast Track Security System | | | | | |
| Slots Availability | | | | | |
| E-freight System | | | | | |

| S.No | External Environmental Resources | Representation |
|---|---|---|
| 1 | Efficient Energy resources positively impact performance | EER1 |
| 2 | Seasonality positively impacts performance | EER2 |
| 3 | Competition positively impacts performance | EER3 |
| 4 | Tourism Oriented Approach improves performance | EER4 |

| S.No | Institutional Resources | Representation |
|---|---|---|
| 1 | Ownership Form positively affects the performance of PPP airport | IR1 |
| 2 | Price-Cap regulation positively impacts PPP airport performance | IR2 |
| 3 | Operational Arrangements positively impact PPP airport performance | IR3 |
| 4 | Management Style and Concession Agreement positively impacts PPP performance | IR4 |

| S.No | PPP Airport Performance | Representation |
|---|---|---|
| 1 | External Environment and Institutional Structure improves passenger services | PAP1 |
| 2 | External Environment and Institutional Structure positively impacts airside standards | PAP2 |
| 3 | External Environment and Institutional Structure improves financial prospects | PAP3 |
| 4 | External Environment and Institutional Structure improves security & safety | PAP4 |
| 5 | External Environment and Institutional Structure positively impacts the community near airport vicinity | PAP5 |

| S.No | Tangible Resources | Representation |
|---|---|---|
| 1 | Airport Economic Zone | TR1 |
| 2 | Children's Arena & Facilities | TR2 |
| 3 | Aeronautical and Non-Aeronautical Revenue | TR3 |
| 4 | Route Network Development | TR4 |
| 5 | Number of Flights and ATM | TR5 |
| 6 | Cross Rail Connectivity | TR6 |
| 7 | Aerobridge and Escort Personnel | TR7 |
| 8 | Security Control Points | TR8 |
| 9 | Security Screening Resources | TR9 |

| | | |
|---|---|---|
| 10 | Runway and Hangar Resources | TR10 |
| 11 | Ground Transportation and Support Services | TR11 |
| 12 | Multi-Level Car Parking System | TR12 |
| 13 | Dedicated Areas to Airlines | TR13 |
| 14 | Cargo & Business Infrastructure Facilities | TR14 |
| 15 | Terminal Landscape and Functional Experience | TR15 |
| 16 | Gate Scheduling and Assignment | TR16 |
| S.No | Tangible Resources | Representation |
| 17 | Baggage Handling Resources | TR17 |
| 18 | Self-Service and Self-Security Kiosks | TR18 |
| 19 | Landside Access System | TR19 |
| 20 | Rental Space Availability | TR20 |
| 21 | Health Facilities | TR21 |
| 22 | Lounges | TR22 |
| 23 | Special Passenger Services | TR23 |
| 24 | Logistic Park & Maintenance Facilities | TR24 |

| **S.No** | **Intangible Resources** | **Representation** |
|---|---|---|
| 1 | Human Resources | ITR1 |
| 2 | Managerial Skills and Training | ITR2 |

| | | |
|---|---|---|
| 3 | Operational Readiness & Airport Transfer program | ITR3 |
| 4 | Resource Management System | ITR4 |
| 5 | Social- Media and the Internet | ITR5 |
| 6 | CDM Program | ITR6 |
| 7 | Smart Phone Application System | ITR7 |
| 8 | Technical Efficiency/Smart Scanning Technology | ITR8 |
| 9 | Moving System – Signalling & Advertising | ITR9 |
| 10 | Cybersecurity and Protection | ITR10 |
| 11 | Fast Track Security System | ITR11 |
| 12 | Slots Availability | ITR12 |
| 13 | E-freight System | ITR13 |
| 14 | Innovative automatic border passage system | ITR14 |

# APPENDIX D

The underutilization of resources at PPP metropolitan airports in India can be attributed to a variety of barriers hindering their effective operation. The following factors contribute to this phenomenon. Kindly rate each based on the provided criteria:

1. **Strongly Disagree**
2. **Disagree**
3. **Somewhat Disagree**
4. **Neither Agree nor Disagree**
5. **Somewhat Agree**
6. **Agree**
7. **Strongly Agree**

| **Resources Affecting PPP Airport Efficiency and Performance** | **Checking Agreement** | | | | | | |
|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| 1. Route Network Development | | | | | | | |
| 2. Airport Economic Zone | | | | | | | |
| 3. Cargo & Business Infrastructure Facilities | | | | | | | |
| 4. Logistics Park and Maintenance Facilities | | | | | | | |
| 5. Ownership Form | | | | | | | |
| 6. Price Cap Regulation | | | | | | | |
| 7. Concessions Agreement | | | | | | | |
| 8. Managerial Skills and Training | | | | | | | |
| 9. Managerial Skills and Training | | | | | | | |
| 10. Technology | | | | | | | |
| 11. Operational Arrangements | | | | | | | |
| 12. E-Freight Systems | | | | | | | |
| 13. Competition | | | | | | | |
| 14. Seasonality | | | | | | | |
| 15. Multi-Level Car Parking System | | | | | | | |

# RESEARCH PUBLICATIONS

1. **Research Paper 1 (Published)**

   Application of RBV Theory in Business Management – A Bibliometric Analysis

   Acta Universitatis Bohemiae Meridionalis, Vol 25, No 2 (2022),

   DOI 10.32725/acta.2022.015, ISSN 2336-4297

   ABDC Journal List – C Category

2. **Research Paper 2 (Published)**

   Merger and acquisition – barrier prioritization in the Indian airline industry using AHP and FAHP techniques.

   Int. J. Logistics Economics and Globalisation, Vol. 10, No. 2, 2023

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