Analysis of Air-Cargo Traffic Handled in Major Airports of India

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Submitted by

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DECLARATION

I, **M.X. Sergious Beryl (Registration No.: 2003305033)**, student of School of Maritime Management of INDIAN MARITIME UNIVERSITY-CHENNAI CAMPUS, declare that the project report titled **"Analysis of Air-Cargo Traffic Handled in Major Airports of India"** is a bonafide record of work carried out by me under the supervision of **Dr. M Sekar**, Assistant Professor, School of Maritime Management, Indian Maritime University-Chennai Campus, submitted in partial fulfilment of the requirements for the award of the degree of Master of Business Administration in (International Transportation & Logistics Management). The information submitted is true to the best of my knowledge.

Place: Chennai

Date: 20-05-2022

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Most importantly, I would like to express my heartfelt thanks to my beloved parents for their blessing, my friends and classmates for their help and wishes for the successful completion of this project.

CERTIFICATE

School of Maritime Management

Indian Maritime University, Chennai.

This is to certify that the project report entitled "ANALYSIS OF AIR-CARGO TRAFFIC HANDLED IN MAJOR AIRPORTS OF INDIA", submitted to the School of Maritime Management, Indian Maritime University, Chennai Campus., in partial fulfillment for the award of the degree of Master of Business Administration in International Transportation and Logistics Management, is a record of work carried out entirely by M.X. Sergious Beryl, Reg. no.: 2003305033

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Place: Chennai

Date: 25th May 2022

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CHAPTER 1 – Introduction

The rapid growth of the air freight logistics industry has been aided by changing business models such as Just-in-Time Manufacturing and Global Outsourcing. Because product life cycles have shortened and demand for speedy delivery has increased, the need for air cargo transportation has expanded dramatically in recent years. This paper will give an overview on how good the India's major airports are performing in terms of air cargo handling throughout the past years and during the pandemic and after the pandemic period.

1.1 Definition & Meaning

Major Airports

According to AERA (Amendment) Act 2019 -"…..any airport which has, or is designated to have, annual passenger throughput in excess of three and a half million or any other airport as the Central Government may, by notification, specify as such." As on date there are 24 major airports in India

Air Cargo

Any property or goods carried or to be carried on an aircraft, other than mail or other property transported under the conditions of an international postal treaty, baggage, or the carrier's property; provided, however, that baggage travelling under the terms of an air waybill or a shipment record is cargo.

Freight

It refers to the sum to be paid for air freight transportation. The price paid for the movement of commodities as they are shipped from one location to another is known as freight. As a result, air freight refers to the costs of air transportation.

Tariff- The published rates, charges and related rules of a carrier.

IATA

The International Air Transport Group (IATA) is a trade association that represents airlines, passengers, shippers, travel agents, and governments. It was founded in 1945. The organization promotes safety, form uniformity (baggage checks, tickets, and weigh bills), and assists in the establishment of foreign airfares. Geneva, Switzerland is the headquarters of IATA.

IATA code

The International Air Transport Association's (IATA) Location Identifier is a three-letter identifier (also known as the IATA code) that is used to identify airports in aviation and logistics.

Transit -A period of time spent between flights.

ICAO

Organisation for Civil Aviation (ICAO). A UN specialized organization that serves as the global platform for civil aviation and aims to ensure the safe, secure, and long-term development of the industry through collaboration among member governments.

Transhipment

The act of shipping an exported product through an intermediary country before routing it to its final destination is referred to as transhipment.

The Air Cargo Tariff (TACT)

Rules, regulations and rates published for international air shipments

Cargo Aircraft

Aircraft built with the purpose of carrying nothing else than cargo.

Scheduled services

In the case of air transportation, these are services provided by flights that are scheduled and performed for a fee according to a published timetable, or that are so regular or frequent as to form a recognizably systematic series, and are available for direct booking by members of the public; also,

extra revenue flights caused by overflow traffic from scheduled flights; and preliminary revenue flights on planned new air services.

Load Factor

The proportion of available seats occupied with paying passengers, or the proportion of freight capacity used. Revenue passenger miles divided by available seat miles or cargo ton miles divided by available cargo ton miles are the mathematical formulas.

1.2 Objective of the study

The main objective of this project work is to provide a clear insight on India's major Airport wise air-cargo traffic by different parts of country. This project is carried out in an effort to visualize the trends in air cargo traffic handled in both domestic as well as international airports in India, over the years.

1.3 Research Methodology

This chapter discusses the research methods used for collection of data and the criteria based on which the data collection plan is implemented. The Research was done on the air cargo traffic handled in India's major airports. The data for this research is drawn from different report and through well-known persons in the field. The main objective will be carried out by going through the websites of the Airports Authority of India and The Minister of Civil Aviation. These websites will provide a lot of information regarding each and every aspect of the project and the status of it. The information related to the movement of cargo and fairway development are included in this objective of the study. The researcher endeavors to analyze the situation and make critical assessment. The data was analyzed using various graphs of particular years.

1.4 Scope of the Study

- This project provides a clear insight on India's major Airport wise air-cargo traffic by different parts of country.

- This project would be helpful for the student community or any other organization for getting insight of the ongoing trend in air-cargo traffic handled in airports across India.
- Students who are interested to explore about India’s major Airports can know the present scenario and future prospects.

1.5 Limitation

It is for sure that research will have some limitations and it is normal. However, it is critically important to be striving to minimize the range of scope of limitations throughout the research process. Some of the limitations of the research methodology selected is given below:

- The main limitations are that the scarcity of data and its volume which was restricted to its official website only.
- The study depends on the secondary data published in newspapers, books and journals of the researchers. In some cases, data that is published by the researchers can't dissect the fresh data and publish the old data which isn't valid.
- The information collected from various sources may differ in such case there will be error in actual interpretation.

CHAPTER 2 – Literature Survey

2.1 Literature Review

[1] Yonghwa Park, Hun-Koo Ha and Oh Kyoung Kwon (2006) et al. This study analyzes and evaluates the competitiveness of airports in Northeast Asia by looking at their efficiency. The competitiveness of airport efficiency was compared using Data Envelopment Analysis (DEA), which was chosen based on the region's top-ranking freight operations. Because there had been no previous research on the competitiveness of hub concentration airports in terms of air cargo volume, the variables were chosen based on air freight reference papers and records. The study found that in Northeast Asia, larger airports are related with increased efficiency. Airports that are inefficient have been hampered by excess capacity or undeveloped input.

[2] Robert Mayer (2016) Airport Classification based on Cargo Characteristics et al. Using a hierarchical cluster analysis, this study used absolute (cargo tonnage) and relative metrics (share of cargo work load units, freighter movements, and international cargo) to determine the reliance of different airport types and groupings on air cargo. The study's findings revealed that airports that rely substantially on air cargo benefit from a prominent position within cargo airline networks, whilst other airports with large cargo volumes produce these as a result of significant passenger belly capacity. Understanding cargo airport variability is essential for future benchmarking studies.

[3] Thomas van asch ,Woulter Dewulf ,Franziska Kupfer (2019) Air cargo and airport competitiveness et al. Airlines and airports used to see air freight as a by-product. While looking for new income sources, airlines and airports found the potential of air cargo. This article investigates how competitive European airports are in terms of air freight. The key elements characterizing an airport's competitiveness in terms of

air cargo are identified after extensive literature study and discussions with industry professionals. This study could help airports evaluate and improve their air cargo strategy, while (potential) shareholders will have an additional tool to determine whether or not an airport investment is viable.

[4] Karthikeyan Lenin (2015) A Study on the Air Cargo Logistics Operations in Dubai et al. Air freight is an unique sector that plays a crucial part in modern logistics because it provides a highly integrated and complete facility with safe, rapid, dependable, convenient, and highly efficient services. The air transportation industry is relatively new compared to land and sea transportation, but it has been a major facilitator for civilization's economic progress. Air cargo is an important part of the global transportation and logistics value chain, attracting a cargo industry that is expected to grow four to five times faster than passenger travel by 2020. In this article, the author examines the air freight handling technique with reference to Emirates Skycargo, and critically evaluates the operational issues that the company may encounter. Findings and recommendations were presented to ensure that products and services are aligned to consumer wants.

[5] S.vasantha (2019) Analyze the Challenges and Problems in Air Cargo Operations ,Chennai, TN et al. The focus of this thesis is to better understand the issues that comes with air freight operations. The study aims to uncover issues that arise during cargo import and export via air transport. This research provides insight into the issues and challenges that are faced in air freight operations. Problems such as a customs clearance backlog, congestion at airport cargo terminals, reducing dwell time, unskilled labour, inefficient use of belly cargo capacity, forecasting airline cargo capacity and space distribution, obstacles in handling hazardous and dangerous goods, and so on.

2.2 Literature gap

In India, airport research has paid little attention to air freight air-cargo traffic. Overall, a few researches that are present are mostly done in Western countries, where the data were available readily which is not so when it comes to India. Moreover, the literatures that were referred are all based on the data that existed pre-pandemic, researchers have not seen such a devastating change in normal air cargo traffic, which is why the concept of "pre- pandemic and post pandemic" was never considered in previous studies and it totally new. Considering this literature gap, this project paper is basically an attempt to visualize the impact of covid-19 in India's Major airports- cargo traffic and also forecast future growth and trend in air-cargo traffic (airport wise) that can be expected, provided that the global trade conditions stay in a positive manner.

CHAPTER 3 – Aviation industry & Airports

3.1 Sector Background

Airports are critical to cities, governments, and regions' economic development. They contribute to economies either directly or indirectly by providing services to airlines, moving people, and transporting cargo. Governments, consumers, and businesses all gain from the free movement of products and people.

There are around 4,500 airports with scheduled flights around the world (as of 2021). Airports Council International (ACI), a global trade organisation for the world's airports, reported $172.2 billion in revenue in 2017, up 6.2 percent from the previous year. The airport sector has been continuously growing in recent years, owing to increased passenger traffic. Total journeys crossed 9 billion in 2019, up 3.4 percent year over year.

3.2 Air Cargo and Airports

Airports are critical components of the air cargo system because they provide as a link between ground transportation and aircraft operations (Morrell, 2011).

Airports act as nodes in air transport for three flows in the air cargo system.

- First, the airport handles local aviation cargo destined for domestic use as well as exports from the area.
- • Second, airports serve as entry points for cargo generated or headed for the manufacturing sector in the airport's immediate vicinity.
- • Finally, airports serve as transshipment hubs for "hub freight," or cargo flown from one aircraft to another with a destination outside the airport's local vicinity.

3.3 Aviation industry in India

During the last three years, India's civil aviation industry has emerged as one of the country's fastest-growing industries. According to the

International Air Transport Association, India has become the world's third-largest domestic aviation market and in the next 10 years, it is predicted to overtake China and the US as the world's third-largest air passenger market.

However, between 2016 and 2021, freight traffic fell by 1.77 percent, from 2.70 million tons (MT) to 2.47 million tons (MT). India's airport freight traffic has the potential to reach 17 MT by FY40.

While the cargo side of air transportation is little in compared to passenger traffic, it is important to airlines, airports, and the wider economy, but it has received little attention in Indian airports.

3.4 Airports in India

India has been rapidly developing, resulting in the construction of numerous airports throughout the country. The Airport Authority of India is responsible for both international and domestic airports in India.

The Airports Authority of India (AAI) manages Indian airports, while the Ministry of Civil Aviation is in charge of developing, upgrading, maintaining, and managing India's civil aviation infrastructure.

AAI operates and maintains 136 airports including 30 Civil Enclaves at Defense airfields in the country. Out of the above 136 airports, 110 airports are operational, out of which 24 are AAI International airports including 3 International Civil Enclaves; 10 are AAI Customs airports including 4 Customs Civil Enclaves; and 76 are AAI Domestic (Operational) airports, including 21 Domestic (Operational) Civil Enclaves.

Over 2.8 million square nautical miles of airspace, AAI offers air navigation services. To maintain the safety of aircraft operations, the Airports Authority of India (AAI) offers Air Traffic Management Services (ATMS) over the whole Indian airspace and adjacent maritime areas, with ground installations at all airports and 25 other locations.

3.5 Airports Authority of India (AAI)

The Airports Authority of India was established in 1995 under the Ministry of Civil Aviation by the Airports Authority of India Act, 1994. As a result, it is a statutory entity. The Airports Authority of India has its headquarters in New Delhi.

The AAI is responsible for the development, enhancement, maintenance, and management of India's civil aviation infrastructure. The AAI's primary responsibility is to provide Air Traffic Management (ATM) services over Indian Territory airspace and adjacent marine areas. It also contains CNS (Communication Navigation Surveillance). It is in charge of developing, managing, maintaining, and upgrading the country's aviation infrastructure. The AAI is in charge of international airports, domestic airports, customs airports, and civil enclaves on defense airfields.

The functions of AAI are as follows:

- International and domestic airports and civil enclaves design, development, operation, and maintenance.
- ICAO-approves control and management of Indian airspace that extends beyond the country's territorial limits.
- Development & Management of cargo terminals at international/domestic airports.
- Providing passenger information systems to passenger terminals.

- Expansion and strengthening of the operation area, including runways, aprons, and taxiways, among other things.
- provide of visual aids regarding the airport performance.
- Communication and navigation aids, such as ILS, DVOR, DME, and Radar.

3.6 Classification of Airports in India:

International Airports:

Any airport designated as an airport of entry and departure for international air traffic by an ICAO Contracting State on whose territory it is located, where formalities such as customs, immigration, public health, agricultural quarantine, and similar procedures are carried out. These airports have been designated as international airports and are open to scheduled international flights by Indian and foreign airlines. International flights are handled. Customs and an international terminal are included in international airports. Passengers can take direct or connecting flights to other countries.

Joint venture International Airports:

As per the policy of Government of India, some airports have been doing Operation, maintenance and development under Joint venture model. AAI has formed Joint Venture in 7 airports. The seven airports in which AAI has stakes are, Chhatrapati Shivaji Maharaj International Airport, Kannur International Airport, Kannur Mumbai, Dr. Babasaheb Ambedkar International Airport, Nagpur, Rajiv Gandhi International Airport, Hyderabad, Chandigarh Airport, Chandigarh. Indira Gandhi International Airport, Delhi, Kempegowda International Airport, Bengaluru.

PPP International Airports:

A Public-Private Partnership (PPP) is a collaboration between the public and private sectors to deliver a project or service that would otherwise be provided by the public sector. When effective cooperative agreements between the public and private sectors are employed, the management

abilities and financial acumen of private enterprises could produce better value for money for taxpayers. The Airports Authority of India (AAI) has awarded six airports, namely Ahmedabad, Jaipur, Lucknow, Guwahati, Thiruvananthapuram, and Mangaluru, to the best bidder, M/s Adani Enterprises Limited (AEL), for operations, management, and development on a 50-year lease basis.

Custom Airports:

Airports that handle international flights but do not have customs checking and clearance facilities are not promoted to International Airport status. Customs and immigration services are available at these airports for limited international operations by national carriers as well as foreign tourist and freight charter aircraft.

Domestic Airports:

This category includes all other airports. Deals with domestic flights. Because domestic airports lack customs and immigration services, they are unable to handle flights to or from international airports. These airports often feature short runways that can accommodate short and medium-haul flights as well as regional air traffic.

Civil Enclaves in Defence Airport:

A civil enclave is a section of a military air base dedicated to civil aviation. Civil enclaves are frequent in nations such as India, Sri Lanka, and Pakistan, where a portion of an air base, almost always a World War II relic, is designated for domestic air traffic rather than constructing a new civilian airport. Civil aircraft are not permitted to operate during the curfew (typically after sunset) at these airports. Morning hours are often set aside for military aviation instruction. Altitude restrictions are implemented in several civil enclaves. i.e. one below which a civilian aircraft cannot descend while over-flying the enclave. Curfews may cause airport congestion, while altitude restrictions may result in extended detours and increased fuel usage. In India, there are 26 civil enclaves on Defence Airfields.

3.6.1 Region-wise airport clusters

Airports in India are also divided based on the geographical locations. That is, the airports are grouped Region-wise into five clusters. They are as follows,

- Northern Region
- Western Region
- Eastern Region
- North East Region
- Southern Region

3.6.1.1 Northern Region

DELHI (UT)	INDIRA GANDHI INTERNATIONAL AIRPORT, NEW DELHI (JVA)	International
	SAFDARJUNG(DELHI)	Domestic
HIMACHAL PRADESH	KANGRA (GAGGAL)	Domestic
	KULLU (BHUNTAR)	Domestic
	SHIMLA	Domestic
JAMMU & KASHMIR	JAMMU (CE)	Domestic
	LEH (CE)	Domestic
	SRINAGAR (CE)	International
PUNJAB	ADAMPUR (CE)	Domestic
	AMRITSAR	International
	BHATINDA (CE)	Domestic
	LUDHIANA	Domestic
	PATHANKOT (CE)	Domestic
RAJASTHAN	BIKANER (CE)	Domestic
	JAIPUR	International
	JAISALMER (CE)	Domestic
	JODHPUR (CE)	Domestic

	KOTA	Domestic
	UDAIPUR	Domestic
	KISHANGARGH	Domestic
UTTAR PRADESH	AGRA (CE)	Domestic
	ALLAHABAD (CE)	Domestic
	BAREILLY (CE)	Domestic
	GORAKHPUR (CE)	Domestic
	KANPUR (CHAKERI) (CE)	Domestic
	KANPUR (CIVIL)	Domestic
	LUCKNOW	International
	VARANASI	International
	LALITPUR	Domestic
UTTARAKHAND	DEHRADUN	Domestic
	PANTNAGAR	Domestic

Table 1: Airports in Northern Region

3.6.1.2 Western Region

MAHARASHTRA	AKOLA	Domestic
	AURANGABAD	Custom
	GONDIA	Domestic
	JALGAON	Domestic
	JUHU (MUMBAI)	Domestic
	CSI AIRPORT, MUMBAI (JVA)	International
	KOLHAPUR	Domestic
	NAGPUR (JVA)	International
	PUNE (CE)	Custom
	SHOLAPUR	Domestic

GOA	GOA (CE)	International
MADHYA PRADESH	BHOPAL	Domestic
	GWALIOR (CE)	Domestic
	JABALPUR	Domestic
	KHAJURAHO	Domestic
	INDORE	Domestic
	KHANDWA	Domestic
	PANNA	Domestic
	SATNA	Domestic
GUJARAT	AHMEDABAD (SVBPI)	International
	BHAVNAGAR	Domestic
	BHUJ (CE)	Domestic
	KANDLA	Domestic
	KESHOD (JUNAGARH)	Domestic
	JAMNAGAR (CE)	Domestic
	PORBANDAR	Domestic
	RAJKOT	Domestic
	SURAT	Custom
	VADODARA	Domestic
	DEESA (PALANPUR)	Domestic

Table 2: Airports in Western Region

3.6.1.3 Eastern Region

ANDAMAN & NICOBAR ISLANDS	PORTBLAIR (CE)	International
BIHAR	GAYA	Custom
	PATNA	Custom

	JOGBANI	Domestic
	MUZAFFARPUR	Domestic
	RAXAUL	Domestic
CHANDIGARH (UT)	CHANDIGARH (CE)	Custom
	RAIPUR	Domestic
	BILASPUR	Domestic
JHARKHAND	RANCHI	Domestic
	CHAKULIA	Domestic
	DEOGARH	Domestic
WEST BENGAL	BAGDOGRA (CE)	Custom
	BEHALA	Domestic
	KOLKATA (NSCBI)	International
	ASANSOL	Domestic
	BALURGHAT	Domestic
	COOCH BEHAR	Domestic
	MALDA	Domestic
SIKKIM	PAKYONG	Domestic
ORISSA	BHUBANESWAR	International
	JHARSUGUDA	Domestic

Table 3: Airports in Eastern Region

3.6.1.4 North East Region

ARUNACHAL PRADESH	DAPARIZO	Domestic
	PASSIGHAT (CE)	Domestic
	TEZU	Domestic
MANIPUR	IMPHAL	International
MEGHALAYA	SHILLONG(UMROI)	Domestic
MIZORAM	AIZAWAL (TURIAL)	Domestic
NAGALAND	DIMAPUR	Domestic
ASSAM	DIBRUGARH (MOHANBARI)	Domestic
	GUWAHATI (LGBI)	International
	LILABARI (NORTH LAKHIMPUR)	Domestic
	JORHAT (CE)	Domestic
	SILCHAR (CE)	Domestic
	TEZPUR (CE)	Domestic
	RUPSI	Domestic
	SHELLA	Domestic
TRIPURA	AGARTALA	Domestic
	KAILASHAHAR	Domestic
	KAMALPUR	Domestic
	KHOWAI	Domestic

Table 4: Airports in North-East Region

3.6.1.5 Southern Region

LAKSHADWEEP ISLAND	AGATTI	Domestic
ANDHRA PRADESH	RAJAMUNDRY	Domestic
	TIRUPATI	International
	VIJAYAWADA	International

	VISAKHAPATNAM (CE)	Custom
	CUDDAPAH	Domestic
	DONAKONDA	Domestic
KARNATAKA	BANGALORE (CE)	Domestic
	BELGAUM	Domestic
	HUBLI	Domestic
	MANGALORE	International
	MYSORE	Domestic
KERALA	CALICUT	International
	COCHIN	International
	KANNUR	International
	THIRUVANANTHAPURAM	International
PUDUCHERRY	PUDUCHERRY	Domestic
TELANGANA	HYDERABAD (BEGUMPET)	Domestic
	NADIRGUL	Domestic
	WARANGAL	Domestic
TAMIL NADU	COIMBATORE	International
	CHENNAI	International
	MADURAI	Custom
	SALEM	Domestic
	TIRUCHIRAPALLI	International
	TUTICORIN	Domestic
	THANJAVUR (CE)	Domestic
	VELLORE	Domestic

Table 5: Airports in Sothern Region

3.7 Major Airports in India

Recently the old AERA Act 2008 has been replaced by AERA (Amendment) Act 2019 which came into effect vide Gazette Notification dated 26-09-2019 wherein the definition of a "major airport" has been amended as under: "…..any airport which has, or is designated to have, annual passenger throughput in excess of three and a half million or any other airport as the Central Government may, by notification, specify as such." As on date there are 24 major airports in India, namely:

1) Indira Gandhi International Airport, Delhi

IATA: *DEL*

ICAO**:** *VIDP*

The airport is located in Palam, Delhi, and covers a total area of 5,106 acres. Delhi International Airport (DIAL), a public-private coalition led by GMR Group, manages Indira Gandhi Airport. The concession to operate the airport is currently held by GMR, Airports Authority of India, Eraman Malaysia, and Fraport.

2) Chhatrapati Shivaji Maharaj International Airport, Mumbai

IATA: BOM

ICAO: VABB

The airport covers a total land area of 750 hectares and has two active terminals. The bid to manage and run CSMIA was won by a consortium consisting of GVK Industries Ltd, Airports Company South Africa, and Bidvest. Mumbai International Airport Private Limited (MIAL), a joint venture between the consortium and the AAI was founded to accomplish this goal.

3) Kempegowda International Airport, Bengaluru

IATA**:** *BLR*

ICAO**:** *VOBL*

Kempegowda International Airport is an international airport in Bangalore, Karnataka's capital, in the southern Indian state of Karnataka. The airport

covers around 4,000 acres (1,600 ha). Bengaluru International Airport Limited (BIAL), a public–private partnership, owns and operates the airport. Domestic and international activities could be combined in a single integrated passenger terminal.

4) Rajiv Gandhi international Airport, Hyderabad

*IATA***:** HYD

*ICAO***:** VOHS

Hyderabad, the capital of the Indian state of Telangana, is served by Rajiv Gandhi International Airport, an international airport. It opened in March 2008 to replace Begumpet Airport, which was Hyderabad's only civilian airport. West of the passenger terminal lies the cargo terminal.

GMR Hyderabad International Airport Ltd (GHIAL), a public–private partnership, is the owner and operator of RGIA. It is made up of the Airports Authority of India (13%) and the Government of Telangana (13%) as well as GMR Group (63%) and Malaysia Airports Holdings Berhad 11 %. As per the agreement between GHIAL and the Central Government, GHIAL has the right to run the airport for 30 years, with the option to continue for another 30 years. Within the terminal, there is a Pharma Zone, a temperature-regulated facility designed to store pharmaceuticals. The first ever facility to be laid at an Indian airport, RGIA pharmaceuticals account for 70% of exports from the airport.

5) Cochin International Airport, Kochi

*IATA***:** COK

*ICAO***:** VOCI

Cochin International Airport serves the city of Kochi, the state of Kerala is first to develop under a public-private partnership (PPP) model in India. This project was funded by over 10,000 NRI (Non-resident Indians) from 32 countries. The airport has three passenger terminals and one cargo terminal of total area 225,000 m^2.

The Government of Kerala has 33.36% stake, which makes it the largest investor in the project. Government companies like Air India, BPCL, AAI has 8.74% stake, along with this, Abu Dhabi based Emke Group, the Oman-based Galfar Group, UAE based Majeed Bukatara Trading has 5.42% stake. Indian companies hold 8.57% stake, while Federal Bank, SBT and Canara Bank has 5.91%.

6) Chandigarh International Airport, Chandigarh

*IATA***:** IXC

*ICAO***:** VICG

Chandigarh International Airport Limited (CHIAL) is a joint venture company formed under companies Act, 2013 by Airports Authority of India (AAI) in association with Government of Punjab and Haryana. It is also one of the famous tourist destinations in Northern India. Today, Chandigarh Airport is more of a domestic terminal with connecting flights to major cities of India.

7) Chennai International Airport, Chennai

*IATA***:** MAA

*ICAO***:** VOMM

Formerly, Chennai International Airport known as Madras Airport, serving Metropolitan Area in Chennai, Tamil Nadu. Spread over 1323 acres, Chennai International Airport has three terminals: the old terminal at Meenambakkam is used for cargo and the other two terminals at the at Tirusulam used for domestic and international passenger operations, respectively.

8) Netaji Subhas Chandra Bose International Airport, Kolkata

*IATA***:** CCU

*ICAO***:** VECC

Netaji Subhas Chandra Bose International Airport is an international airport serving the Kolkata Metropolitan, West Bengal and it act as the aviation

hub for the eastern and north eastern India. Kolkata Airport is the largest hub for air traffic in the eastern part of the country.

9) Sardar Vallabhbhai Patel International Airport, Ahmedabad

IATA: AMD

ICAO: VAAH

Sardar Vallabhbhai Patel International Airport is an international airport that serves two cities of Ahmedabad and Gandhinagar in Gujarat, India. The airport today consists of four terminals: domestic, international, an additional terminal for a cargo terminal as well. The airport consists of 45 parking bays and both the international & domestic terminals have 4 aero-bridges each. The new terminal has been designed and built based on Singapore Changi Airport.

10) Trivandrum International Airport, Thiruvananthapuram

IATA: TRV

ICAO: VOTV

It is the first airport in the state of Kerala, established in 1932, and 5th international airport of India. Spread over 700 acres. There are two terminals. One of the terminals is for domestic flights (except Air India), and other terminal is for all international flights as well as all domestic flights of Air India.

11) Chaudhary Charan Singh International Airport, Lucknow

IATA: LKO

ICAO: VILK

It was earlier also known as ''Amausi International Airport'', located in the Amausi area of the city 14 km far from the city centre. It was later renamed in 2008 after Chaudhary Charan Singh. It is owned and run by the Lucknow International Airport Limited (LIAL), a public- private consortium led by Adani Group. In February 2019, the Adani Enterprises led - Lucknow International Airport Limited (LIAL) won the rights of operations, management and development of the airport under the public-private

partnership (PPP) model. As per the agreement, for a period of 50 years the airports would be handed to the company at the highest bid of ₹171 per passenger. The company will pay the per-passenger fee to AAI for every domestic and international passenger handled at the airport.

12) Jaipur International Airport, Jaipur

IATA: JAI

ICAO: VIJP

Jaipur International Airport serves Jaipur, the capital of the Rajasthan. It is located in the southern suburb of Sanganer. The airport was granted the status of international airport on 29th December 2005. The airport consists of two Passengers terminals and a cargo terminal. Jaipur airport has been leased out to Adani Group by the Indian government for a period of 50 years.

13) Lokpriya Gopinath Bordoloi International Airport, Guwahati

IATA: GAU

ICAO: VEGT

Lokpriya Gopinath Bordoloi International Airport also known formerly as 'Borjhar Airport' and aka Guwahati International Airport, is the primary airport of North-Eastern states of India. This airport serves both the civil as well as military aircrafts throughout the year. Lokpriya Gopinath Bordoloi International Airport is also the epicentre of International UDAN scheme, rolled out by the Government of India.

14) Calicut International Airport, Kozhikode

IATA: CCJ

ICAO: VOCL

Calicut International Airport aka Karipur Airport or Kozhikode Airport, is an international airport in Karipur, Malappuram district of Kerala, India. It serves the Malabar region of Malappuram, Kozhikode, Palakkad and Waynad.

15) Goa International Airport, Goa

IATA: GOI

ICAO: VOGO

Dabolim Goa International Airport is an international airport in Dabolim, Goa, India. It is run by the Airports Authority of India as a civil enclave in named INS Hansa- an Indian Navy naval airbase. The airport is in Dabolim, 4 kilometers from the nearest city Vasco da Gama, 23 kilometers from Margao, and 30 kilometers from the state capital Panjim.

The airport is spread over 688 hectares. The airport's terminal handles both international and domestic passengers. It was opened in December 2013.

16) Pune International Airport, Pune

IATA: PNQ

ICAO: VAPO

The airport is a civil enclave run by the Airports Authority of India at the western side of the Indian Air Force Station, Lohegaon. The airport handles both domestic and international flights, especially to Western parts of Asia. In 2020, the airport was awarded as 'Best Airport by Hygiene Measures' in Asia-Pacific by Airports Council International.

17) Jay Prakash Narayan International Airport, Patna

IATA: PAT

ICAO: VEPT

Jayprakash Narayan Airport, a customs airport situated in Patna, the state capital of Bihar in India. It is classified as a restricted international airport due to its short runway. The Airports Authority of India (AAI) is working to modernise and expand the airport infrastructure. The airport is currently undergoing an expansion project that is expected to be completed in 2023. In addition to this, the AAI has proposed to develop a second airport for Patna to serve as civil enclave at Bihta Air Force Station. Jay Prakash Narayan International Airport is the 18th busiest airport in India located at 5km southwest of the city. Patna Airport is under expansion mode to handle

the rising number of passengers. It is well-connected to the city by means of taxis and auto rickshaws.

18) Guru Ram Dass Jee International Airport, Amritsar

IATA: ATQ

ICAO: VIAR

It is named after Guru Ram Das, the fourth Sikh Guru who is also the founder of Amritsar city. Amritsar Airport is the largest and the busiest airport in Punjab, Indian. It is located on the Amritsar-Ajnala Road, closer to the village of Raja Sansi. Sri Guru Ram Das Ji International Airport is an international airport about 11 Km northwest of the city of Amritsar, Punjab, India. Amritsar Airport is the largest and the busiest airport in the Indian state of Punjab. It is the second largest airport in Northern India after Delhi Airport. The airport was the 3rd fastest-growing airport in India during the fiscal year 2017–18. It acts as a hub of cargo movements, both domestically and internationally. The Airport is ranked the 6th-best regional airport in India and Central Asia in 2019 and 2020 by Skytrax. In 2020, the airport is awarded as the best airport in Asia-Pacific by Airports Council International.

19) Lal Bahadur Shastri International Airport, Varanasi

IATA: *VNS*

ICAO: *VEBN*

Lal Bahadur Shastri International Airport is an international airport located at Babatpur, 26 km northwest of Varanasi, Uttar Pradesh, India. It was officially renamed after Lal Bahadur Shastri, the second Prime Minister of India, in October 2005. Formerly, also known as Varanasi Airport. In terms of passenger movement, it is India's 20th-busiest airport and second-busiest airport in Uttar Pradesh. In 2020, the airport is awarded as the best airport in Asia-Pacific by Airports Council International.

20) Biju Patnaik International Airport, Bhubaneswar

IATA: BBI

ICAO: VEBS

Biju Patnaik Airport, often known as Bhubaneswar Airport, serves Bhubaneswar, the state capital of Odisha. It is 4 kilometers south of the Bhubaneswar railway station and 6 kilometers from the city center.

The airport is named after the former chief minister of Odisha, Biju Patnaik, a famed aviator and freedom fighter, it is the 11th busiest among the airports maintained by Airports Authority of India and16th busiest airport in India, registering an 11.7% fall in traffic over the previous year. Biju Patnaik Airport is one of the major civil aviation hubs in Eastern India. The airport boasts two active scheduled passenger terminals i.e.) Terminal 1 for domestic and Terminal 2 international passengers.

21) Swami Vivekananda Airport, Raipur

IATA: RPR

ICAO: VERP

Swami Vivekananda Airport, formerly known as Raipur Airport and referred to as VARP until February 2018, is a significant airport in Chhattisgarh, India. It is Central India's busiest airport as well as Chhattisgarh's busiest airport. The airport is located in Mana, around 15 kilometers from Raipur and 10 kilometers from Naya Raipur. By passenger traffic, it is India's 22nd busiest airport. The airport was renamed Swami Vivekananda Airport on January 24, 2012, as a memorial to the popular saint who spent a significant portion of his life in Raipur. The new terminal was opened by then-Indian President Pranab Mukherjee on November 7, 2012. The building, which cost around 165 crore (US$22 million), is 22,000 m2 in size. It can accommodate 1300 passengers at a time, with 400 international travelers.

22) Tiruchirappalli International Airport, Tiruchirappalli

IATA: *TRZ*

ICAO: *VOTR*

Tiruchirappalli International Airport is a major international airport in Tiruchirappalli, Tamil Nadu, India. It's about 5 kilometers south of the city center on National Highway 336. It is now India's 31st busiest airport in terms of passenger traffic and 28th busiest in terms of total aircraft movement. There are two terminals at the airport. When a modern integrated passenger terminal was erected in 2009 for both international and domestic aviation traffic, the original passenger terminal was turned into an international freight complex housing the control tower and technical building. AAI has awarded construction of a considerably larger terminal on available land in the airport's southern end, which is expected to be finished in 2022, due to increased passenger demand.

23) Mangalore International Airport, Mangaluru

IATA: IXE

ICAO: VOML

Mangalore International Airport is an international airport that serves Mangalore, India's coastal city. It is one of Karnataka's two international airports, the other being Bangalore's Kempegowda International Airport. Mangalore International Airport is Karnataka's second busiest airport. Mangalore International Airport is an international airport that serves Mangalore, India's coastal city. It is one of Karnataka's two international airports, the other being Bangalore's Kempegowda International Airport. Mangalore International Airport is Karnataka's second busiest airport. Flights to key Middle Eastern cities depart daily in addition to domestic destinations.

24) Kannur International Airport Limited, Kannur

IATA: CNN

ICAO: VOKN

Kannur International Airport serves Kerala's North Malabar region, as well as the Karnataka districts of Kodagu and Mysore, and the Puducherry district of Mahé. It lies 28 kilometers east of Kannur and 24 kilometers east of Thalassery, in the Thalassery taluk of Kannur district, Kerala, near the municipality of Mattannur. Kannur International Airport Limited (KIAL), a public–private partnership, owns and operates the airport. On December 9, 2018, the airport began commercial operations.

CHAPTER IV – Analysis & Interpretation

4.1 Data collection

Data was collected by carrying out secondary research. Data sources in this paper are extensively taken from the secondary data that are publicly available in the Airports Authority of India and The Minister of Civil Aviation annual and monthly reports.

4.2 Analysis

The analysis is done using the available data and results were listed using various graphs and pie chart, also including the yearly percentage change seen in the air cargo traffic handled in top 5 major airports in India.

4.2.1 Trend Analysis

A statistical tool for assisting data understanding is linear trend estimation. It generates a line of best fit that can be used to depict the data's behavioral features in order to see if any patterns emerge. A trend line is an analytical tool used most often in conjunction with a scatter plot (a two-dimensional graph of ordered pairs) to see if there is a relationship between two variables.

The idea of a trendline, **y = mx + c** is to reveal a linear relationship between two variables, **x** and **y**. Deriving the line equation that links two variables allows us to extrapolate, or predict, how one variable will change given any change in the other. The main purposes of a trend line:

- Determining if a set of points exhibits a positive trend, a negative trend, or no trend at all.
- Predicting unknown or future data points.

4.2.2 Percentage Change

When there is "old" and "new" number, or a "beginning" and "final" value, this calculation will be most useful. A positive change is defined as a rise in the % value, whilst a negative change is defined as a reduction in the percentage value's absolute value.

$$\%Change = \frac{Final\ value - initial\ value}{initial\ value} \times 100$$

4.2.3 Forecasting Growth

The percentage change of a specific variable over time is referred to as growth rates. The annual change in a variable is expressed as a percentage using growth rates.

Formula for Average Annual Growth Rate (AAGR)

$$\text{AAGR} = \frac{GR_a + GR_b + \cdots .. + GR_n}{N}$$

where:

GR_a - Growth rate in period *A*

GR_b - Growth rate in period *B*

GR_n - Growth rate in period *n*

N - Number of years

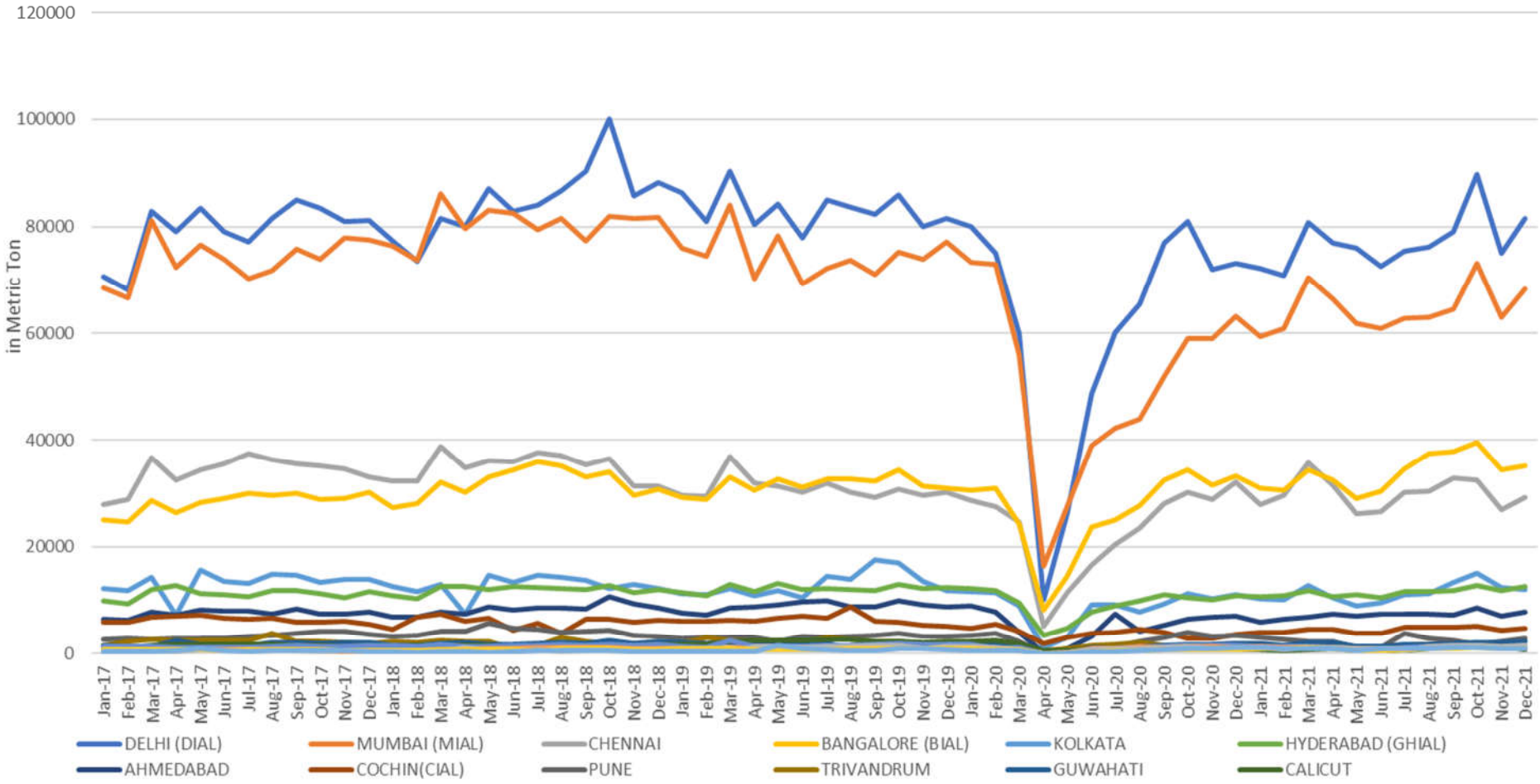
4.3 Interpretation

Collected data are analysed using different tools in excel software and data are put in structured tables and sort accordingly. Using pivot tables and filter functions the data of certain airports are extracted out and their details are examined and interpreted in the form of tables and graphs for better visualization of data.

% Change in yearly total cargo traffic	DELHI	MUMBAI	CHENNAI	BANGALORE	HYDERABAD	KOLKATA	AHMEDABAD	COCHIN	PUNE	TRIVANDRUM
% Change 2018	7%	9%	3%	13%	7%	-4%	11%	-7%	26%	-13%
% Change 2019	-2%	-7%	-11%	-1%	1%	2%	6%	8%	-24%	12%
% Change 2020	-27%	-33%	-25%	-17%	-24%	-34%	-41%	-41%	-26%	-40%
% Change 2021	27%	28%	30%	29%	24%	32%	39%	19%	2%	-2%
Average Annual growth rate	1%	-1%	-1%	6%	2%	-1%	4%	-5%	-5%	-11%
forecasted % Change 2022	0%	-2%	-8%	4%	9%					

Table 6: Annual Percentage change and Average Annual Growth Rate

4.3.1 Month-wise Total air cargo handled in airport with Pre-COVID and post-COVID (2017-2021)



Source: AAI Traffic News | AIRPORTS AUTHORITY OF INDIA

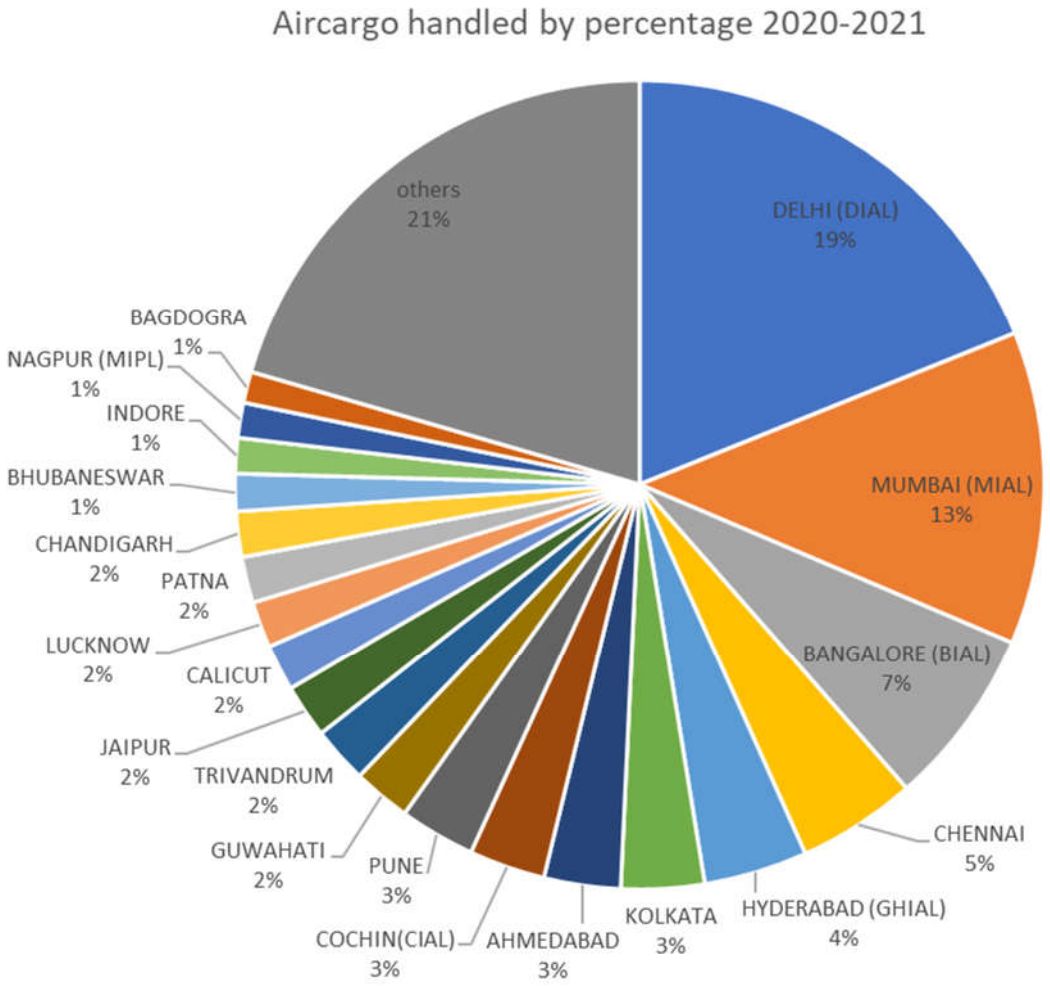
Graph 1:Air-Cargo handled in major airports of India (2017-2021)

4.3.2 Top 10 busiest Airports in India by cargo handled (2020-21)

Rank	Name of Airport	City
1	Indira Gandhi International Airport	DELHI (DIAL)
2	Chhatrapati Shivaji Maharaj International Airport	MUMBAI (MIAL)
3	Kempegowda International Airport	BANGALORE (BIAL)
4	Chennai International Airport	CHENNAI
5	Rajiv Gandhi international Airport	HYDERABAD (GHIAL)
6	Netaji Subhas Chandra Bose International Airport	KOLKATA
7	Sardar Vallabhbhai Patel International Airport	AHMEDABAD
8	Cochin International Airport	COCHIN(CIAL)
9	Pune International Airport	PUNE
10	Lokpriya Gopinath Bordoloi International Airport	Guwahati

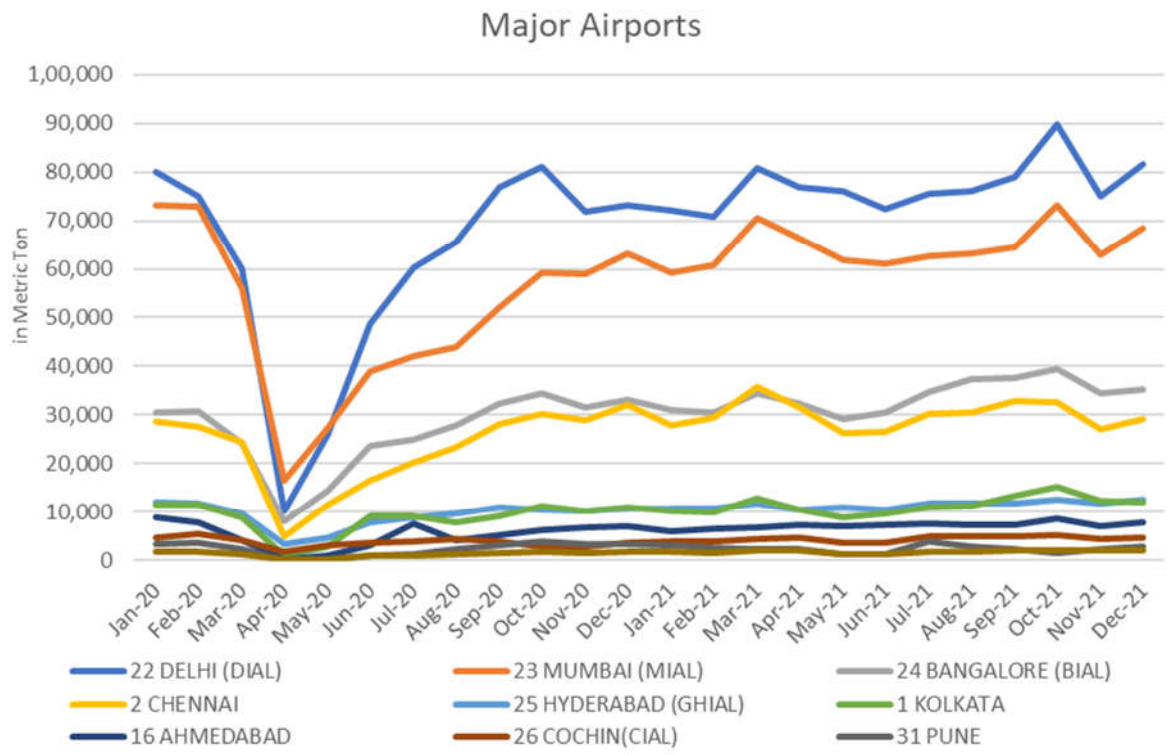
Table 7: Top 10 Major Airports in terms of cargo traffic handled
Source: AAI Traffic News | AIRPORTS AUTHORITY OF INDIA

4.3.3 Percentage share of air-cargo traffic handled in Airports across India (2020-21)



Graph 2: Percentage share of air-cargo traffic handled in Airports across India (2020-21)
Source: AAI Traffic News | AIRPORTS AUTHORITY OF INDIA

4.3.4 Month-wise Total air cargo handled in Top 10 major airport airports



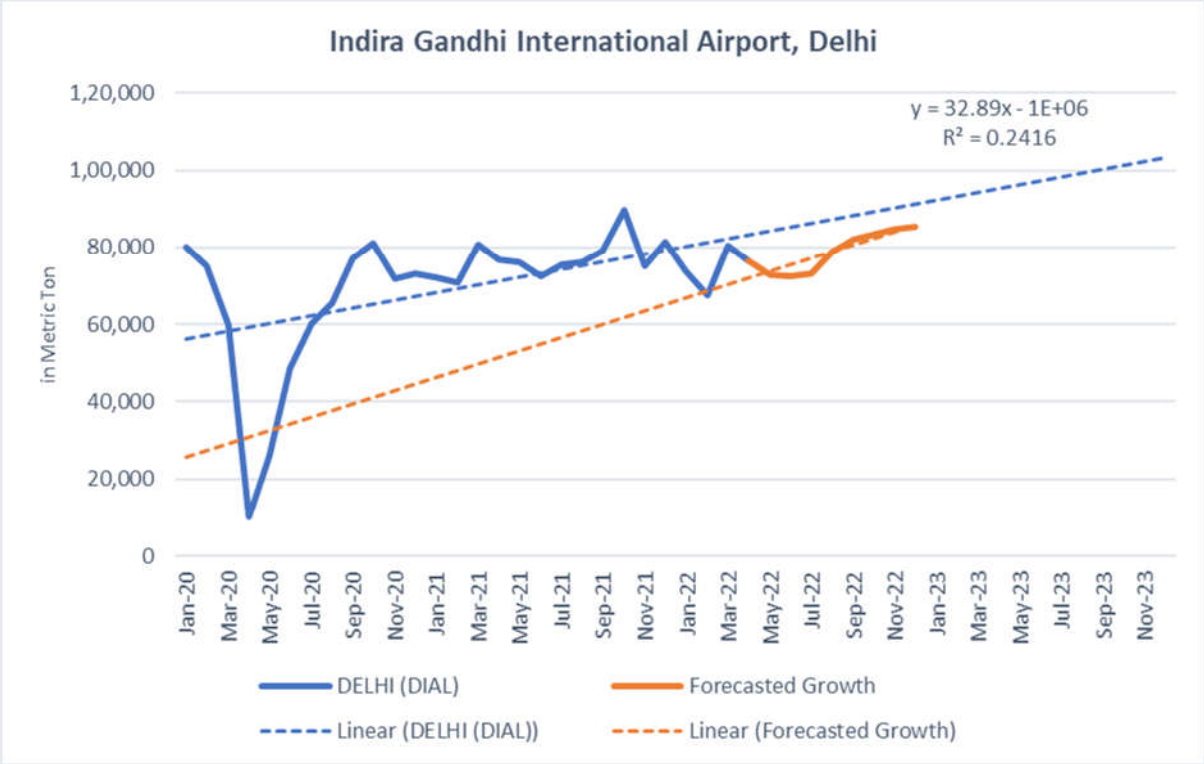
Graph 3: Impact of covid in air cargo traffic in major airports

Source: AAI Traffic News | AIRPORTS AUTHORITY OF INDIA

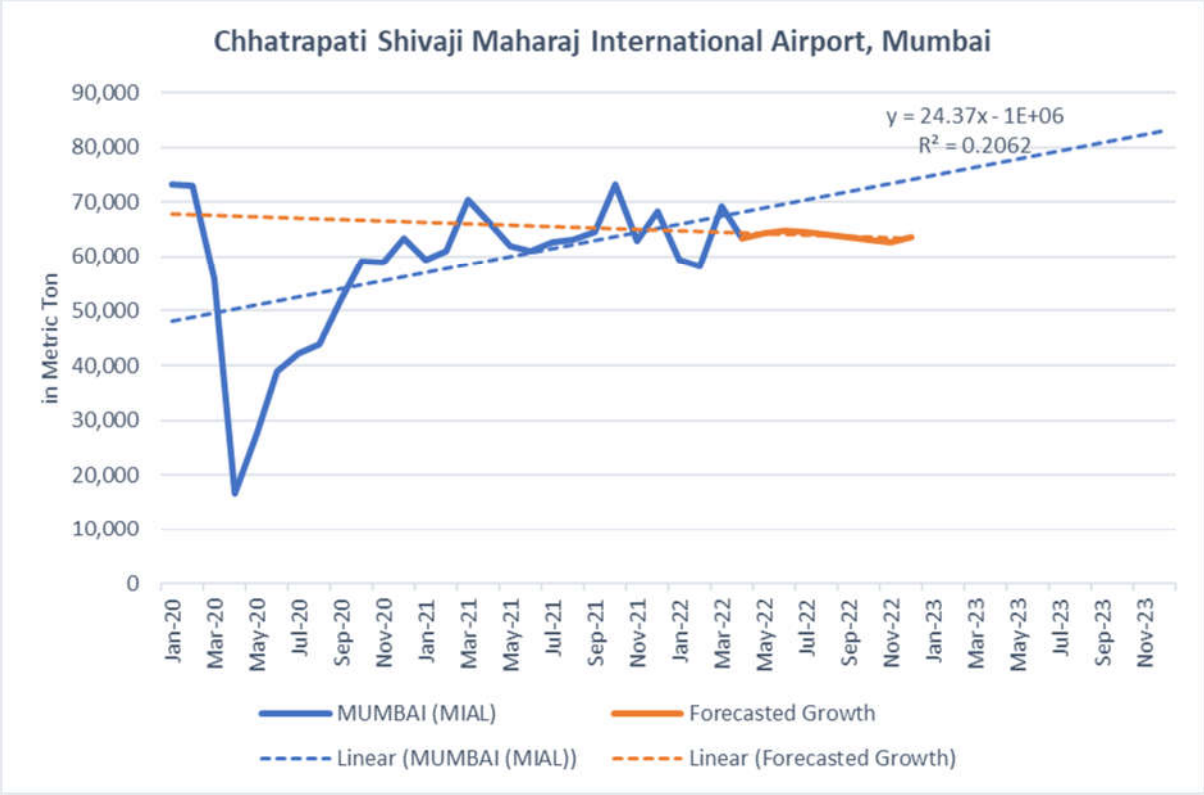
4.3.5 Forecasting air-cargo traffic in top 5 major airports

To obtain the forecast growth pattern, time period between Mar 2021- Mar 2022 is taken, thus a complete seasonal pattern seen in the previous year is taken into consideration. The period where there is Sharp decline is in included in obtaining forecast, since it would reflect in an unrealistic prediction.

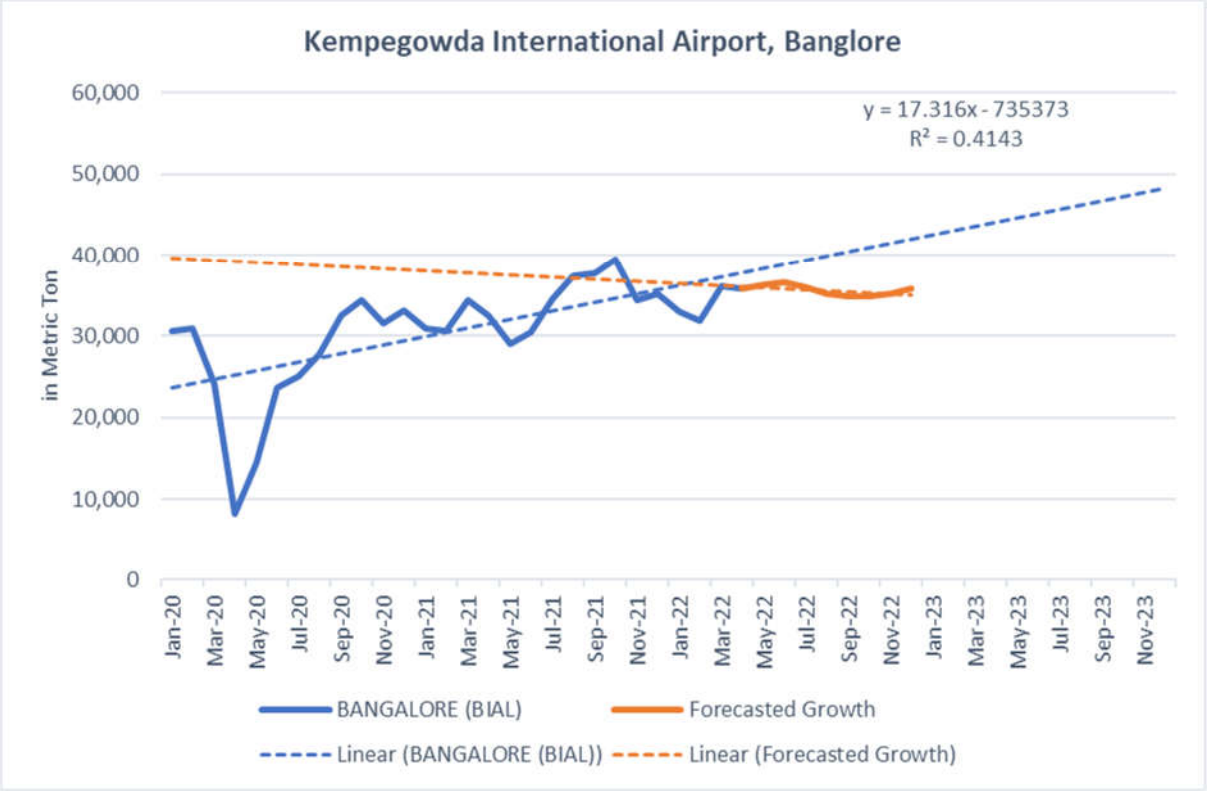
Using the data collected, a graph is plotted with air cargo traffic handled in metric tons in y-axis and time period by months in x-axis. The graphical data shows the trend seen in past (Jan 2020- Apr 2022) as well as the trend that can be expected in the upcoming months (Mar 2022- Dec 2022). The following procedure is carried out in each of the top 5 major airports in India, i.e) Delhi, Mumbai, Banglore, Chennai and Hyderabadi respectively.



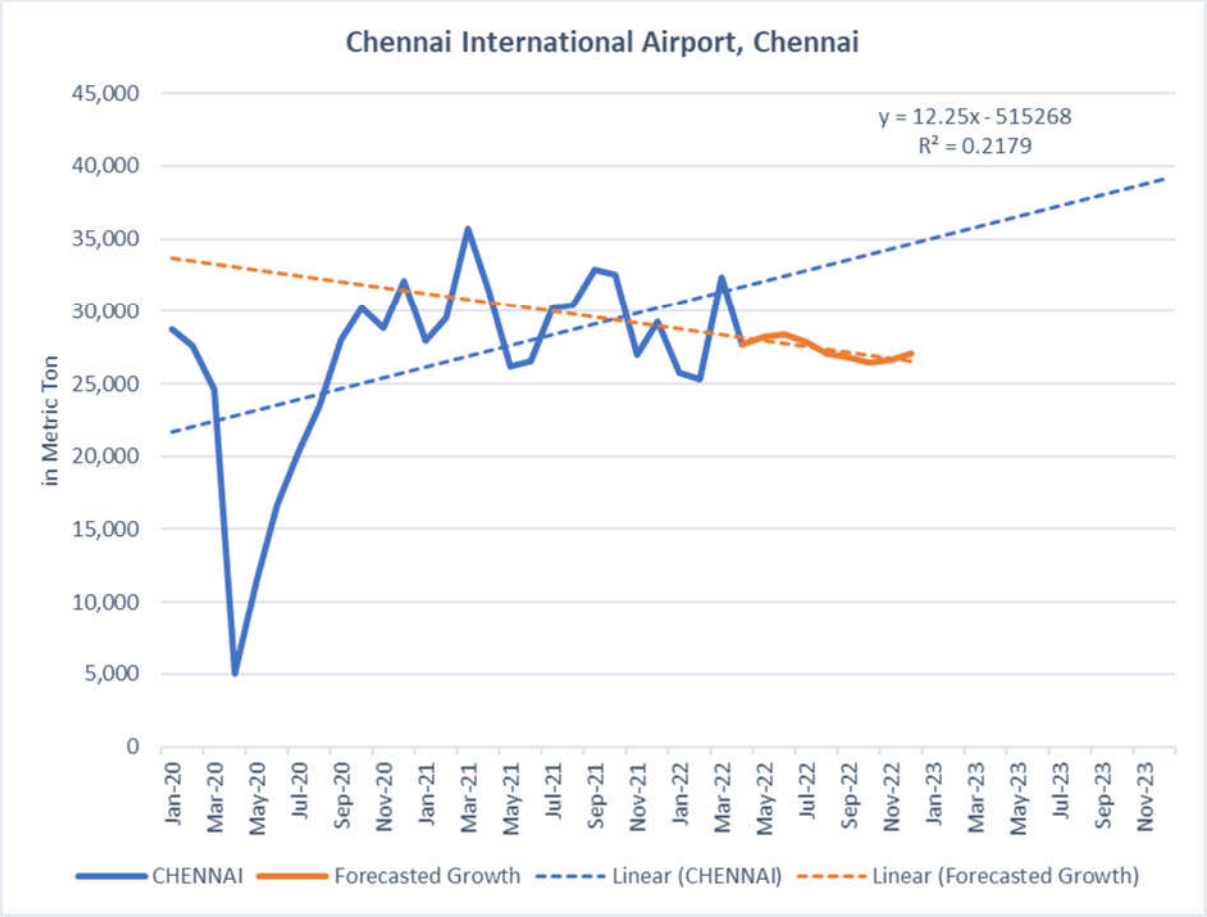
Graph 4: Actual & Forecasted trend of cargo traffic in Delhi Int. Airport



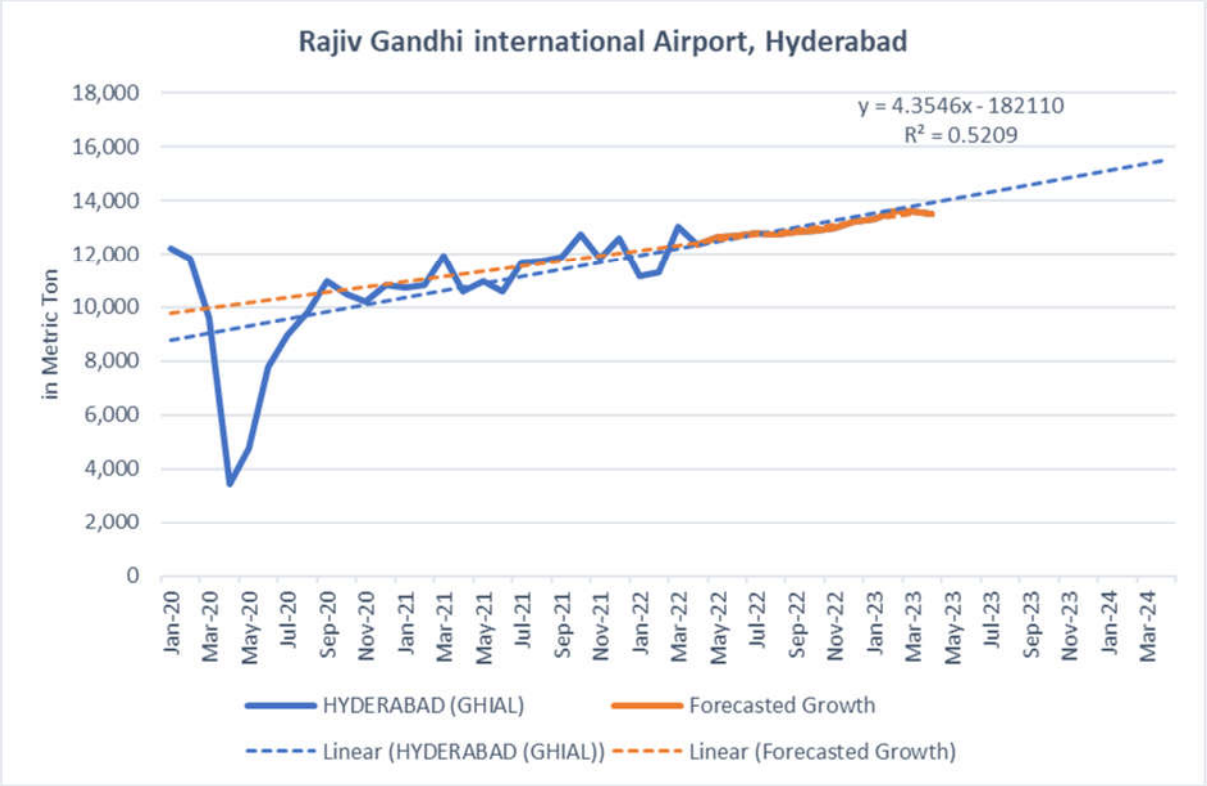
Graph 5: Actual & Forecasted trend of cargo traffic in Mumbai Int. Airport



Graph 6: Actual & Forecasted trend of cargo traffic in Bangalore Int. Airport



Graph 7: Actual & Forecasted trend of cargo traffic in Chennai Int. Airport



Graph 8 : Actual & Forecasted trend of cargo traffic in Hyderabad Int. Airport

CHAPTER V – Conclusion

5.1 Findings

The decline in air cargo traffic in nation-wide airports started in FY20, the decline since then has been largely on account of the Covid-19-induced travel and trade restrictions. The percentile changes in yearly cargo traffic showed the worst affected airports.

Among the major airports, the decline in cargo traffic was the most at Ahmedabad with over 41% decline, Cochin 41% decline, followed by Trivandrum 40% decline, Kolkata 34% decline and Mumbai 33% decline respectively.

The data on total cargo traffic handled in every airport of India for the year 2020-2021 is analyzed and found that, a huge share of over 19% of India's total air cargo traffic is of handled in Indira Gandhi International Airport, Delhi. 13% share of total air cargo has been handled in Chhatrapati Shivaji Maharaj International Airport, Mumbai. 7% in Kempegowda International Airport, Bengaluru, 5% in Chennai International Airport, Chennai and 4% in Rajiv Gandhi international Airport, Hyderabad. It can be seen that the total share from Delhi is relatively very high when compared with the rest of the airport's cargo traffic. Due to this, the Average Annual Growth Rate (AAGR) of individual major airports reduced significantly.

Once when the nation-wide lockdown is lifted and the world trade presumed back to normal, the air cargo traffic also entered the recovery stage. All the major airports started to show increase in air cargo traffic by the end of 2021. The recovery in cargo traffic is seen as follows, Ahmedabad with over 39% rise, Chennai 30% rise, Kolkata 32% rise, Bengaluru 29% rise and Mumbai 28% rise respectively.

Though the air cargo traffic in Indian airports has entered the recovery phase, the result from the forecasted growth in top 5 major airports shows that there the growth is not prominent and adequate enough to get back to normal trend seen in the pre-covid era.

5.2 Suggestions

The results from this research could be of some importance to the new airlines service providers or transport services providers trying to enter and capture the air cargo transportation market, in and around the particular airport of interest. Airlines may stop or start providing their services depending on the seasonal demand and cargo traffic between particular airports, based on the forecast. Though, there are six airports that are being operated under Public Private

Partnership model, there is a lot of scopes for other airports to switch and adopt this same model across the country. The airports in Kerala which are operated under joint venture and public private partnership models are performing relatively better both in terms of passenger traffic and air cargo traffic handled since they have foreign investment. Similar approaches should be followed in other airports of India to boost their performance in terms of cargo traffic as well as passenger traffic.

5.3 Conclusion

The study has been undertaken with the prime objective of understanding the pattern or tend that is seen in the air-cargo traffic in major airports of India and forecast growth in the upcoming months after a global level pandemic. During the Pre-COVID era the Indian aviation industry is more or less Passenger-driven and the significance of cargo is neglected. But, during the pandemic due to nation-wide lockdown and international restriction in passengers travel the passenger traffic saw a historic dip in the traffic pattern, but it is not so in air cargo traffic. This is due to the export & import of essential commodities never stopped. Moreover, the transport of covid vaccine is arranged by means of air transport in most cases. The demand for cargo has reflected in the immediate months after the decline. But it is not enough cargo traffic to fully recover from the decline, it still hasn't got back to normal.

5.4 Direction for future researchers

In this research, the sole importance is given to airports air-cargo traffic alone. In further researches in the same field could be done considering few other dimensions or aspects that are relevant and directly or indirectly influence the cargo handling of an airport in India. This will allow us to understand the exact reason behind the fluctuations of air-cargo traffic in Indian airports. I wish good luck to all the researchers of the future doing research in this field.

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