

“A STUDY ON AIR CARGO LOGISTICS”

Project Report submitted in partial fulfilment for the award of the degree of

MASTER OF BUSINESS ADMINISTRATION (MBA)

IN

**INTERNATIONAL TRANSPORTATION AND
LOGISTICS MANAGEMENT**

By

MUHAMMED AMEEN ABDUL AZEEZ - 2203305020

Under the guidance of

Dr. SEKAR S

Assistant Professor



SCHOOL OF MARITIME MANAGEMENT

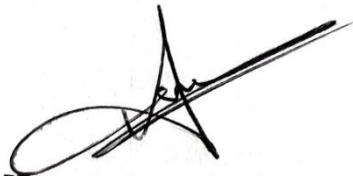
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MAY 2024

DECLARATION

I, MUHAMMED AMEEN ABDUL AZEEZ , Registration No.:**2203305027** hereby declare that this project report “**A STUDY ON AIR CARGO LOGISTICS**” submitted in partial fulfilment of the requirement for the degree of MBA (INTERNATIONAL TRANSPORTATION AND LOGISTICS MANAGEMENT) is my original work and it has not formed the basis for the award of any degree/ diploma or associate ship of any University Institution.



MUHAMMED AMEEN ABDUL AZEEZ
(Reg no: 2203305020)

Place: Chennai

Date:10/05/24

CERTIFICATE

This is to certify that the project report entitled 'A STUDY ON AIR CARGO LOGISTICS' submitted to the School of Maritime Management, Indian Maritime Management, Chennai Campus, in partial fulfilment for the award of the Degree of Masters Of Business Administration (MBA) in International Transportation and Logistics Management, by **MUHAMMED AMEEN ABDUL AZEEZ**, Reg no. 2203305020



Dr. SEKAR S

Assistant Professor, SMM



Dr B Swaminathan

Associate Professor & Head, SMM

External Examiner:



Place: Chennai

Date: 10/05/24

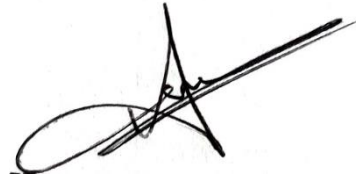
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MUHAMMED AMEEN

Place: Chennai

Date 10/05/24

EXECUTIVE SUMMARY

The global supply chain relies heavily on air cargo to deliver commodities and products quickly across continents and oceans. Nonetheless, a number of obstacles may impede air cargo operations, such as limited capacity, hold-ups in customs clearance, ineffective cargo handling, mistakes in freight forwarding, and failures in coordination and communication. In order to increase efficacy and efficiency, this project aims to analyze the current situation of air freight operations and pinpoint areas for improvement. The project will identify the main operational bottlenecks in air cargo using data analysis, stakeholder interaction, and process mapping, and it will create practical recommendations to resolve these issues.

A variety of parties, including airlines, freight forwarders, ground handling firms, customs officials, and regulatory agencies, will collaborate on the initiative. The project's collaborative efforts to strengthen the air cargo supply chain are intended to promote economic growth and increase international trade. The project's deliverables will comprise a comprehensive report presenting the analysis's conclusions and suggestions, together with a series of workable strategies for putting the advice into practice and tracking advancement over time. Through the implementation of significant modifications to air cargo operations, the project will contribute to the maintenance of this essential sector of the world economy.

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CHAPTER 1

BACKGROUND OF THE STUDY

INTRODUCTION

In the world of today's global political economy, no nation can exist in isolation. Through international trade, global interconnectedness has been seen as actively participating in the international system. Global economies are increasingly being driven by international trade. Given the current state of affairs, when technology and creativity across all disciplines have thrown wide the doors to globalization, no nation can afford to remain sovereign and isolated. As a result, many country economies around the modern world are now dependent on one another. International trade's export and import aspects have greatly aided in the development of national economies and the expansion of their worldwide markets. Every nation has significant advantages when it comes to resources and expertise. Certain nations import the skills and resources that they lack or are not as equipped with. To benefit from commerce, some nations export the resources and expertise in which they are experts. For instance, while some nations have abundant supplies of natural resources including minerals, lumber, rich soil, fossil fuels, and precious metals, other nations suffer shortages in many of these areas.

Furthermore, while many nations lack sophisticated infrastructures, sophisticated educational programs, and sophisticated capital markets, a select few can pursue sophisticated manufacturing and technical advancements. They engage in commerce to exchange and obtain the resources needed to fully realize their growth potential.

Both corporations and individual customers benefit from imports frequently, nations must import items that are either more affordable or difficult to obtain domestically. Individual customers gain from other products that are imported into the nation as well as locally made goods containing imported components. Imported goods frequently provide customers more options or a better price, raising their level of living. Instead of being net importers,

countries prefer to be net exporters. While imports may not always be detrimental, they can stand in the way of a nation's progress. A nation is losing more money on imports than it is bringing in from export sales if its imports exceed its exports conversely, more exports lead to increased domestic economic activity in a nation. More exports equate to increased output, earnings, and jobs. Gross domestic product (GDP) rises when a nation is determined to be a net exporter. Stated differently, a nation's wealth rises as a result of its net exports. To utilize these excessive It is necessary to implement opportunities for sophisticated logistical services. One such method for gaining greater advantages from international trade is air shipping.

1.1 DEFINITION AND MEANING- AIR FREIGHT/ AIRCARGO

The movement and dispatch of products by an air carrier, such as on a commercial aircraft or a portion of a charter flight, is referred to as air shipping. Air freight is a premium service that has advantages over disadvantages and is among the fastest ways to carry freight throughout the world. One of the main benefits of shipping via airfreight is that it provides more consistent arrival and departure timings, which means there is a greater degree of predictability to aid with supply chain planning. A range of time-sensitive air services, such as Same-Day, Next-Day, Next-Flight-Out (NFO), and any other day- and time-definite airfreight demands, are included in priority airfreight forwarding capabilities. Priority Airfreight is best suited for last-minute or project-critical shipments, where the cost-benefit of the item arriving on time far outweighs the premium of express services.

1.2 OBJECTIVES

- To Study the overview Air Cargo Management
- To Review the operational effectiveness of Air Cargo Management
- To Suggest findings from the above study

1.3 SCOPE AND RATIONALE OF THE STUDY

Scope of the study

- Analysis of the global air freight industry: evaluating the state and trends of the aviation logistics industry globally.
- Market segmentation: It is the process of determining the main categories of freight, means of transportation, and geographical areas within the air cargo logistics sector.
- Regulatory Environment: Examining the international regulatory frameworks that control air cargo logistics operations and how they affect business practices.
- Technological Innovations: Examining how automation, the Internet of Things, and artificial intelligence are influencing the efficacy and efficiency of air cargo transportation.
- Supply Chain Management: Examining how air cargo logistics can be integrated with larger supply chain networks that encompass last-mile delivery, distribution, and warehousing.
- Environmental Sustainability: Analysing how air freight logistics operations affect the environment and proposing solutions for eco-friendly projects and sustainable practices.

Rationale of the study

- **Economic Significance:** Stressing the financial benefits of air freight logistics in promoting international trade, bolstering domestic industry, and spurring economic expansion.
- **Efficiency and Speed:** Understanding the vital function air cargo operations play in delivering perishables and goods with a short turnaround time while reducing delays.
- **Global Connectivity:** Stressing the importance of air cargo logistics in establishing smooth cross-continental international commerce flows and linking remote markets.
- **Reaction to Market Trends:** Handling the growing need for quicker and more dependable freight transportation services, which is being fueled by the expansion of e-commerce, just-in-time inventory management techniques, and globalization.
- **Risk management:** It is the process of identifying the dangers and difficulties that are specific to air freight logistics, such as supply chain interruptions, security concerns, and unstable market conditions, and then coming up with solutions to reduce those risks.
- **Environmental Concerns:** Recognizing the effects of air cargo operations on the environment, such as noise pollution and carbon emissions, and looking at ways to implement sustainable methods and lessen ecological footprint.
- **Innovation and Competitiveness:** Understanding how technical advancements can boost the ability of air cargo logistics companies to compete, increase operational effectiveness, and satisfy changing client demands.

1.4 RESEARCH METHODOLOGY

This project's research methodology is secondary data, meaning that a variety of news items and journals have been gathered in order to complete the project.

1.5 STUDY LIMITATION

- Sensitive and proprietary data on air freight logistics may restrict the quantity of information available for study by researchers.
- A complicated collection of laws that differ by nation or area govern the logistics of air freight. These rules may restrict researchers' capacity to make generalizable findings and have an effect on how air cargo logistics are conducted.

CHAPTER – 2

LITERATURE REVIEW

REVIEW OF LITERATURE

The literature at the nexus of tourism research and air transportation is reviewed in this paper. Despite the fact that the tourist and aviation industries are interdependent, not much is known about how they interact. Relevant journal papers published in 54 Australian Business Dean Council (ABDC) A*, A, or B-ranked journals between 2000 and 2014 were chosen and analyzed using a systematic literature review process. There includes discussion of study themes, prominent researchers, their institutions, and places. The application of content and thematic analysis results in the development of an expanded framework for the classification of the literature. The most prevalent research themes among those that were identified are "environment," "passengers," and "airlines." Gaps in the literature and potential avenues for further research have been found through the application of systematic reviews. A few of the areas that have been recognized as exhibiting an increasing amount of interest in the relationship between aviation and tourism are the growth of air routes and services, passenger experiences, low-cost airlines and their effect on tourism, the consequences of new direct long-haul flights, and carbon offsets. **(Spasojevic et al., 2018)**

Purpose: The present research article finds the volatility spillover and connectedness for the Indian financial markets. The study also assesses how the volatility is transmitted among the three significant Bombay Stock Exchange's three significant Indices. The "Sensex represents the size effect," the primary Index, Mid Cap Index, and the Small Cap Index. The study also focuses on finding the impact of the present COVID -19 impact design / Methodology / Approach: The volatility transmission and the connectedness have been brought forth to its popularity among Diebold and Yilmaz's researchers. David Gabauer further extended the method to its present state of using the TVP-VAR methodology, which

overcomes the Diebold and Yilmaz method's shortcomings.

Findings: The method does represent that 58% of the volatility spillover is from within the model. This means that the size alone is responsible for the 58% volatility. The largest dispenser of the spillover is from the Mid Cap. Originality / Value: Researchers have widely used the method of Diebold and Yilmaz. However, the use and analysis of the Indian financial markets have been significantly less. Especially the size effect using the Gabauer forwarded method of Diebold and Yilmaz Paper type: View Point **(Subodh kesharwani & Tomar, 2021)**

The aviation sector, according to the International Air Transport Association (IATA), promotes travel and global trade by offering the only quick global transportation network in existence. In 2011, airlines connected the world's cities with 36,000 routes, carrying 47.6 million metric tons of air freight in addition to 2.8 billion people. The aviation sector contributes significantly to economic growth and offers a range of social and economic advantages by offering these services. (The Competitiveness of Travel and Tourism Report, 2013). Domestic airlines are becoming more important in Bangladesh, both commercially and socially. Four major domestic airlines are taken into consideration as the sample, and secondary data are essentially used. The history of the aviation sector in Bangladesh, a summary of local carriers, and present trends were the main topics of the article. A few policy proposals are included in the paper's conclusion to help Bangladesh's airline industry grow even more. **(Sultana, 2020)**

Blockchain is a very new and developing technology that has only recently been used in the aviation industry. The study used Indian airports as its example, where the implementation is now underway. The experts were asked about how they see blockchain technology being used in the Indian aviation sector. The study contributes to our understanding of the

practical challenges faced by management in the Indian aviation sector during the blockchain system's implementation. The study determined stakeholder perceptions regarding blockchain implementation in the Indian aviation industry with the aid of focus groups. A number of important subjects came up during the conversation, including infrastructure, security, privacy, workforce, and stakeholder consultation and regulation. As a result, the study has important managerial ramifications for the parameters found. **(Damodaran et al., 2022)**

In order to satisfy the constraints pertaining to perishability, capacity, and lower carbon emissions, this paper considers a freight forwarder service problem by optimizing the total shipping cost, which includes inventory, processing, and transportation costs in addition to other incidental costs like trucking, storing, shipment planning, etc. To reduce the overall cost of shipping goods by air, a mathematical model for efficient cargo handling is created. Two evolutionary algorithm versions are used to solve the problem in order to capture the important characteristics, which include integration and consolidation of shipments, the time it takes for items to be delivered, the scheduled time, the volume and weight of shipments, temperature balance in containers, and emission reduction. A precise approach has been used to confirm the dataset's optimality, and sensitivity analysis has been done to help assess the influence of the amount of shipments, agents, and destinations. Ultimately, a few managerial takeaways are presented to explore the advantages of this model for cost optimization. **(Sahoo et al., 2023)**

The purpose of this paper is to demonstrate how a company can use the technical and social talents of its employees to leverage BIM to produce lean and environmentally friendly project outputs, hence developing organizational capacities. The resulting three-layered hierarchical structure (technology, process, and outcomes) for BIM-based

organizational capabilities development is described. Design, procedure, and strategy: In order to achieve lean and environmentally friendly results on building projects, BIM has been identified for this study as both a process and an enabler. This study defines the organizational competencies required by the Architecture, Engineering, and Construction (AEC) companies to successfully apply BIM on construction projects, based on a thorough review of the literature. A sequential mixed-method approach was used to conduct the study, which included focus groups, semi-structured interviews, and qualitative comparison analyses. Results: It was found that in order to achieve the intended project objectives, an organization must adopt a BIM adoption culture at all levels of the organization, not just within its project teams. The study also found that using BIM in an integrated manner on construction projects—linking it to lean and green initiatives—improved project outcomes, particularly for projects that focused on lean and green components of improvements. Practical implications: As organizations strive for successful use inside their organizations, the proposed blueprint for BIM-based organizational capabilities will assist them in focusing on the "human factors" in addition to the technical factors. **(Nightingale et al., 2018)**

In order to forecast where risks to US national interests may arise, this study proposes a model. The United States can then concentrate its limited resources in such areas to discourage such acts by foreseeing these difficulties. Through the use of threshold graph analysis, two comparable case studies of the Taiwan Straits crises in 1955 and 1958 were found to differ significantly from one another. The graphs showed how to describe the surroundings in a way that makes predictive analysis possible. Further efforts are required to fully validate this theoretical concept. However, first research into its potential benefits is encouraging. This study was unable to disprove the null hypothesis, which said that the probability of an asset being challenged could be predicted by analyzing

the relationship between a country's declared and real commitment to that asset. In order to see and analyze that link, the Theoretical Threshold Graphing Model is put out in this work. As the model was developed, seven distinct types surfaced. Of the seven partnerships that were found, three discouraged challenges, or at the very least did not invite them, while four encouraged them. The ideal setting, the Leap relationship, and the Article 5 relationship were the categories that successfully discouraged challenges. These graphs, which include the Accident, Redline, Bluff, and Limited Commitment categories, attracted challenges. Analysis of case studies showed that cases could belong to multiple groups. The type that best describes the connection between the messaged and actual threshold for action will be the defining one. **(Lieberman, 2015)**

It is often known that coastal shipping is an effective and environmentally friendly substitute for vehicle transportation. Nevertheless, no region's hurdles to the business have been thoroughly researched. This study seeks to identify the most important policy hurdles to coastal shipping development from an Indian point of view. A Delphi research is used to identify significant obstacles, and the decision-making-trial and evaluation laboratory analysis (DEMATEL) technique is used to quantify the cause-and-effect linkages between those barriers. It's noteworthy that the primary obstacles, or those that most affect the growth of coastal shipping, aren't often the ones that are most well-known. The investigation also reveals the latent cause-and-effect connections between a number of obstacles. Four main barriers are identified: (1) Indian maritime legislation (especially cabotage rules); (2) issues in the infrastructure and procedures at port and port-centric areas; (3) underdevelopment of small ports; (4) lack of a collaborative culture among the various service providers involved in the logistics supply chain. The study's final recommendations include easing cabotage laws to

encourage foreign investment and expand coastal shipping, enhancing the current port system by cooperation between the ports, Indian customs, and the government, and promoting supply chain cooperation. **(Venkatesh et al., 2017)**

The value of published research on aviation in academic settings is bolstered by this study. The researcher examined studies that were published on the subject after 2010 for this investigation. In order to create a roadmap for future scholars, this study aims to: (1) examine the literature on Indian Aviation (IA) methodically; and (2) present an overview of the many causes and the effects in relation to transportation and aviation. This paper employs the Systematic Literature Review (SLR) approach. The collected literature comes from forty research publications that were published between 2010 and 2020. It has been shown that over the past ten years, there has been a 50% growth in the number of journals in the category. This might be the case because more journals are being published due to the decreased cost of journal publishing, and more journals means there is greater interest in the issues across a wider range of disciplines. Financial success, operational effectiveness, customer satisfaction, service quality, traffic data, and profitability have all been highlighted as significant drivers. Up to now, no comprehensive review has examined the theories, background, constructions, and practices in this field. As a result, this assessment delivers in-depth knowledge of the subject and a cohesive image of the sector. **(Khosla et al., 2021)**

We examine the global organization of the global air transportation network, an essential infrastructure that has a significant influence on the local, national, and global economies. We discover that the global network of air travel is a small-world network without scale. However, we discover that the most connected cities are not necessarily the most central, which leads to anomalous values of the centrality, contrary to the prediction of

scale-free network models. We show that the multicommodity structure of the network is the cause of these anomalies. We identify the communities inside the air transportation network and demonstrate that geopolitical factors must be taken into account, as the community structure cannot be fully described by geographical limitations alone. By using the pattern of connections between and within communities to determine each city's worldwide role, we are able to derive scale-specific representations of the network. The National Academy of Sciences of the United States, 2005. **(Guimerà et al., 2005)**

The Paris Agreement was adopted in December 2015, and India committed to reducing the emission intensity of its GDP by 33–35 percent from 2005 levels by 2030 when it ratified the agreement through the Nationally Determined Contribution (NDC). As the main conduit of the production value chain, the transportation sector has played a significant role in the worldwide emissions of greenhouse gases (GHGs) related to energy. It is imperative in this particular situation that a critical production research study assess the relationship between NDC and freight transit. The suggested framework entails defining objectives, consulting with experts, and advancing knowledge in the area of freight transportation. First, the objective and the criterion (or quality) for reaching NDC via the freight industry are determined. Subsequently, professional views from experts in transportation and climate change are requested. Finally, using the fuzzy analytic hierarchy process (FAHP), results and insights about the most practical options—heavy road, heavy rail, hybrid, heavy waterborne, and heavy air—are drawn in relation to a few key attributes and their sub-attributes, namely slower growth, structural changes in the economy and sector, operational and strategic decisions, technology and innovation, and regulatory and economic tools. The strength of the suggested methodology lies in its use of FAHP to provide policymakers, supply chain managers, and logistics professionals

with clear solutions to climate change. Without it, these stakeholders would have struggled to understand such a complex topic with just limited and poorly quantified data. **(D. Mahapatra et al., 2021)**

Examining Cargolux Airlines International's (one of the largest specialized all-cargo airlines globally) strategic position in the global air cargo supply chain was the aim of this study. An approach to qualitative research was taken in order to accomplish this goal. Document analysis was used to look over the data collected for the study. Porter's Five Forces Model served as the basis for Cargolux Airlines International's strategic study. According to the report, Cargolux has created a wide range of products that meet the needs of specific air cargo market sectors. Additionally, the airline has agreements in place for strategic partnerships with Nippon Cargo Airlines (NCA), Oman Air, and Emirates SkyCargo. These partnerships have allowed the partners to increase the number of routes they serve and more effectively utilize their air cargo capacity. Additionally, Cargolux founded Cargo Italia in Milan, with the goal of catering to the significant air cargo market in Italy. Together with Henan Civil Aviation and Investment Company (HNCA), one of its largest shareholders, the airline has also devised a successful two hub plan. Cargolux announced the "Cargolux 2025 Strategy" in 2017, marking the start of a transformational journey. The lack of availability of Cargolux's annual revenues was one of the study's limitations. Therefore, an analysis of the airline's revenue performance was not feasible. **(Baxter, 2019)**

Every aspect of the aviation sector relies on air freight demand estimation to set rules and make investment, pricing, and marketing choices. Using the two-step generalized method of moments (GMM), this study examines factors influencing the air cargo demand of the European Region (23 nations) where no previous studies were found. Using a data set spanning the years 2009 through 2018, the effects of total airport investments, the

consumer price index, GDP per capita, population, foreign trade volume, the industrial production index, and the exchange rate on air cargo demand were investigated. The results showed an inverse association between the change in the consumer price index and the volume of cargo, and that past air cargo demand has explanatory power on current demand. Furthermore, a positive correlation between the Industrial Production Index and Foreign Trade is indicated by the panel regression estimator. The findings demonstrate the critical necessity of price stability from both a macroeconomic and microeconomic standpoint. This study assesses the effects of the aviation industry's air cargo trend on Asian policy, airport expansion, and airline operations. In order to support the region's expanding need for air travel, emphasis is placed on how it affects airports, airlines, regulatory bodies, and logistics. **(Senguttuvan, 2006)**

Due to the weakening market conditions, the airlines operating in our nation are facing low yields, cheap prices, low load factors, a fall in premium travel, and a decline in cargo loads. Companies need to have a defined strategy and management techniques to turn around the airlines in order to weather this storm. Companies may only do this if they are aware of the performance difference between them and the benchmarked airline. The goal of the current effort is to use the DEA framework to calculate the relative performances of the various domestic airlines in India (there are currently 11). The various outputs that airlines produce and the multiple inputs that they employ are the basis for creating performance indices using data envelope analysis. The outcome is used to determine which performance-affecting variables are under the managers' partial control and how important they are in relation to one another. The airline manager's issue has a clear solution thanks to data envelope analysis (DEA). **(A. K. Singh, 2011)**

The purpose of this paper is to develop the foundation for fuel consumption optimization (FCO) in the aviation sector of India. This paper's goal is to create a five-facet fuel consumption optimization model and construct the methodology (FCO). Few studies have been done to investigate the elements that influence FCO in the aviation sector. This paper explores important elements influencing FCO and suggests the FCO model in an effort to close this gap. Techniques: The structural model was tested as well as confirmatory and exploratory factor analyses were part of the study process. Using exploratory factor analysis (EFA), the full set of items was grouped in the first stage based on a high correlation between the variables. Using a confirmatory factor analysis (CFA), one or more fictitious factor structure models were specified and estimated in the second stage. These models each provide a collection of latent variables to explain covariance among a group of observed variables. In the third step, we employed the Structural Equation Modeling (SEM) method to investigate empirically the connections between aircraft operations (AO), technology and design (ATD), social-economic and political (SEP), aviation infrastructure (AI), and alternate fuels and fuel properties (AFP) and fuel consumption optimization. Findings: Structural equation modeling (SEM) yields a variety of findings and uses. (1) It has been determined that the five major influencing factors—aircraft operations (AO), airplane technology and design (ATD), socioeconomic and political concerns (SEP), aviation infrastructure (AI), and alternative fuels and fuel properties (AFP)—have a favorable impact on FCO in the context of India. (2) Of the five variables influencing fuel economy (FCO), aircraft technology and design has the biggest impact, followed by aircraft operation, fuel characteristics and alternative fuels, socio-economic and political issues, and aviation infrastructure. (3) The relationship between aircraft technology and design and aircraft operations showed the strongest squared correlation. Conclusions and upcoming projects: The proposed research framework that explains the links between FCO and its aspects has empirical support thanks to this study. To find the major variables

influencing the FCO, he has created an integrated model of the FCO. Understanding the relationships between variables can help construct an objective function, set of constraints, and set of equations relevant to Indian scenarios. The data of the selected important components with respect to the Indian scenario may be used to form the equations, which will result in the development of an optimization-based fuel consumption model that provides room for more research. The findings of this study serve as the cornerstone for the best fuel-consumption solution, which might be the focus of future research. Copyright 2014 Author(s). **(V. Singh & Sharma, 2014)**

A Synopsis of the Background Over the past five years, the Indian economy has grown at an average rate of more than 8%. In 2007–2008, the economy grew at a 9.0% annual pace. Similarly, the logistics business is experiencing significant expansion due to the manufacturing sector, which has achieved a growth rate of 8.2%. The industry's primary logistics tasks include freight forwarding, warehousing, and transportation. The anticipated amount spent in India on the logistics sector **(Srinivas & Krishna, 2009)**

This paper attempts to revise level of various service quality of the airline industry and arrange these, with their relative importance using fuzzy approach. And utmost care was taken to ascertain these attributes, with fuzzy Delphi technique. The study was conducted in Hyderabad city, India. To gather the relative information, structured questionnaire was taken with proper validation and consistency. As the airline is the one of major medium to access the globe, as well as in the international transport, time demand to study quality of services in airline industry. Due to services and quality are related to combining activities of different factors, and again it concern to human judgment, it is difficulties to measure the same. Therefore the study attempts to fill the gap in the

existing literature with a different approach for evaluating airline service quality. At last, some valuable conclusions and useful suggestions are provided to airline industry, to improve the service quality further. **(S. C. Mahapatra & Shekhar, 2014)**

The coronavirus pandemic has caused significant disruptions to the aviation industry, endangering the long-term viability of airlines. In addition to significant losses attributable to halted activities, business predicts a severe recession. It is anticipated that restricted travel, low tourism, reduced income, condensed commercial activity, and fear psychosis will reduce passenger demand from 30 to 60%, jeopardizing the airline industry's capacity to make a profit. In order to survive the long-term effects of COVID-19, airlines in India, which are fragile to sustain the cyclic transitory shocks of oil price variation, demand flux, and dropping currency, need to make significant structural adjustments to their operating strategies, business models, revenue, and pricing strategies. This paper aims to examine the effects of the shutdown and COVID-19 pandemic on Indian airlines, as well as potential future issues. The study also offers a potential workaround for reducing the anticipated losses. **(Agrawal, 2021)**

The current study looked into the connection between the price of crude oil and airline shares. Based on their market capitalization, three crude oil markets—Brent—North Sea Brent Crude, Dubai—Dubai Crude, and WTI—West Texas Intermediate and Texas Light Sweet—as well as six airlines—Air India, Go Air, IndiGo, Jet Lite, Jet Airways, and Spice Jet—were chosen for this study. Empirical findings indicate that most airline stock returns were influenced by changes in the price of crude oil. In addition, throughout the research period from January 1, 2007, to November 30, 2018, Air India, IndiGo, Jet Airways, and Spice Jet showed statistically significant correlations between their stock returns and the price of crude

oil, but not a correlation with it. Policy makers and individual and institutional investors would find value in the study's conclusions. **(Kathiravan et al., 2019)**

LITERATURE GAP

RELATED ARTICLES

1. The sky's the limit, how air freight can bring more agility to your global supplychain

The globalization of trade and e-commerce has led to a large growth in air cargo, an essential sector of the logistics business. This study of the literature aims to investigate the state of the art in the field of air cargo research and pinpoint the major trends, obstacles, and prospects.

Dr. Julian Dragondorf (2022) claims that the history of air cargo transport stretches back to the early 1900s. In 1910, the first cargo plane took off from Dayton, Ohio, and carried bolts of silk to Columbus, Ohio. The use of air freight has grown since express delivery services were introduced in the 1970s, as companies in almost every industry have come to rely on its reliability and speed. There is a growing demand for air freight, with earnings from air cargo transportation climbing by 27.2% in 2020 to reach an all-time high of USD 128.2 billion. Estimates suggest that by 2035, the volume of goods moved by air would have more than doubled.

Maersk has announced its intention to acquire Senator International, a multinational freight forwarding company with operations in Europe, Asia, South Africa, and America, in order to meet growing customer demand. Senator International operates an operational air freight platform with own-controlled capacity.

Using the advantages of air freight can assist businesses that ship goods internationally become more adaptable and robust, allowing them to smoothly integrate into their current supply chains and promote sustainable growth.

Four main consumer benefits—speed, security and control, flexibility and reliability, and reactivity—are what motivate this.

These advantages are connected, driven by the main benefit of speed, and give customers the vital tools they need to overcome complicated challenges, streamline their logistics plans, and improve the efficiency and visibility of their supply chains.

Source: MAERSK

2. The small package air freight industry in the United States: A review of the federal express experience

According to Yupo Chan and Ronney J. Ponder (10 October 2016) The rise in demand for quick and dependable delivery of tiny and urgent products is to blame for the increase in air freight traffic in the United States. An all-cargo airline that can efficiently manage its own fleet of trucks and realise economies of scale by combining traffic looks to be the answer to the issue. Federal Express is a small package airline that offers direct, single-source door-to-door service using its own fleet of aeroplanes and pickup/delivery trucks as an example. Via a focused effort in Memphis, traffic is combined from low density markets. Together, these two characteristics enable small and medium-sized cities to receive services at a reasonable cost. Because of the airline's relative youth and entrepreneurial spirit, concepts and management strategies are frequently developed from scratch and diligently carried out. The airline has operated with a great deal of freedom beyond the boundaries of regulatory restrictions because it has long qualified as an air taxi. A portion of the company's advantages may be lost as it grows and when a set of national

air cargo regulations changes. For both professionals and academics in the field of air freight, the future success of the "Federal Express Model" is an intriguing case study.

OBJECTIVES

- By integrating traffic looks, a company may effectively manage its own fleet of vehicles and realise economies of scale.
- Operating beyond the boundaries of regulatory requirements.

Source: ELSEVIER transportation research part A:
General

3. The underlying drivers and future development of air cargo

According to Franziska Kupfer and Hilde Meersman (02 July 2016) In the chain of air travel and the worldwide economy, air cargo is essential. The demand for air cargo is derived, just as the demand for other modes of transportation. According to prior research, the demand for air cargo is primarily affected by the trade in goods and the proportion of manufactured goods in that commerce. By including the impact of oil prices and air freight yields while modelling the development of global air cargo, this research tries to fill a gap in the literature. Also, it offers a glimpse into how air cargo can develop in the future. Predictions for the period up to 2023 are based on various scenarios for the primary factors influencing demand for air cargo. Moreover, information on the current air cargo industry is provided, including traffic volumes, types of actors, and traffic flows. The findings are helpful for academics as well as business stakeholders for whom air freight is a significant source of revenue or cash.

HIGHLIGHTS

- An error correction model is built to explain air freight development.
- The main determinants are merchandise trade and the share of manufactures here in.
- Air freight yields and oil prices further explain the development of air freight.
- Scenarios are created to analyze the future development of air freight.

Source: Elsevier journal of air transportation management

4. Sustainability and Air Freight Transportation: Lessons from the Global Pandemic

According to John R. Bartle and Rebecca K. Lutte (27 march 2021) One of the biggest effects of the COVID-19 problem has been on the way that public, private, and non-governmental organisations (NGOs) offer services and goods. In light of recent, significant human and financial consequences on a global scale, this study explores sustainability while focusing on related opportunities and problems in air freight transport management. As a result of the recovery process, there is a chance for the aviation sector and a number of private and public partnerships to undergo changes that will increase long-term stability and sustainability in the social, economic, and environmental spheres. The effect of the current environment on air cargo operations is also discussed in this article, including how drastically condensed airline schedules affect total air freight capacity. In order to achieve the objectives of sustainability, efficiency, effectiveness, and citizen responsiveness, it takes into account the potential role of government in providing the framework for sectoral

collaboration. NGOs give community organisations a voice in ways that governments and businesses often cannot. Through local and international supply chains, efficient marketplaces connect producers at various levels to consumers. This article examines the short-run and long-run planning needed by each of the three sectors to address the immediate gaps in international air transportation by integrating fundamental principles from sustainable development and logistics. After that, it looks into pressing but longer-term environmental problems associated with air travel, such as air pollution, global climate change, and the non-renewable nature of fossil fuels. Well-crafted solutions may offer sustainability advantages across industries, given the significant impact that air travel has on a variety of other goods and services. This article offers suggestions for advancing chances for a more effective freight supply industry that minimises negative impacts through sustainable development, since the tragedies of COVID-19 eventually upset the foundations of organisational systems in all three sectors.

To address system cargo capacity, some passenger airlines have utilized their passenger carrying aircraft as all flights. Passenger carrying aircraft are normally restricted to carry cargo only in the designated lower cargo areas. In May of 2020, the Federal Aviation Administration (FAA) granted an exemption to allow passenger carrying aircraft to carry freight in the main cabin when no passengers are being carried]. This exemption, originally expiring at the end of 2020, was extended until the end of July 2021. As of June 2020, IATA estimated that passenger airlines had operated approximately 1300 flights as all-cargo.

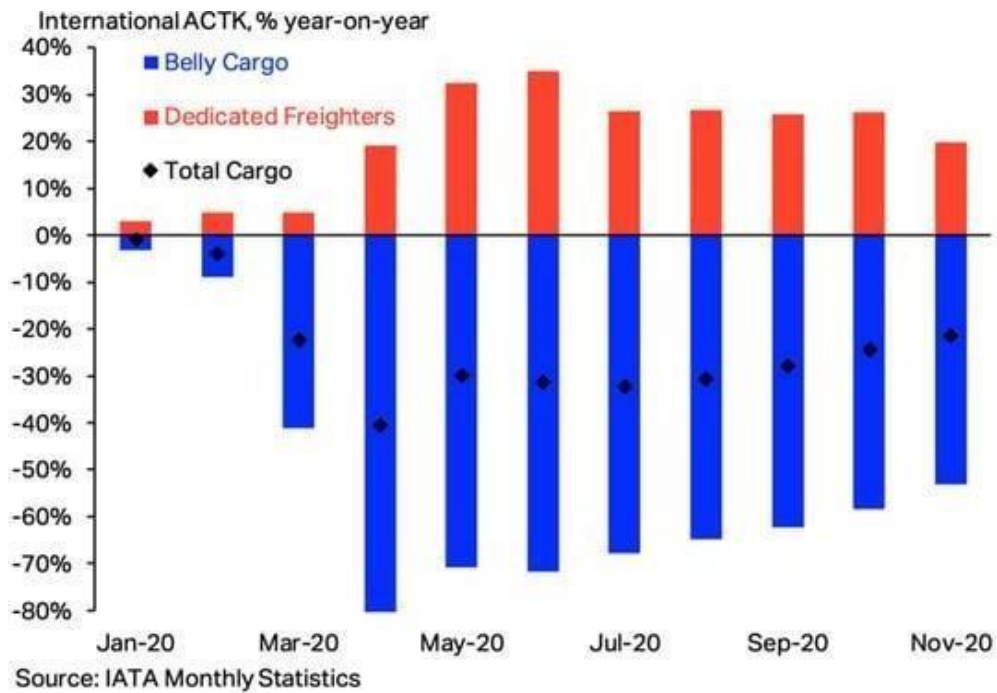


Figure 1(International ACTK)

By June 2020, with international passenger flights starting to increase once again, air cargo rates started to decline, in part due to the increased belly cargo capacity.

5. Latest digital air cargo innovation will accelerate global recovery



Figure 2(digital air cargo innovation)

According to ICAO (8 February 2022), New technical specifications for digital air cargo have been completed by ICAO and the United Nations Economic Commission for Europe (UNECE), which will hasten the transition to supply chains that are safer and more resilient while making significant contributions to the COVID-19 response and recovery efforts.

The use of contactless air cargo and increased cross-border trade resilience in the face of potential pandemic threats will be made possible by digital innovations, allowing the air transport industry to move away from long-standing paper-based documents that have been used to facilitate the movement of international air freight.

The specifications will aid in reducing physical contact among experts in international trade and transport, in keeping with the recommendations of the ICAO Council's Aviation Recovery Task Force (CART), and will thereby better safeguard the flexibility of cross-border trade and international transport operations from pandemic-related restrictions.

The most recent developments "represent ICAO's integrated,

collaborative, and multilateral approach to transport rules including air cargo and mail supply chains, and will play a key role in tackling both current and future pandemic risks," said ICAO Secretary General Juan Carlos Salazar. We anticipate that they will contribute to addressing the enormous burden that the COVID-19 epidemic and its accompanying phenomenal rise in international e-commerce have placed on global supply chains.

The pandemic has amply illustrated the importance of coordinated strategies to guarantee robust transport connection across all modes and further underlined the crucial significance of increased digitization. I am pleased with the contribution made by the useful tools created with help from UN/CEFACT, the United Nations Centre for Trade Facilitation and Electronic Commerce. As Olga Algayerova, executive secretary of UNECE, stated, "UNECE looks forward to continuing on this successful cooperation with ICAO for smooth multimodal transport and trade to promote countries' sustainable socioeconomic recovery efforts."

Source: ICAO

6. A survey and optimization-based evaluation of development strategies for the air cargo industry

According to Yu-Hern Chang and Chung-Hsing Yeh (16 June 2006) Evaluates potential plans for the growth of a nation's air freight industry using a survey and optimization-based technique. To demonstrate how the technique integrates specialists' viewpoints from three stakeholder groups (the government, the academia, and the carrier) regarding the relative importance and viability of 18 different strategies, an empirical study of Taiwan's air cargo industry is conducted. A new hierarchical pairwise comparison procedure is implemented, with the ratio scale being represented by triangular fuzzy numbers, to assist experts in subjectively weighing various techniques. Using triangular fuzzy numbers to represent linguistic variables, different strategy achievability levels are determined.

A carrier-oriented optimal weighting approach is designed for maximising the overall preference value of the carriers, subject to the weight ranges provided by the government and academic experts, to assure the acceptability of the evaluation result. The optimal weights and their level of attainability are combined to determine the overall preference and ranking of the alternative solutions. The method can be used generally to evaluate policy solutions while taking into consideration the individual opinions of various stakeholder groups. In Taiwan, the air cargo market has grown significantly over the past 20 years, with an average annual growth rate of over 8%, with over 90% of the total air cargo volume being foreign traffic. Due to the strong ties between Taiwan's high-tech manufacturing sectors and the global market, Taiwan's 2002 entry into the World Trade Organization, liberal bilateral air service agreements, and likely direct transport links between Taiwan and China, this growth rate is likely to remain stable or even increase (Zhang, 2003). Although air cargo traffic has been steadily expanding, Taiwan's air cargo industry still has to contend with fierce regional and international competition, particularly from Hong Kong and Singapore.

Three stakeholder groups (the government, the general public, and the air cargo business) are involved in the issue of evaluating potential development plans for putting Taiwan's national air cargo development policy into practise, each of which has different beliefs and interests. By polling Taiwan's experts in these three stakeholder groups about their preferences for alternative development strategies in terms of these strategies' relative importance and viability, we can ensure the effectiveness and acceptability of the evaluation result for ranking alternative development strategies. While the achievability of various development strategies can be evaluated separately, that is, by absolute measurement using ratings, their relative importance (weight) must be evaluated in terms of comparisons.

To put a country's air cargo development policy into practise, alternative

strategies supported by the government and industry must be evaluated and categorised. The potential development plans for advancing Taiwan's air cargo business have been ranked and categorised using the survey and optimization-based evaluation approach we've described in this study.

Source: International journal of production economics

7. Analysis of the air cargo transport network using a complex networktheory perspective

According to Alessandro Bombelli (June 2020) A sophisticated network analysis of the air transportation system from the standpoint of air freight as opposed to passengers. To the best of our knowledge, this is the first study to examine the capacity of a worldwide cargo network that includes passenger airlines, full-cargo carriers, and integrators. Estimated annual cargo capacity between airport pairs served as the model's input. The whole network was created by superimposing each individual sub-network after evaluating the network properties of the sub- networks that represented the various carrier kinds. Both small-world and scale-free properties characterise the resulting network. With a smaller characteristic path length and diameter than its passenger counterpart, it had a stronger flow imbalance and concentration as a result of its topological characteristics. This outcome is consistent with cargo airports' bigger catchment areas and their reliance on road feeder services for the ground leg. Finally, we demonstrated how diverse attack techniques lead to airports acting as bridges between towns or centres of hub-and-spoke networks being attacked first. In an era where new players are continually joining the air cargo market and competition is always growing due to the growth of e-

commerce and next-day delivery, we feel that this work is relevant for academics and practitioners alike.

- Complex network theory analysis of the air cargo transport network.
- Air cargo transport network displays small-world and scale-free characteristics.
- Smaller characteristic path length when compared to passenger networks.
- Different role of hub airports of hub-and-spoke systems and bridge airports between communities is identified.

Source: ELSEVIER transportation research part E:
logistics

8. Business process re-engineering of an air cargo handling process

M.R. Rotab Khan (5 January 2000) states that business process re-engineering (BPR), which is the rapid and radical redesign of strategic, value-added processes and the organizational systems, policies, and structures that support them in order to maximize an organization's work processes and productivity, is one of the most recent developments in industrial engineering and management science. The focus of this paper's BPR effort and program is the air cargo handling process at an international airport. This paper aims to demonstrate how the application of a BPR technique can significantly improve key performance indicators, such as turnaround time and service quality in the airline cargo handling process. Field data on the service parts of the process have been collected using time as the metric.

To fully comprehend the current process and identify any potential areas for improvement, process-flow diagrams, process analysis worksheets, and data summary charts are developed. For the purpose of demonstrating the anticipated advantages, a fact-based, justifiable, and quantitative "Before-after chart" of BPR has been produced. BPR has demonstrated to be a

cutting-edge, practical industrial engineering and management technique for achieving a significant increase in operational efficiencies for high-quality airline cargo handling services.

The core of BPR is large step level improvement, not incremental progress. The "Framework at a Glance" and the "Holistic Wheel" based on "Business System Diamond" are the two models on which the re engineering technique is based. The client serves as the hub of the holistic wheel. Regarding the customer, there are two key ideas: (1) the customer must be at the heart of whatever the firm does, and (2) customers are the engine that propels the entire business system. To fulfil client expectations, business processes, organisational structure, work, management systems, beliefs, and behaviours must all be in harmony.

The "Framework at a Glance" created by Texas Instruments for Kodak practitioners to use in conjunction with the BPR team is the second implementation model. Project start, process understanding, new process design, and business transition are the four engineering phases offered by the technique. The likelihood of success is significantly increased by constantly maintaining both of these models in front of the BPR team and consulting them.

There are nine basic process improvement principles which include

- (i) eliminate waste
- (ii) minimize waste
- (iii) Simplify
- (iv) whenever possible combine process steps
- (v) design processes with alternative paths
- (vi) think parallel
- (vii) collect data once at its source

- (viii) use technology to improve processes and
- (ix) let customers assist in the process. The basic theme is always to eliminate or minimize waste.

Source: ELSEVIER international journal of production economics

9. Assessment of carbon emission costs for air cargo transportation

As per Ching-Chang Chao (4 June 2017), a set of models has been developed to ascertain the carbon emissions generated during every stage of flight when air cargo is transported. These models also investigate the carbon footprints that are left behind based on the type of aircraft and the flight path, and they forecast a rise in airline transportation expenses due to the carbon taxes enforced by the EU ETS. Airlines can use the expected results as a useful reference when allocating aircraft to different routes and selecting aircraft for future acquisitions. The validity of the model is tested by simulating the likely impacts of the EU ETS's adoption on the costs of air freight transportation for six routes and six distinct aircraft types.

The results indicate that a number of factors, such as the unit carbon emissions per aircraft, the aviation emission allowances per airline, and the costs of carbon trading, may have an impact. According to data, cost increases for air freight transportation might vary from 0% to 5.27% for each aircraft and each route. Therefore, the EU ETS's introduction might encourage airlines to cut their carbon emissions in order to save money on operations and, as a result, lessen the pollution that comes from moving freight by air. Any country that has ratified the United Nations Framework Convention on Climate Change is required to meet the emission reduction targets.

These methods also aid in enhancing the abilities and talents of the involved persons. Certain businesses and facilities must lower their greenhouse gas (GHG) emissions in accordance with the Kyoto Protocol. The European Union (EU) created an emissions trading scheme (ETS) for various industries and installations in 2005 in order to partially meet these criteria. (Union European, 2003). The EU ETS is presently in the midst of its third trading phase, which is scheduled to conclude in 2020. Consequently, aviation is now vulnerable to the risk of shifting CO2 prices.

Source: ELSEVIER

CHAPTER – 3

**CORPORATE PROFILE OF AIR
FREIGHT MARKET AND
ANALYSIS**

3.1 OVERALL PROFILE OF AIRCARGO LOGISTICS

Another word for air freight is air cargo. It is the moving or carrying of freight via airborne vehicles. Air transport services, such as air mail, air freight, and air express, are the most valuable when it comes to moving express shipments over the globe. Within the passenger cabin, cargo may also be delivered by hand by a "on-board courier". Two of the main uses of air transportation in logistics and trade are the management and control of the flow of energy, information, and goods.

Every year, air freight carries more than US \$6 trillion worth of commodities, accounting for over 35% of all trade in value. During the COVID-19 pandemic, air freight made about one-third of airline revenue. Data for the global air cargo markets as of July 2022, released by the International Air Transport Association (IATA), show that, although air cargo has receded from the exceptional performance in 2020–2021, it is tracking at levels similar to 2019. Since April, the cargo markets have effectively drifted sideways due to volatility brought on by constraints in the supply chain and shifting economic conditions. Data from July show that air freight is currently doing well, but as with almost every other industry, we need to keep a close eye on impending political and economic developments. Which things are transported by air depends mostly on two factors: the cost of the commodities and the desired speed of delivery. Air cargo is usually used to transport valuable things including high-value commodities and technology equipment, as well as urgent materials like radiopharmaceuticals for medical diagnosis or treatment. Certain culinary items, such fresh seafood, exotic fruits, and cut flowers, are best transported by air. New rules for the appropriate handling of time- and temperature-sensitive shipments have also been introduced as a result of the increase in demand for the transportation of healthcare and pharmaceutical products.

The shipping of these goods is governed by certain regulations that must be followed when preparing, offering, accepting, and handling this cargo. Among these are goods that are sensitive to temperature and timing, live animals, perishable cargo, wet cargo, and hazardous items. Among these are goods that are sensitive to temperature and timing, live animals, perishable cargo, wet cargo, and hazardous items.

The Live Animals and Perishables Board (LAPB), the Time and Temperature Working Group (TTWG), and the Dangerous Goods Board (DGB) are the three boards within IATA that oversee the rules and regulations pertaining to the transportation of these goods. This is done to make sure that the safety and convenience of these items are guaranteed by globally harmonised standards. For the air transportation of dangerous goods, the IATA Dangerous Goods Regulations (DGR)

document is the only acceptable norm. It provides all the tools needed to classify, prepare for, receive, and manage shipments of dangerous products in compliance with international aviation regulations. IATA has been releasing the DGR for over 60 years. The DGR is released once a year to ensure that the industry is informed about the most recent developments surrounding the shipping of hazardous materials. IATA works closely with governments, other industry organizations, and the International Civil Aviation Organization (ICAO) to develop these regulations.

IATA ensures that the regulations governing the air transportation of hazardous materials are effective and internationally recognized in order to enable the transportation of these materials while putting passenger safety first. Some harmful commodities are too unsafe for air transport, unless the civil aviation authority grants highly particular permissions. Many dangerous products can only be transported on cargo-only aircraft, while others can be transported on both cargo and passenger planes.

Air cargo management includes a series of steps

Booking and planning shipments:

There is a lot to be done in the booking and planning phases of the cargo handling process before a shipment even leaves the plant. A well-planned course of action facilitates booking and helps avert problems later on in the proceedings. To accurately book the cargo, the following steps need to be completed. The following actions performed by freight forwarders are likewise covered by these procedures:

- Acknowledge shipper requests and verify security status
 - Get shipper freight details
- Schedule the routing—direct or consolidation
- Check capacity against carrier or forwarder inventories
- Verify capacity
- Schedule freight pickup

How Air Cargo is Received and Accepted for Shipment:

The next step in logistics is how air cargo is received and approved for transportation. This multi-step procedure involves a number of shareholders, including ground handling service providers, cargo service providers, and trucking companies, among others. Throughout the shipping process, every player in the air cargo supply chain prioritizes safety above all else. For example, it's imperative to guarantee that packages are accurately and clearly

identified and labeled. Additionally, the packing itself needs to be suitable for the contents and able to protect the goods from damage.

Receive Shipments into Carrier Domain:

The products can be received by the carrier domain once the freight forwarding vehicle has reached it and the driver has notified the cargo handling agent of their arrival. The following details must to have been sent to them beforehand, which is why it is usually advised to file electronically:

- Electronic house waybill information for combined shipments;
- Electronic air waybill information
- Vehicle type and number (if applicable)
- Approximate arrival time (if known)
- Requirements for security screening (if available/known)

The driver will be given a time slot and location for unloading after the information is received and the truck arrives. Various slots are allotted according on demands, including those for dangerous commodities, live animals, ULDs, medical supplies, and more.

Accept Shipments as Ready for Carriage:

Airport cargo and ground handling staff need to fulfill a few procedures before accepting a consignment as ready for transportation in order to fulfill the requirements for shipping goods by air. They must first confirm that the shipments have received security clearance. They then have to confirm that the carriage is ready. This means confirming that all the data matches the actual cargo and making sure all operational limitations and embargoes are in place. Following a thorough inspection, the data is updated and verified

against the reservation. The principal aim is to verify that the shipments adhere to the:

- Carrier specifications
- Local export laws and ordinances
- Rules governing the transit airport(s) and airspace (if any)
- Import laws of the country of destination

Preparing Cargo for Flight:

Airport cargo and ground handling staff can get the air cargo ready for flight after receiving shipments that are ready for conveyance. Receiving the items in transit and re-clearing security are requirements. Transit cargo is anything that is left on an aircraft while it is in flight. This transit cargo needs to undergo security checks by cargo and ground handling services, which include x-ray and explosive trace detection (ETD) screening. The integrity of the cargo, the e-AWB, and the item count are all carefully examined. A build-up plan that specifies what air cargo is to be assembled for flight must be created once the carrier provides the pre-plan details, and the information must be forwarded to the warehouse.

Sending Shipments to Flight:

Here, the loaded ULDs are transferred to a safe flight holding area where all sensitive data, including dangerous items and temperature-controlled materials, is carefully considered. If it is known, the ULDs can be arranged in order to get ready for ramp transit, ensuring that no flights are delayed. Every ramp safety procedure must to be adhered to. Once all of these procedures have been completed specifically, the aircraft would be loaded in accordance with the load plan, with particular cargo arrangements noted. Any disparities

must be corrected by amending the electronic Flight Manifest after the aircraft is loaded.

At this point, the ramp handler takes over control of the air cargo from the warehouse operator. There are several steps involved in moving cargo from a cargo terminal to an airplane. The airplane can now take off, but the cargo loading process is not finished until the flight manifest, loading, and carriage information are mailed. during the loading and unloading procedure, of all ground support equipment is required. For this reason, it is essential that all cargo and ground handling employees receive adequate training on IATA laws and regulations.

At this point, the ramp handler takes over control of the air cargo from the warehouse operator. The IATA Cargo Handling Manual (ICHM) provides the best outline for the multi-step process of transporting products from cargo terminal to aircraft.

How Air Cargo is Unloaded:

Compared to shipping and loading, the unloading of air cargo at an airport requires fewer steps for ground handlers and cargo. However, there are still a lot of laws and guidelines that ground handling and cargo employees need to follow. By carrying out activities methodically and adhering to ramp safety regulations, accidents can be prevented and aircraft turnaround times can be managed. The precise procedures for offloading air cargo are as follows, per the IATA cargo handling manual:

- Unload and dispatch shipment to warehouse
- Check-in shipments
- Arrive shipments

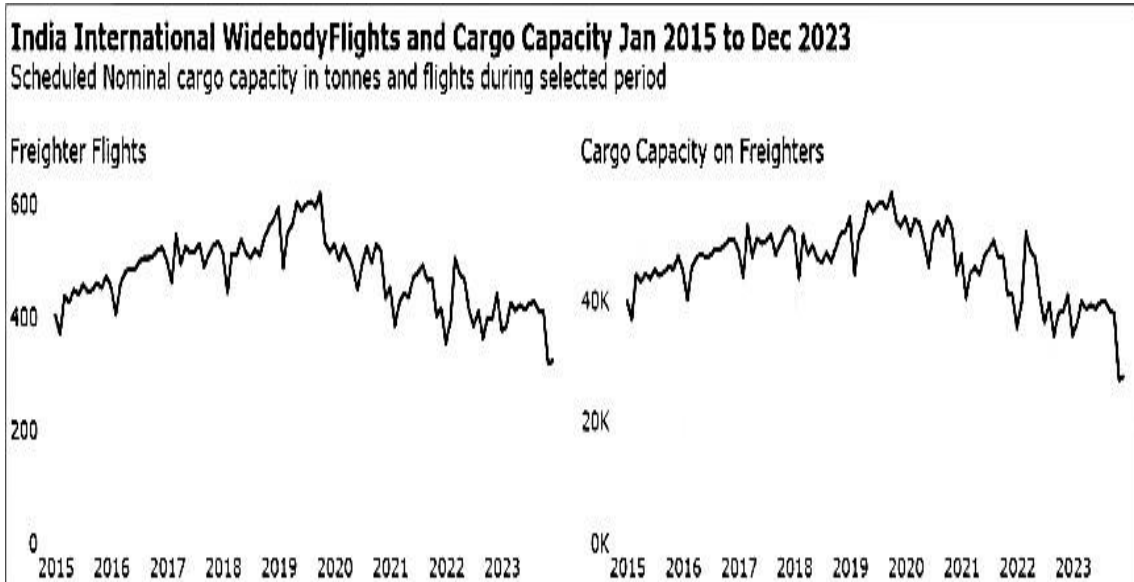
- Hand over shipments to forwarders

Last Steps before Delivery:

The vehicle delivers the items to the freight forwarder hub, where they are unloaded and inspected, after it has picked them up from the carrier's domain. Goods are frequently shipped via a Forwarder Branch Facility, given to the Consignee, and then delivered to the ultimate recipient. These steps are covered in the ICHM's subsequent chapters, which provide additional information on each step:

- Load truck and create run sheet
- Arrive shipment to forwarder hub
- Transfer shipment at forwarder hub

3.1 ANALYSIS OF INDIAN AIR CARGO MARKET



With 2.2 million tons of traffic, the Indian air cargo market is one-fifth the size of China's and around one-tenth that of the United States. Approximately thirty percent of the traffic is created in the domestic sector, with the remaining portion being generated on the international one.

According to a Trade and Transport Group research titled "India Air Cargo Outlook 2023," about 90 percent of international traffic is carried by non-Indian carriers with Gulf-based carriers as well as Aerologic (operating for Lufthansa Cargo and DHL), Cathay and Turkish being the most important. As passenger and belly capacity return, the amount of cargo handled by Indian airports might reach 2.4–2.5 million tons in 2023, according to Frederic Horst, Managing Director, Trade and Transport Group. The India connection will always be significant since five or six Indian conglomerates venture outside. India is therefore in a strong position with regard to trade.

Aerologic now holds the greatest share of the Indian carrier market at 14%, with Qatar Airways at 13%, Emirates at 13%, Air India/Air India Express at 8%, and Cathay Pacific at 7% following. With this rise, Turkish Airlines now has roughly 5% of the market. (In Aerologic's instance, there has been some traffic substitution between Aerologic and Lufthansa Group carriers. Aerologic is a 50:50 joint venture between Lufthansa and DHL, wherein Lufthansa markets five of the carrier's 21 aircraft.) Air India and Air India Express account for 2/3rd of traffic carried by Indian carriers with IndiGo, Vistara and SpiceJet accounting for the balance.

Economic justification for expansion

"There are chances for growth, driven by imports and exports of intermediate and manufactured goods as well as e-commerce traffic, with economic and trade growth predicted to outperform in the near term. A shift by the United States and Europe away from China may also be advantageous for India, but it will depend on how manufacturing capacity grows overall and in particular in the consumer goods and high tech sectors. India now trades more manufactured goods than it did before the pandemic; in 2022, imports rose by 17% and exports by nearly 10%. We anticipate strong export performance in a variety of industries, including automotive, pharmaceuticals, industrial equipment and parts, and other high-tech industries. Less so are home products, apparel, and shoes. On the import side, we expect industrial equipment and parts, semiconductors and equipment and automotive sectors to grow.

Dynamics of the market

The traffic performance in 2022 was largely favorable, with the market expanding by 8.4% overall. IndiGo experienced a 14.5% growth. Blue Dart experienced a 2.5% growth. Air India traffic dropped by 2 percent; Go Air, Air Asia, and Vistara all saw growth of about 30 percent; SpiceJet saw a decline of nearly 30 percent, mainly because it had to remove two of its fleet's five freighter aircraft. Freight operations have traditionally struggled in the Indian domestic market due to an abundance of high frequency belly capacity. Passenger aircraft carry around 80% of the freight travel. In the domestic cargo market in India, the average haul length is about 1,200 km.

All cargo operations

There are now 103 non-scheduled and 17 scheduled aircraft operators in India. Five of these fly cargo planes. Indian carriers operate exclusively narrowbody freighter aircraft. There are now five freighter operators in operation: SpiceJet, Blue Dart Aviation, IndiGo, Quikjet, and Pradhana Air Express. Freight activity has increased in India, but Indian carriers have not kept up with this expansion. We see potential for expanding the fleet of widebody freighters. Due entirely to the expansion of services by non-Indian carriers, scheduled international freighter flights on widebody freighter aircraft grew from around 5,300 trips in 2015 to 6,900 flights in 2019—a 30% increase. Nevertheless, this number fell to 6,000 in 2020, 5,300 in 2021, and 5,000 in 2022.



X-axis: Financial Year (2018-2019 to 2022-2023)

Y-axis: International Cargo Transported (Metric Tonnes)

Observations:

The graph shows a possible increase in international cargo transported through Indian air cargo over the five financial years.

Cargo volume appears to start around 500,000 metric tonnes in 2018-2019 and increases to around 2,000,000 metric tonnes in 2022-2023.

Uncertainties:

The limited timeframe (five years) makes it difficult to determine a definitive trend.

There could be fluctuations within these years that the graph doesn't capture.

Possible explanations:

Growth in Indian exports: An increase in India's international trade could lead to more goods being shipped by air cargo.

Improved air connectivity: Investments in airports and expansion of flight routes could facilitate faster and more efficient international cargo movement.

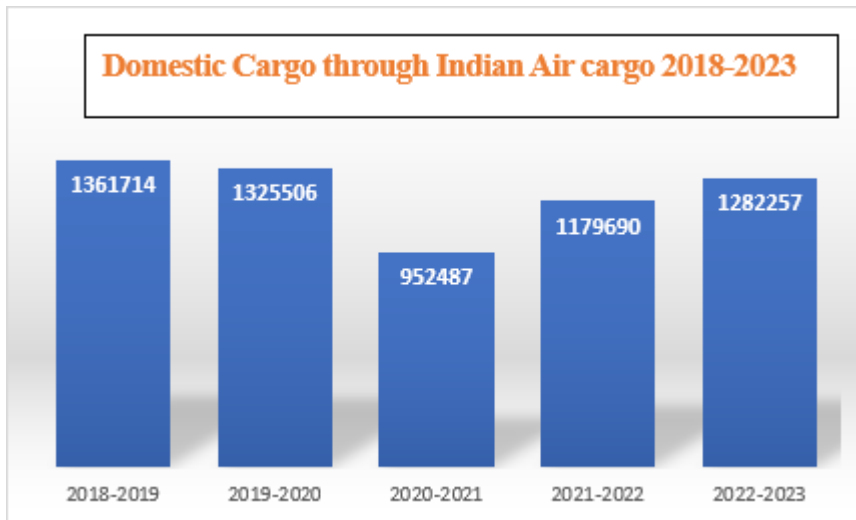
Strategic location: India's geographical position as a link between Southeast Asia, the Middle East, and Europe could position it well to handle international cargo.

Further considerations:

Data on the specific types of goods being transported internationally would provide more insights.

Information on the origin and destination of the cargo would reveal trading partner trends.

Overall, the data suggests a possible growth in international air cargo handled by India. However, a more in-depth analysis with data over a longer period and additional details would provide a clearer understanding of the trend and influencing factors.



Observations:

There appears to be a positive trend in domestic air cargo movement over the five-year period.

Domestic cargo tonnage increased from approximately 950,000 metric tonnes in 2018-2019 to roughly 1,360,000 metric tonnes in 2022-2023.

This represents a growth of around 43% over the five years.

Possible explanations for the growth:

E-commerce boom: The surge in e-commerce activity in India could be a significant driver as faster delivery options often rely on air cargo.

Economic growth: India's growing economy might be leading to increased demand for domestic air cargo transportation across various sectors.

Improved infrastructure: Investments in airport infrastructure and expansion of air connectivity within India could be facilitating smoother cargo movement.

Further considerations:

The data only reflects a five-year timeframe. A longer-term analysis would provide a more comprehensive picture.

It would be helpful to know if the growth rate is consistent or if there were significant fluctuations year-to-year.

Examining the data by cargo type (e.g., perishables, manufactured goods) could reveal specific sectors driving the growth.

Overall, the data suggests a positive trajectory for the domestic air cargo market in India. However, a more detailed analysis with additional data points would provide a clearer understanding of the contributing factors and future trends.

3.2 ANALYSIS OF GLOBAL AIR CARGO LOGISTICS

a) TO STUDY THE FACTORS THAT AFFECT THE DEMAND FOR AIR CARGO LOGISTICS

Studying the factors that affect the demand for air cargo logistics can be a complex task, as there are numerous variables that can influence it. However, some common factors that can affect the demand for air cargo logistics include:

- **Economic conditions:** The state of the economy, both globally and domestically, can have a significant impact on the demand for air cargo logistics. For example, during periods of economic growth, there may be an increase in demand for air cargo logistics due to an increase in international trade.
- **Industry trends:** The demand for air cargo logistics can also be influenced by trends in specific industries. For example, the growth of e-commerce has led to an increase in demand for air cargo logistics, as consumers expect faster delivery times.
- **Geopolitical factors:** Political instability, trade restrictions, and changes in regulations can all impact the demand for air cargo logistics. For example, changes in customs regulations can slow down the movement of goods across borders, leading to a decrease in demand for air cargo logistics.
- **Infrastructure:** The availability and quality of infrastructure, such as airports and air traffic control systems, can also affect the demand for air cargo logistics. For example, if there are delays at airports due to congestion or poor weather conditions, it may lead to a decrease in demand for air cargo logistics.
- **Fuel prices:** The cost of fuel is a significant factor in the cost of air

cargo logistics, so changes in fuel prices can impact the demand for air cargo logistics. For example, if fuel prices rise, it may lead to a decrease in demand for air cargo logistics as shippers may opt for cheaper transportation modes.

Overall, studying the factors that affect the demand for air cargo logistics requires a careful analysis of a variety of factors, including economic conditions, industry trends, geopolitical factors, infrastructure, and fuel prices.

Proposes a model for analysis that enables assessing the potential for air cargo in an airport to increase. For this, a model has been created that identifies the factors that affect an airport's ability to draw cargo operations and air cargo airlines. The investigation of the whole logistics chain, including the physical flow, the documentary flow, and all the agents engaged, as well as a sectorial evaluation of air freight were used to identify the model's constituent pieces. The logistics chain has been analyzed from an operational, technological, socioeconomic, and environmental perspective, taking into account all the variables that affect the logistics network's competitiveness. Particularly, the technologies for the handling of goods and its control (on land and on board), as well as the operational qualities that an air cargo transport requires both at the level of airport infrastructure and logistics operators, have been explored. The various product kinds that are delivered in accordance with their features, the accompanying supply chains that take into account the places and routes where their origins and destinations are, and the current markets with the primary demands of each type of item are further characteristics. The Analytic Hierarchy Process approach and absolute measurements were used to construct the model. This methodology takes into account the opinions of experts when determining how to weight the many aspects and features that make up the model.

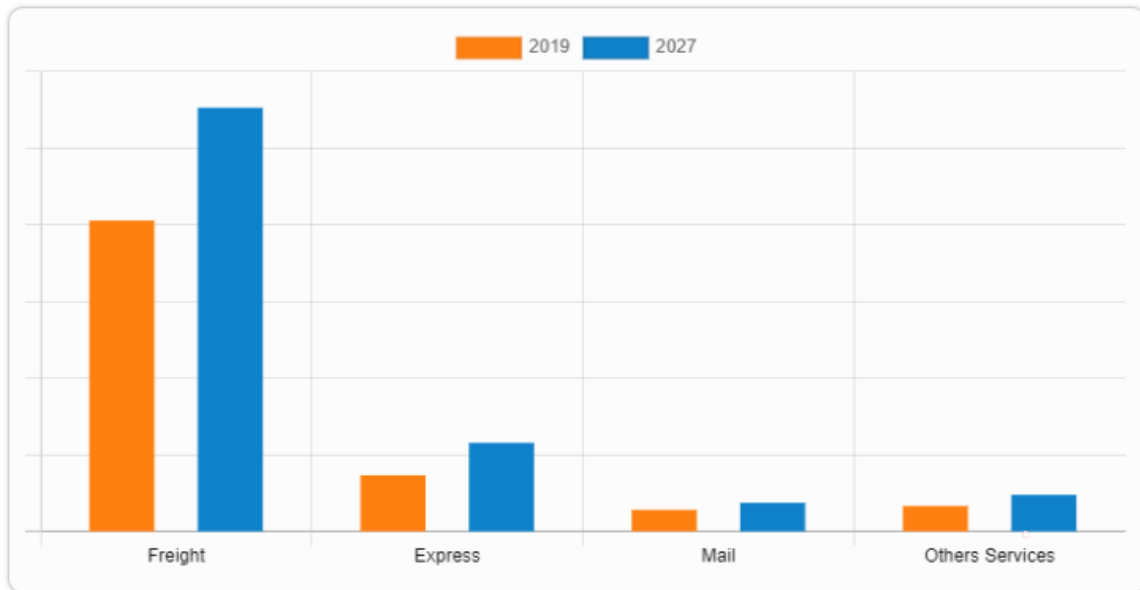
b) Faster delivery of shipments as compared with other logistics solutions

The quickest method of delivery among all kinds of transportation is via cargo jets. Air transport makes the delivery of things in only a few hours, but other forms of transportation, such as cargo, rail or road transport, typically take days or weeks. Because there is less inventory to offload than there would be aboard a cargo ship, customs clearance happens quickly, and there is considerably less of a need for local warehousing. Additionally, air freight is the safest way of shipping among all others because it requires the least amount of handling and airport safety measures are closely enforced.

This reduces the possibility of theft and shipment damage. Additionally, because air freight shipments are typically short in duration, insurance costs are frequently modest. These elements make air freight a superior and necessary means of moving products. Nearly 35% of the value of world trade is carried by air cargo ships carrying almost \$6 trillion worth of products. Air freight plays a significant role in the delivery of the 7.4 billion parcels and 328 billion letters that are transported yearly, according to IATA. Shipping high-value commodities like electronics, jewellery, pharmaceuticals, perishables, and other items through air freight is very advantageous. Initially, cargo aircraft were only used to transport fruit, flowers, and vegetables. However, with time came the development of temperature-controlled packing techniques, procedures, and facilities for handling frozen and chilled goods, including chilled storage and freighter capacity. Additionally, given the large profit margins associated with jewellery and pharmaceuticals as well as the fragility of some electronic goods, air freight is the best mode of transportation.

Air Freight Market

By Service



Express is projected as the most lucrative segment

Figure 3 (comparison with other logistics services)

Air cargo market analysis and forecast 2023-2027

Between 2022 and 2027, the market for air cargo is anticipated to expand at a CAGR of 5.32%. It is anticipated that the market will grow by 19.52 million tonnes. The market's expansion is dependent on a number of variables, such as an increase in e-commerce sales to support the aircargo business, increased demand from APAC, and rising demand from just-in-time producers.

This study goes into great detail about market segmentation by type (belly cargo, freighter), geography (APAC, North America, Europe, Middle East and Africa, and South America), and end-user (manufacturing, FMCG and retail, pharmaceuticals and chemicals, and other industries). It also

features a thorough study of the factors, patterns, and difficulties. The research also contains historical market information from 2017 through 2021.

c) Fastest-Growing Segment in the Air Cargo Market

During the anticipated timeframe, the manufacturing segment's market share will expand significantly. Due to the automobile industry, which is a subset of the manufacturing business, the manufacturing industry has the biggest market value. Cars are being sent out by air cargo carriers for various businesses.

With 19.58 million tonnes in 2017, the manufacturing sector gradually increased its market share, and this trend maintained through 2021. Due to its quick and damage-free delivery, air cargo transport services are used by many enterprises that produce automotive components. As a result, it is predicted that over the forecast period, an increase in the import and export of cars and related replacement parts will propel the worldwide air cargo market. In addition, our study offers a concise analysis of market categories, historical and projected market shares, and the drivers of growth from 2017 to 2027.

This segment's expansion is primarily attributable to the rising use of air cargo services, which is fuelled by an increase in the demand for the air cargo industry on a global scale.

Key Regions for Air Cargo Market

By 2027, APAC is anticipated to contribute 30% of market growth. The geographical trends and drivers that will shape the market over the course of the forecast have been thoroughly discussed by Technavio's analysts.

As more different raw materials are carried from APAC, where raw

materials are more readily available and less expensive than in other parts of the world, air cargo services from APAC to countries in North America are anticipated to increase. This is a result of the cheaper labour and manufacturing costs in APAC nations like China, India, Vietnam, and Thailand.

d) Efficiency of current air cargo market

The International Air Transport Association (IATA) released data for February 2023 global air cargo markets showing that air cargo demand rose above pre-pandemic levels.

In terms of cargo tonne-kilometers (CTKs*), the global demand decreased 7.5% from February 2022 (-8.3% for foreign operations). This represented a halving of the annual fall rate observed in the two preceding months (-14.9% and -15.3%, respectively). The demand for air freight increased 2.9% in February compared to pre-pandemic levels (February 2019), marking the first time in eight months that this has happened.

When compared to February 2022, capacity (measured in available cargo tonne-kilometers, ACTK) increased by 8.6%. As the passenger side of the company keeps improving, belly capacity has been added, which is reflected in the significant increase in ACTKs. Global belly- capacity increased by 57.0% in February compared to the same month last year, reaching 75.1% of its pre-pandemic 2019 level.

The story of air cargo in February is one of slowing declines. Year-on-year demand fell by 7.5%. That's half the rate of decline experienced in January. This shifting of gears was sufficient to boost the overall industry into positive territory (+2.9%) compared to pre- pandemic levels. An optimistic eye could see the start of an improvement trend that leads to market stabilization and a return to more normal demand patterns after dramatic ups-and- downs in recent years

FEBRUARY 2023 (% YEAR ON YEAR)	WORLD SHARE ¹	CTK	ACTK	CLF(%-PT) ₂	CLF(LEVEL) ₃
Total Market	100.0%	-7.5%	8.6%	-7.9%	45.6%
Africa	2.0%	-3.4%	4.7%	-3.9%	46.8%
Asia Pacific	32.4%	-6.0%	19.9%	-12.8%	46.4%
Europe	21.8%	-15.3%	-1.5%	-9.4%	57.4%
Latin America	2.7%	-2.7%	27.6%	-11.2%	36.1%
Middle East	13.0%	-8.1%	9.3%	-8.4%	44.5%
North America	28.1%	-3.2%	2.8%	-2.5%	40.0%

Figure 4(region-wise comparison)

Asia-Pacific airlines: When compared to the same month in 2022, air cargo volumes for Asia- Pacific carriers fell by 6.0% in February 2023. Compared to January (-19.0%), this performance was noticeably better. After China's reopening, when restrictions were relaxed and business operations were resumed, airlines in the area benefited. As more belly capacity from the passenger side of the business came online, the region's available capacity climbed by 19.9% in comparison to February 2022.

North American carriers When compared to the same month in 2022, North American carriers reported a 3.2% decline in cargo volumes in February 2023. Compared to January (- 8.7%), its performance showed a significant improvement. Notably, the area had a considerable uptick in global demand in February, increasing its market share in global freight

traffic above pre-pandemic levels (21.7% in February 2023 compared to 18.2% in February 2019). In comparison to February 2022, capacity rose 2.8%.

European carriers With a 15.3% drop in cargo volumes in February 2023 compared to the same month in 2022, European carriers had the worst performance of any region. Compared to January (-20.4%), this performance was better. The situation in Ukraine is still having the biggest impact on local airlines. When compared to February 2022, capacity fell 1.5% in 2023.

Middle Eastern carriers Cargo volumes for Middle Eastern carriers fell by 8.1% in February 2023 compared to the same month last year. In comparison to the previous month (-11.8%), this was a minor improvement. When compared to February 2022, capacity rose by 9.3%.

Latin American carriers when compared to February 2022, Latin American carriers reported a 2.7% decline in cargo shipments. Compared to January, when performance increased by 4.6%, this was a decline. When compared to February of 2022, capacity increased by 27.6%.

African airlines Cargo volumes for African airlines fell 3.4% in February 2023 compared to February 2022. In comparison to the prior month (-9.5%), this performance was better. Notably, February saw a large increase in freight demand along the Africa to Asia route, increasing 39.5% over the previous month. The capacity was 4.7% higher than in February 2022.

e) TYPES OF GOODS TRANSPORTED BY AIR CARGO

Over US \$6 trillion worth of goods are transported via air freight every year, making up over 35% of global trade in value; during the COVID-19 epidemic, air cargo accounted for one- third of airline income.

The International Air Transport Association (IATA) has revealed data for the worldwide air cargo markets as of July 2022, indicating that air cargo is tracking at levels close to 2019, while having retreated from the extraordinary performance in 2020–2021. Since April, volatility brought on by supply chain limitations and changing economic conditions has caused the cargo markets to essentially drift sideways. According to July's data, air freight is still holding its own, but as is the case for practically other businesses, we must closely monitor upcoming political and economic changes.

There are two basic categories for the numerous sorts of airborne cargo: general cargo and special cargo. Then, Special Cargo is split up into more compact, highly specialised sub- groups. We shall examine much more closely at these specialised sub-groups in the next sections.

General Cargo

Items classified as general cargo do not fall under the Special Cargo categories and do not need to be handled or transported with additional care. Retail, the majority of consumer goods (with the exception of smartphones, tablets, and laptops), dry goods, hardware, textiles, and other products fall under this category. Consider common, ordinary items; the most of them would go in the general cargo compartment.

Special cargo

Where things become a little trickier is with special cargo. The term "special cargo" refers to products that may require special packing, labelling, paperwork, and treatment along the transport chain due to their nature, weight, dimensions, or value. Specific rules that must be observed when preparing, offering, accepting, and handling this cargo address the transportation of these commodities. Items include, among others,

hazardous materials, live animals, perishable cargo, wet cargo, and temperature- and time-sensitive commodities. IATA has three boards: the Live Animals and Perishables Board (LAPB), the Time and Temperature Working Group (TTWG), and the Dangerous Goods Board (DGB), to ensure that there are globally harmonised standards that protect the safety and facilitate the use of these products.

Dangerous goods

The only standard accepted by airlines for the air transportation of dangerous items is the IATA Dangerous items Regulations (DGR) document. It offers all the resources required to categorise, get ready for, accept, and handle risky commodities shipments in accordance with global air transport rules. The DGR has been released by IATA for more than 60 years. To make sure that the industry receives the most recent information regarding the shipping of dangerous items, the DGR is published once a year. IATA collaborates closely on the formulation of these rules with governments, other business organisations, and the International Civil Aviation Organisation (ICAO).

Classification of dangerous goods

Dangerous goods are grouped into nine classes:

- Class 1-Explosives
- Class 2-Gasses
- Class 3-Flammable Liquids
- Class 4-Flammable Solids; Substance Liable to Spontaneous Combustion; Substances which, in Contact with Water, Emit Flammable Gases
- Class 5-Oxidizing Substances and Organic Peroxides
- Class 6-Toxic and Infectious Substances

- Class 7-Radioactive Material
- Class 8-Corrosives
- Class 9-Miscellaneous Dangerous Substances and Articles, Including Environmentally Hazardous Substances

Temperature controlled goods

Pharmaceuticals, blood products, organ transplants, and other products used in the life sciences require special temperature controls when being transported. Whatever the temperature- controlled items you are shipping, they will be delivered safely and securely if you comply with the TCR's requirements, which are outlined in the IATA Temperature Control Regulations Manual (TCR).

Before a carrier can accept time and temperature controlled goods from a shipper there are many details regarding the shipment that must be laid out in advance. Some of these details include:

- Contents of the time and temperature goods
- Type of packaging
- Flight schedule and routing
- Aircraft type
- Environmental conditions
- Availability of temperature control during all phases
- The anticipated span of the journey
- 24hr emergency contact number
- Country specific regulations

Perishable Goods

Perishable commodities must be transported since they are in great demand due to the year-round increase in popularity of fresh fruits and vegetables. Transporting perishable goods by air is the preferable method of shipping because of the accelerated transit time and controlled temperature. There are special procedures and rules that must be followed when exporting perishable commodities by air. Does the shipment pass muster? Has it been labelled and marked? Does it comply with the requirements, etc.? Additionally, shipper and carrier obligations must be fulfilled. Every stage of the process must adhere to the regulations. There are numerous documents needed for shipping perishable goods. The process begins with ensuring that the Air Waybill is filled out completely and accurately and without unreasonable requests for handling the perishables.

Live Animals

The IATA Live Animals Regulations (LAR) are the global standard for live animal aviation transportation. These rules are in place to protect the safety of the animals, as well as that of the drivers and passengers

IATA's LAR has been formally included into the national rules of 45 nations or regions. The list inside the current IATA LAR is updated annually to incorporate the most recent details regarding which countries apply and enforce the laws. With the exception of guide dogs, all live animals must be transported in a container that is stipulated in the regulations, according to these rules for shipping live animals. The IATA LAR complies with the toughest rules, so if you do as instructed, you will be in full compliance.

When shipping live animals, the shippers are responsible for ensuring all animals are healthy and in good condition. The carriers have a

responsibility to make sure that the shippers have complied with all of the regulations.

When ensuring the guidelines are met, they must check:

- The details of the documentation.
- The design of the container.
- Marking and labelling.
- Routing and reservation information.

f) COVID-19 IMPACT ON THE AIR CARGO INDUSTRY

It is understandable why cargo's fortunes might be viewed favourably by observers looking for a silver lining, as the pandemic approaches its second year, given that IATA reports that global passenger demand and capacity have fallen 70.3% and 58.6%, respectively, over the same period (forward bookings are also off about 79% year-on-year).

The availability of COVID-19 vaccines for worldwide distribution, however, has boosted industry professionals both above and below deck. The global distribution of billions of doses of vaccines presents a profit opportunity for cargo carriers with climate-controlled facilities, while passenger airlines are hopeful that the vaccines will help to halt the spread of the virus and eventually lift the restrictions on travel.

While the epidemic has generally been detrimental to aviation, it has also accelerated the global shift to e-commerce in a way that will ultimately be advantageous for all freight transportation service providers. The global shift to e-commerce may have been sped up by five years, according to a recent IBM assessment.

As e-commerce volumes increased during the pandemic, freighter movements through the airport were also boosted by the abrupt decline in cargo space offered by significantly fewer passenger flights. Some freight-focused aviation facilities, like East Midlands Airport (EMA), are in a position to benefit from the market shift.

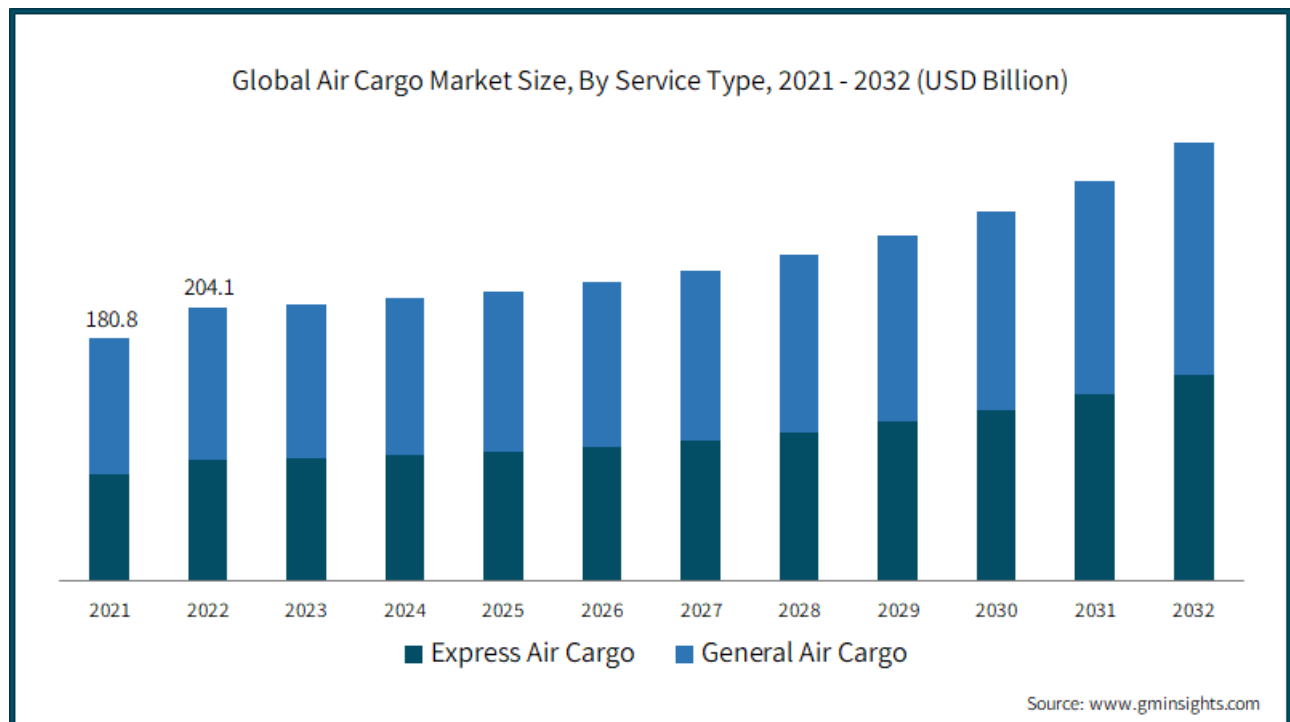
A similar decline was found in the Asia Pacific region, the world's biggest market, where demand fell a comparative 10.6% in November. The Middle East, which represents about 13% of the global market, fared somewhat better in November when volumes fell by just 2.3% year on year.

Just 1% of global trade moves by air, but that 1% represents 35% of global trade by value, according to IATA

Just 1% of global trade moves by air, but that 1% represents 35% of global trade by value, according to IATA, a fact that has air cargo results closely scrutinised by economists looking for forward financial indicators.

With e-commerce on the rise, IATA and other industry bodies have been stressing the need to improve shipment-tracking technology, in part to better monitor and secure the flow of global trade's highest-value goods, which typically move by air.

3.3 CHALLENGES AND FUTURE TRENDS OF AIRCARGO LOGISTICS



The air freight market is a significant component of the global logistics industry, and it has experienced significant growth in recent years due to the rise of e-commerce and globalization of trade. The purpose of this analysis is to provide an overview of the air freight market, including its size, structure, trends, and challenges.

1. Market Size and Structure:

According to the International Air Transport Association (IATA), the air freight market transported over 61 million metric tons of cargo in 2020, representing a 9.7% increase from the previous year. The market is dominated by a few large carriers, including DHL, FedEx, UPS, and Emirates Sky Cargo, which collectively account for a significant share of the global air freight market. Additionally, several airports, including Hong Kong, Memphis, and Shanghai, serve as major hubs for air cargo

transportation.

2. Market Trends:

The air freight market has experienced significant growth in recent years due to the rise of e-commerce and globalization of trade. The COVID-19 pandemic also had a significant impact on the market, with the demand for medical supplies and personal protective equipment driving the market's growth in 2020. Another trend in the market is the increasing use of technology, such as automation and artificial intelligence, to improve the efficiency and speed of air cargo transportation.

3. Market Challenges:

The air freight market faces several challenges, including volatile fuel prices, increased competition, and regulatory issues. The market's dependence on oil prices can impact profitability, and competition can result in price pressures and reduced margins. Additionally, regulatory issues, such as security and safety regulations, can increase the cost of operations and limit market growth.

4. Market Opportunities:

The air freight market presents several opportunities for growth, including the increasing demand for e-commerce, the rise of emerging markets, and the need for faster and more efficient transportation. Additionally, advancements in technology, such as the use of drones and autonomous vehicles, present opportunities for innovation and improved efficiency in air cargo transportation.

In conclusion, the air freight market is a significant component of the global logistics industry, and it has experienced significant growth in recent years. The market is dominated by a few large carriers, and several airports serve as major hubs for air cargo transportation. The market's

growth is driven by trends such as e-commerce and globalization of trade, and the market faces challenges such as volatile fuel prices, increased competition, and regulatory issues. However, the market presents several opportunities for growth, including the increasing demand for e-commerce, the rise of emerging markets, and advancements in technology.

3.4 PORT HANDLING OF AIRCARGO

Air cargo logistics, the backbone of global trade, thrives on efficiency and speed. Within this dynamic system, port handling – the meticulous process of managing cargo at airports – plays a critical role. This essay explores the intricate sub-processes within port handling, highlighting their significance in ensuring smooth air cargo movement.

1. Pre-Arrival Operations: Setting the Stage

Even before a shipment arrives at the airport, meticulous planning sets the stage for efficient handling. This includes:

- **Documentation Processing:** Accurate and timely processing of shipping documents, including customs clearance, ensures a smooth transition through airport security and facilitates faster onward movement.
- **Flight Information:** Real-time flight information allows for optimal resource allocation and streamlined cargo handling upon arrival.
- **Cargo Acceptance and Consolidation:** Incoming cargo undergoes inspections to verify weight, dimensions, and compliance with regulations. Consolidation involves grouping smaller shipments into larger units for efficient loading onto aircraft.

2. Arrival and Offloading: A Delicate Dance

The moment the aircraft lands, a well-orchestrated offloading process begins:

- **Ramp Operations:** Trained personnel secure the aircraft and connect specialized equipment like conveyor belts and high loaders. Time is of the essence, as quick offloading minimizes aircraft turnaround time and optimizes airport operations.
- **Cargo Segregation and Sorting:** Upon offloading, cargo is segregated based on destination, type (perishable, fragile, etc.), and urgency. This meticulous sorting ensures efficient onward processing and minimizes delays.

3. Warehousing and In-Transit Storage: A Temporary Home

Not all cargo departs immediately. Warehousing facilities play a crucial role in managing in-transit cargo:

- **Short-Term Storage:** Cargo awaiting onward flights or customs clearance is stored in designated areas within the airport warehouse. Modern warehouses utilize advanced inventory management systems for efficient tracking and retrieval.
- **Temperature-Controlled Storage:** Perishable goods require specialized storage with controlled temperature and humidity to maintain freshness and prevent spoilage.

4. Security Screening: Maintaining Vigilance

Air cargo security is paramount. Stringent security measures ensure the safety of passengers, crew, and the public:

- **X-ray Screening:** Cargo undergoes X-ray screening to detect prohibited or hazardous materials. Advanced technology allows for efficient screening while minimizing delays.
- **Physical Inspections:** Random physical inspections supplement X-ray screening for enhanced security. Trained personnel meticulously inspect suspicious cargo to identify any potential threats.

5. Customs Clearance: Navigating Regulations

For international shipments, customs clearance is a crucial step:

- **Documentation Verification:** Customs officials meticulously verify shipping documents to ensure compliance with import/export regulations and assess any applicable duties or taxes.

- **Duty Payment:** If applicable, duties and taxes are paid before the cargo can be released for final delivery. Streamlined customs procedures expedite clearance and minimize delays.

6. Onward Movement: The Final Stretch

Once all necessary processes are complete, the cargo embarks on its final leg:

- **Delivery Planning:** Based on destination and urgency, cargo is allocated to the most suitable onward transportation mode, be it direct delivery trucks, feeder flights connecting to smaller airports, or onward consolidation for international ocean freight.
- **Loading and Paperwork:** Cargo is carefully loaded onto designated vehicles or aircraft, ensuring proper weight distribution and adherence to safety regulations. All necessary documentation accompanies the shipment to facilitate seamless delivery.

Modern technology plays a vital role in streamlining port handling operations. Warehouse Management Systems (WMS) provide real-time inventory tracking, optimizing storage space and retrieval processes. Advanced cargo tracking software allows for continuous monitoring of shipments throughout their journey, enhancing transparency and ensuring timely delivery. Additionally, automation in tasks like sorting and loading can significantly reduce turnaround times and improve overall efficiency.

Port handling, with its intricate sub-processes, acts as a vital artery in the air cargo logistics system. From meticulous pre-arrival planning to efficient cargo movement and stringent security checks, every step plays a crucial role in ensuring timely and reliable delivery. By embracing advanced technology and fostering collaboration between various stakeholders, airport authorities and logistics providers can continuously improve port handling operations, ensuring a well-oiled machine that keeps global trade moving forward.

CHAPTER – 4

COMPARATIVE ANALYSIS



Figure 5 (comparison with road and sea logistics)

4.1 To analyze the prospects of air cargo v/s road and sea logistics.

We may compare the potential benefits of air cargo to road and marine logistics by taking into account a number of variables, including capacity, speed, cost, dependability, and environmental impact.

- **Speed:** The quickest form of transportation is air cargo, which makes it possible to deliver items effectively and on time. In contrast, road and sea logistics are slower since they depend on shipping lanes and on land transportation.
- **Cost:** Because aircraft maintenance and fuel are expensive, air freight is typically more expensive than sea and land logistics. Sea logistics are the most economical choice, but road logistics are typically less expensive than air cargo.

- **Reliability:** Compared to road and marine logistics, which are subject to traffic, weather, and other unanticipated events, air cargo is more reliable since air travel timetables are predictable.
- **Capacity:** Compared to road and sea logistics, which can handle higher volumes of products, air cargo has a comparatively low capacity. Air cargo, on the other hand, can be utilized for valuable or urgent commodities that need to be delivered quickly but in lesser quantities.

In general, the logistics option selected is determined by the particular requirements of the cargo being moved. Due to its dependability and speed, air freight is the best choice for high-value and time-sensitive items. Road and maritime logistics are more economical and ecologically friendly for higher cargo volumes. In a world growing increasingly interconnected by the day, international transit serves a vital purpose and is essential. Experts claim that in the last 20 years, distribution logistics have expanded by 170%, and that in terms of the quantity of commodities handled, the developing world's South has surpassed the developed North. Three options for transporting cargo worldwide will be discussed in this post: air freight, marine freight, and ground transportation. Every one of the three has unique advantages and disadvantages, similarities, and differences. Of course, a lot also relies on the type of cargo you wish to ship. Let's examine them as a group. International logistics service companies make important judgments every single day. Certainly, one among those decisions will be how to ship your package. This is a very straightforward decision, but it has become more challenging due to the epidemic and other factors requiring adjustments in global transportation patterns. Air freight and ocean freight are the two most popular ways to move products across international borders. But as of last year, both of these forms of transportation are having serious problems.

Because of this, before deciding on one over the other, freight businesses must now more than ever thoroughly weigh the advantages and disadvantages of both air and sea freight.

4.2 THE CURRENT PROBLEMS IN THE AIR AND SEA FREIGHT INDUSTRY

Problems in the ocean freight industry

The maritime freight industry is currently facing several challenges, such as a scarcity of containers, congested ports, and a high demand for space. Industry analysts claim that shipping costs have gone up as a result of desperate businesses paying exorbitant fees and waiting weeks for containers, as reported by CNBC. Another significant problem facing the container transport industry is the growing cost of shipping. The shipping charge has gone up more than four times since it was last charged.

The crisis in the marine freight shipping industry is the reason for the 35-point drop in the global schedule reliability relative to the benchmark. Ships find it hard to stick to schedules.

According to a Reuter's statement, "average container turnaround times have ballooned to 100 days from 60 days previously." The international maritime freight shipping business is currently experiencing an unanticipated problem because to the Covid-19 outbreak. In addition, industry experts do not anticipate this problem ending very soon.

Problems in the air freight industry

Like every other mode of transportation in this sector, aviation cargo suffered greatly from the outbreak. The need for air freight services and operating

constraints were the two main issues it had to deal with. In addition, because of the crisis in the maritime freight industry, forwarders are opting to ship via air. As a result, we have serious capacity constraints. We don't know how this industry will react to the growing need for air freight. The small number of passenger planes, which formerly had enormous cargo holds in their bellies, is the primary cause of the capacity shortage.

Additionally, the price of air cargo was also impacted by the anomalies in supply and demand. Since the beginning of the pandemic, air freight rates have increased significantly. Even if the price started to stabilize a little in early 2021, it is still over average. Due to the impending peak Christmas season, we anticipate a further increase in air freight prices.

Which transportation mode should be selected by the international logistics service providers?

The decision between air and ocean freight typically comes down to the volume, weight, and content of the cargo. It also depends on how soon they need to be relocated. Because it was more economical, little, urgent cargo was therefore usually carried by air freight. For retail goods and technological equipment, when rapid rotation is essential, shipping via air freight is typically advantageous. But currently, air freight is extremely expensive, and the future of container transport is likewise not looking well. Choosing between the two in this case could be difficult and need some preparation beforehand. Let's examine several factors that affect your decision.

1. Cost

Air freight shipments are the most economical alternative if the shipping cost is less than 15%–20% of the cargo value. For this reason, light shipments should ideally be sent by air. It is also safer, faster, and more dependable than marine freight. Nevertheless, even with the increased prices of ocean transportation today, air freight remains more expensive. However, ocean

freight provides you with more capacity and better pricing. Its one big drawback is speed, even if it's far less expensive. The jammed ports, a deficiency of equipment and containers, and a labour shortfall are causing additional delays.

2. Speed

Goods transported by air and sea may take many weeks to reach their destination. But you also need to consider whether your customer is prepared to pay a substantial premium for the additional speed. Most international shipments are planned ahead of time. Thus, money is a more pressing concern than time. On the other hand, a long transit duration is not suitable for cargo with a short shelf life. Medication and perishable products should ideally be shipped by air since marine shipments are more prone to be delayed. Moreover, urgent material that must be delivered to a distant site in a few days should always be transported by air freight. As an alternative, it is prudent to consider how much money you would save by choosing ocean freight. Simply said, whether travelling by air or sea, the best option depends on a number of variables, including shelf life, cargo danger, storage at the port or airport, the cost of the goods, etc.

3. Safety and reliability

The vital component of your cargo's safety is one where air freight and marine freight are equally competitive. When shipping by sea, there is almost no possibility that your cargo would be lost, but there is a bigger chance that it may be delayed. Reported incidents of containers slipping off are quite rare, so you shouldn't be concerned. Better precautions are also currently being taken by the ship owners to prevent containers from sliding off-board. Ocean freight can be just as safe as air freight if you pack your belongings properly and utilize the right protection. On the other hand, there is less movement during air freight, which lowers the risk of damage and increases stability. Airlines are also often better at handling schedule changes than maritime

carriers. Weather-related problems, such as rain or storms, might cause a flight to be cancelled or delayed, but airlines are far quicker and more efficient in scheduling replacement flights. Additionally, airlines operate many daily flights between the major cities, although most ships only leave once a week.

4. Sustainability

Customers are becoming more and more conscious of the importance of sustainability in logistics when making decisions. Compared to ocean freight, air freight is significantly less sustainable. When compared to air freight, very little CO₂ is produced by marine freight. A seaborne shipment has a much lesser carbon footprint. Furthermore, many international logistics service providers now choose LNG fuels to crude oil. Maersk, the biggest participant in the maritime freight industry, is working to decarbonize its shipping operations in an effort to achieve zero emissions. Their goal is to become carbon neutral by 2030. Their investment will enable the launch of an ocean liner that is carbon neutral within the next two years.

We can therefore fairly draw the conclusion that each mode of transportation has advantages and disadvantages. Before making a choice, the international logistics service providers should take into account a number of variables, including the urgency, nature, price, and volume of the cargo.

4.3 TO IDENTIFY THE BOTTLE NECK IN AIR CARGO.

The air cargo industry is a complex system that involves multiple stakeholders, including airlines, freight forwarders, and ground handling companies, customs authorities, and regulatory bodies. Identifying the bottleneck in such a system can be a challenging task, but here are some potential areas to investigate:

- **Capacity Constraints:** One of the most common bottlenecks in air cargo is capacity constraints. This can be due to a shortage of aircraft, limited runway or terminal capacity, or other infrastructure limitations.

Investigating capacity constraints can involve analysing historical data on cargo volumes and comparing it with available capacity.

- **Customs Clearance:** Another potential bottleneck in air cargo is customs clearance. Delays in customs clearance can occur due to inadequate documentation, regulatory requirements, or capacity constraints at the customs clearance points. Analysing data on customs clearance times and identifying any patterns of delays can help in identifying the bottleneck.
- **Cargo Handling:** Cargo handling at airports involves multiple processes, including offloading, storage, sorting, and loading onto aircraft. Bottlenecks in cargo handling can be due to inadequate infrastructure, staffing, or process inefficiencies. Analysing data on cargo handling times and identifying any bottlenecks in the process can help improve efficiency.
- **Freight Forwarding:** Freight forwarders play a critical role in the air cargo supply chain. Delays in receiving cargo or documentation from freight forwarders can lead to bottlenecks in the system. Analysing data on freight forwarding activities and identifying any delays in the process can help in identifying the bottleneck.
- **Communication and Coordination:** The air cargo industry involves multiple stakeholders, and communication and coordination among them are crucial for the smooth operation of the system. Bottlenecks in communication and coordination can occur due to inadequate communication channels, language barriers, or process inefficiencies. Analyzing data on communication and coordination activities and identifying any bottlenecks can help improve efficiency.

In summary, identifying the bottleneck in air cargo involves analysing data from various stakeholders and processes involved in the system, and identifying areas of inefficiency or capacity constraints that can lead to delays and disruptions in the supply chain.

4.4 SWOT ANALYSIS OF AIR CARGO MARKET



Figure 6(SWOT analysis)

For Air Cargo Carriers, SWOT analysis can help the brand focus on building upon its strengths and opportunities while addressing its weaknesses as well as threats to improve its market position.

Strength

Examined in terms of the company's strengths are the key components of Air Cargo Carriers' business that provide it with a competitive edge in the market. Many factors contribute to a brand's strength, including its financial stability, the caliber of its workforce, the uniqueness of its offerings, and intangible assets like brand value. The SWOT Analysis strengths of the air cargo carriers are as follows:

Speed: Air cargo offers rapid transportation, crucial for time-sensitive shipments.

Global Reach: Air cargo networks cover a vast geographic area, connecting distant regions quickly.

Reliability: Established air cargo carriers often have reliable schedules and track records for on-time deliveries.

Technology Integration: Many air cargo companies leverage advanced technology for tracking, logistics management, and security.

Specialized Handling: Air cargo can handle various types of cargo, including perishable goods, hazardous materials, and high-value items.

Weakness

The weaknesses of a brand are particular aspects of its operations that might be strengthened to reinforce its standing. Certain shortcomings can be defined as attributes that the company doesn't possess or that the competitors do well in. The shortcomings identified in the Air Cargo Carriers SWOT Analysis are as follows:

Cost: Air freight can be expensive compared to other modes of transportation, especially for large or heavy shipments.

Capacity Constraints: Limited space on aircraft can lead to capacity shortages during peak seasons or disruptions.

Environmental Impact: Air cargo contributes to carbon emissions and environmental concerns.

Security Risks: Cargo security is a constant concern due to potential terrorism threats and theft.

Dependency on Infrastructure: Air cargo operations rely heavily on airport infrastructure, and disruptions can lead to delays and inefficiencies.

Opportunities

Any brand can make improvements in specific areas to increase the number of customers it serves. A brand may have opportunities for increased communication, product improvements, and regional expansion. The following are the opportunities identified in the air cargo carriers' SWOT analysis:

E-commerce Growth: The rise of e-commerce presents opportunities for increased air cargo demand, particularly for express deliveries.

Emerging Markets: Growing economies and trade liberalization create opportunities for expanding air cargo services to new regions.

Technology Advancements: Innovations in drone technology, automation, and AI could revolutionize air cargo operations, improving efficiency and reducing costs.

Collaboration: Partnerships between airlines, logistics companies, and technology firms can lead to synergies and improved service offerings.

Sustainability Initiatives: Investment in sustainable aviation fuels and carbon offset programs can address environmental concerns and enhance the industry's reputation.

Threats

Threats to a firm can come from things that potentially interfere with its operations. There are many different things that can pose a threat, such as heightened competition, changing political agendas, substitute products or services, etc. The dangers listed below were found in the air cargo carriers' SWOT analysis:

Economic Volatility: Economic downturns and trade disputes can impact air cargo demand and profitability.

Regulatory Changes: Stringent security regulations and customs procedures can increase compliance costs and operational complexities.

Competition: Intense competition among air cargo carriers and alternative transportation modes can pressure profit margins.

Geopolitical Risks: Political instability, conflicts, and trade barriers can disrupt air cargo routes and supply chains.

Pandemics and Natural Disasters: Global health crises, natural disasters, and extreme weather events can disrupt air cargo operations and supply chains.

CHAPTER – 5

**CONCLUSION, FINDINGS AND
SUGGESTIONS**

5.1 FINDINGS

Capacity constraints: The analysis may indicate that there is a lack of available aircraft or terminal capacity resulting in capacity constraints and delays.

Customs Clearance Processes: The analysis may suggest that customs clearance procedures are inefficient and bureaucratic resulting in delays in cargo release from customs.

Cargo Handling Processes: This analysis may suggest that the cargo handling processes are not efficient and prone to errors resulting in delays in loading and unloading cargo from the aircraft.

Freight Forwarding Processes: These analyses may suggest that freight forwarding processes are not efficient or prone to errors, resulting in delays in shipment and documentation.

These findings can help identify areas of improvement in the air cargo supply chain and provide a basis for developing recommendations to address the bottlenecks and improve efficiency.

5.2 SUGGESTIONS

Here are some general recommendations for conducting an air cargo analysis:

- Define goals and scope: Define the goal and scope of the analysis, including the data sources to be used, the stakeholders involved, and the timeline for the analysis.

- Data Collection and Analysis: Collect and analyze data on air cargo

operations, including cargo volumes, transit times, costs and quality data. This may include reviewing historical data, conducting research and communicating with stakeholders.

- **Identify bottlenecks:** Analyze data to identify bottlenecks in the air cargo supply chain, such as capacity constraints, customs delays, cargo handling inefficiencies, cargo handling errors, or communication and coordination breakdowns.
- **Develop recommendations:** Develop recommendations to address bottlenecks and improve efficiency and effectiveness of air cargo operations. This may include developing new processes, investing in infrastructure or technology, improving training programs or improving communication and coordination between stakeholders.
- **Implement and Monitor:** Implement recommendations and monitor impact on air cargo operations by tracking progress against analytical goals and scope. Modify the recommendations as needed to achieve the desired results.
- **Share results and recommendations:** Share analysis results and recommendations with stakeholders such as airlines, cargo shippers, ground carriers, customs and regulatory agencies to promote collaboration and alignment to improve the air cargo supply chain. Following these recommendations, an air cargo analysis can help identify opportunities for improvement, develop actionable recommendations and lead to significant changes in the air cargo supply chain.

5.3 CONCLUSION

In summary, air cargo plays a key role in global trade and provides a fast and efficient way to transport goods. The growth of air cargo has been accelerated by the growing demand for high-value and time-sensitive products, as well as the expansion of e-commerce and global supply chains. However, the air cargo industry also faces significant challenges such as fluctuating fuel prices, capacity constraints and safety concerns. Our air cargo analysis made several observations and recommendations to improve the efficiency and effectiveness of the air cargo industry. We have found that increasing cooperation and coordination between stakeholders, investing in technology and infrastructure, and improving regulatory frameworks can help address the industry's challenges. We have further identified the pros and cons of major air transport hubs like Colombo Port and ICTT Kochi. Based on these findings and recommendations, our project provided a comprehensive overview of the air cargo industry, highlighting its importance and challenges, as well as potential solutions. By working together and implementing innovative solutions, the air cargo industry can continue to grow and contribute to the development of the world economy.

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