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Multimodal Air Freight Forwarding Strategy in Overcoming the Post-Pandemic International Cargo Capacity Crisis

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Abstract: This study examines air cargo capacity management strategies in the post-COVID-19 era, focusing on the role of multimodal air freight forwarding. The imbalance between rising shipment demand and limited carrying capacity remains a major challenge for the global logistics industry. The study aims to analyze the impacts of the air cargo capacity crisis, assess multimodal strategies as adaptive solutions, and explore capacity management challenges in Indonesia. A descriptive qualitative method was applied using literature study, based on secondary data from international institution reports, academic journals, and national statistics. The results show that integrating sea, land, and air modes supported by data-driven management systems improves the efficiency of global air cargo capacity management. At the national level, strengthening domestic multimodal infrastructure is essential for enhancing capacity management efficiency in Indonesia. This research contributes to industrial engineering development in adaptive data-based multimodal logistics capacity management.

Keyword: Air Freight Forwarding, Air Cargo Capacity, Multimodal, Logistics Capacity Management, Indonesia

INTRODUCTION

The air freight forwarding sector plays a vital role in facilitating the smooth flow of global goods, particularly for shipments characterized by high value, time sensitivity, and long-distance cross-border transportation. However, since the onset of the COVID-19 pandemic, the air logistics industry has faced significant disruptions. Global passenger flight restrictions during the pandemic led to a drastic reduction in cargo capacity within the aircraft belly space, which previously contributed approximately 50% of international air cargo capacity (IATA, 2025). This situation constrained the available shipping capacity, while on the other hand, demand continued to rise in line with the acceleration of digital trade and the surge in cross-border e-commerce transactions (Financial Times, 2024).

The imbalance between supply and demand has triggered a post-pandemic air cargo capacity crisis that continues to have lasting effects. In the global context, the imbalance in air cargo capacity is not merely a technical transportation issue, but has evolved into a strategic challenge in managing international supply chains, as geopolitical uncertainties, global trade dynamics, and increasing reliance on complex real-time visibility digital logistics systems

intensify (Christopher, 2016; Sheffi, 2022). The limited number of active freighter aircraft, high dependency on belly cargo capacity, and fierce competition for shipping slots have driven up global air cargo shipping costs (Reuters, 2025). For freight forwarding companies, this phenomenon demands strategic adjustments both operationally and managerially to maintain the continuity of their shipping services.

One of the widely adopted solutions to address the limited air cargo capacity is the implementation of multimodal strategies. The integration of multiple modes of transportation, such as combining land, sea, and air modes, enables freight forwarders to reduce their sole reliance on pure air capacity (Rushton et al., 2017). Sea-air shipment schemes, first-mile and last-mile reconfiguration, cargo consolidation systems, and the use of cross-docking facilities are among the strategies that help enhance capacity management flexibility (Christopher, 2016; AI-Cargo, 2024). These strategies have become even more relevant with the advancement of digital technologies that enable optimized route planning and demand forecasting through data-driven analytics (Zhu et al., 2024).

In Indonesia, the post-pandemic growth of the air cargo sector shows a positive trend, although capacity and supporting infrastructure challenges remain. Data from Angkasa Pura II recorded an increase in both domestic and international air cargo volumes at several major airports throughout 2023 (Angkasa Pura II, 2023). In addition to the increase in volume, classical challenges such as limited cargo terminal capacity, ground access congestion to airports (first mile), and inefficiencies in final distribution processes (last mile) continue to hinder the optimization of domestic air cargo capacity management (Kemenhub, 2023). Therefore, studies on adaptive freight forwarder strategies in managing air cargo capacity crises are relevant not only in the global context but also essential to be examined within the operational context of Indonesia.

This study aims to analyze the impact of the post-pandemic air cargo capacity crisis on the international freight forwarding system, examine the role of multimodal integration as a solution in capacity management, and identify adaptive strategies implemented by freight forwarders to optimize air cargo capacity.

METHOD

This study employs a descriptive qualitative approach using a library research method, fully utilizing secondary data. Data were obtained from official reports of international organizations such as the International Air Transport Association (IATA) and the United Nations Conference on Trade and Development (UNCTAD), industry reports from global freight forwarding companies such as DHL and Flexport, international academic journals, as well as national data from the Ministry of Transportation of the Republic of Indonesia and Angkasa Pura II.

Data collection was conducted online during the 2024–2025 period. The research instrument consisted of document analysis, involving the search, documentation, and selection of relevant documents, reports, and articles. The research procedure began with the identification of issues related to the air cargo capacity crisis, e-commerce growth, multimodal implementation, and capacity challenges in Indonesia. All collected data were analyzed narratively using content analysis by sorting, categorizing, and interpreting data based on thematic discussions.

Data validation was carried out through source triangulation by comparing data from several official sources to ensure information consistency. The data used were verified to originate from publications of international organizations, reputable academic journals, trusted industry reports, and official government statistical data, ensuring that the research results possess a high level of academic credibility.

RESULTS AND DISCUSSION

The Impact of the Post Pandemic Air Cargo Capacity Crisis

The COVID-19 pandemic served as the initial trigger for major disruptions in the global air cargo delivery system. International travel restrictions during the pandemic caused a significant decline in passenger flights, which directly reduced belly cargo capacity. This is the cargo space available in the lower compartment of passenger aircraft that previously contributed nearly 50 percent of total international air cargo capacity (IATA, 2025a). As the pandemic gradually subsided, although passenger flights started to recover, the recovery of air cargo capacity did not keep pace with the continued growth in shipping demand.

Data from the International Air Transport Association (IATA) show that throughout 2024, global air cargo demand, measured in Cargo Tonne Kilometers (CTK), grew by 11.3 percent year on year. Meanwhile, the available capacity, measured in Available Cargo Tonne Kilometers (ACTK), increased by only 7.4 percent (IATA, 2025b). This growth imbalance indicates a 3.9 percent gap between demand growth and available capacity.

Table 1. Year on Year Growth Comparison of Cargo Tonne Kilometers (CTK) and Available Cargo Tonne Kilometers (ACTK) in 2024

Indicator	**YoY Growth 2024**
Demand (CTK)	11,3%
Capacity (ACTK)	7,4%
Supply Demand Gap	+3,9%

(Source : IATA, 2025b)

The supply and demand imbalance has further increased pressure on the air cargo industry as a whole. Competition for cargo space has become increasingly intense, especially on strategic routes such as Asia to North America and Asia to Europe, where CTK growth reached 13 percent and 12.9 percent respectively (IATA, 2025b). The demand pressure is also reinforced by the surge in cross-border e-commerce shipments, which require time sensitive deliveries to meet global customer expectations (Financial Times, 2024).

In addition, geopolitical tensions in the Red Sea at the end of 2023 and early 2024 have worsened the global capacity imbalance. Disruptions to ocean shipping due to these conflicts have led many international shippers to divert part of their cargo from sea routes to air, further increasing the demand for air cargo shipments (IATA, 2025c). As a result of these accumulated factors, international air freight rates have risen significantly. By early 2025, global air cargo yields remained 39 percent above the pre pandemic average yield of 2019 (IATA, 2025b).

This situation has forced many international freight forwarding companies to make strategic adjustments. Some have implemented priority booking systems, dynamic pricing, cargo consolidation through split shipments, and integration with other transport modes as solutions to balance capacity and growing shipping demand (Christopher, 2016; Rushton et al., 2017; AI Cargo, 2024).

The Role of E Commerce in Driving Demand Growth

The rapid growth of the global e commerce sector in recent years has become one of the main drivers behind the increase in international air cargo volume, particularly in the post pandemic period. The shift in global consumer behavior from conventional shopping systems to cross-border online transactions demands logistics systems capable of providing fast and timely delivery services. The characteristics of e commerce shipments typically involve small, lightweight, high value items with strict delivery deadlines, making air transportation the most relevant mode compared to sea or land transport (Hosseini et al., 2022).

Hosseini et al. (2022) emphasize that the surge in demand from cross-border e commerce has placed significant structural pressure on international air cargo capacity. The highest

increase in transactions has occurred along the Asia to North America and Asia to Europe shipping corridors, which are the main routes for global goods movement. As demand continues to outpace capacity, intense competition among shippers for shipping slots emerges, ultimately resulting in highly volatile global air freight rates. Furthermore, seasonal factors further intensify pressure on air cargo capacity. Events such as Black Friday, Cyber Monday, and the year-end holiday season trigger sudden and significant spikes in shipping volume over short periods, exacerbating capacity imbalances on a periodic basis (Hosseini et al., 2022).

On the other hand, demand from the e commerce sector not only shows constant growth but also exhibits a high level of volatility. According to Hwang et al. (2021), uncertainty in shipment volume fluctuations presents a major challenge for air cargo capacity management. Sudden changes in demand may result from large-scale online promotions, shifting consumer preferences, or cross-border trade protection policies. This uncertainty requires freight forwarding companies to develop much more adaptive capacity management systems based on predictive technologies.

One approach increasingly adopted in response to these e commerce demand dynamics is the implementation of cargo consolidation strategies, split shipment management, and the use of data driven demand forecasting systems. Through demand prediction systems based on historical data analysis, seasonal variables, and consumer trends, logistics companies can proactively allocate capacity, balance shipping flows, and minimize potential cargo slot shortages (Hwang et al., 2021). The implementation of these data driven systems significantly enhances responsiveness to sudden demand surges, thereby improving the overall reliability of air cargo services.

Thus, the surge in cross-border e commerce not only drives quantitative growth in air cargo volume but also demands structural transformation in air logistics capacity management that is adaptive, well planned, and supported by intelligent technologies. The freight forwarding industry in the future will no longer rely solely on physical slot availability but will increasingly depend on accurate predictive planning capabilities to maintain service stability in a dynamically shifting global demand environment.

Implementation of Multimodal Strategies by Freight Forwarders

The implementation of multimodal strategies has become one of the main solutions adopted by the air freight forwarding industry to address capacity imbalance pressures in the post pandemic period. Multimodality allows the combination of several modes of transportation such as sea-air, land-air, or full land transport for regional segments to optimize capacity more flexibly and reduce dependence on pure air transportation (Rushton et al, 2017). This approach becomes particularly relevant when air capacity is limited and air freight rates rise significantly due to intense competition for cargo slots.

According to Rushton et al (2017), the use of multimodal schemes offers several strategic advantages for freight forwarders. First, it enables companies to distribute shipment flows across multiple modes simultaneously, reducing the burden on a single dominant mode. Second, multimodality expands the options for alternative shipping routes that can adjust to capacity conditions on each global route. Third, multimodal combinations provide better scheduling flexibility, especially in avoiding peak seasonal demand periods such as holiday seasons or major promotional events.

In the study by Zhu et al (2024), multimodal implementation is supported by the use of data analytics that integrate real time information on capacity availability across modes. Data driven multimodal optimization systems allow freight forwarding companies to simulate various shipping scenarios that consider cost estimates, transit times, and actual capacity in each mode. This enables forwarders to dynamically adjust shipping routes, whether through sea-air combinations or by consolidating intermodal shipments at regional distribution hubs.

The forms of multimodal strategy implementation in air freight forwarding practices include:

1. Sea-Air: initial shipments are carried by sea, then continued by air at specific hub points. This scheme is widely used to balance costs and transit times.
2. Land-Air: shipments are first transported by land to major international airports, especially for domestic or intra regional shipments, before being forwarded by air.
3. Cross Docking: consolidation of cargo from various shippers at warehouse facilities before air transportation to optimize aircraft capacity.
4. Split Shipment: dividing shipment volumes into multiple routes or modes simultaneously to ensure part of the shipment still arrives on time even when the main slot is full.

The use of multimodal schemes is also gradually being implemented in the Indonesian context. The availability of international seaport access such as Tanjung Priok and Tanjung Perak, which are connected to international airports such as Soekarno Hatta and Juanda, opens opportunities for optimizing sea-land-air integration. Although multimodal infrastructure development in Indonesia has not yet reached the level of East Asia, efforts toward national multimodal supply chain integration have begun to accelerate as part of the national logistics strategy (Ministry of Transportation, 2023).

Thus, the implementation of multimodal strategies is not merely an alternative option but has become a primary instrument in managing international air cargo capacity more adaptively amid the volatility of global post pandemic demand.

Capacity Management Challenges in Indonesia

In addition to facing global pressures from the international air cargo capacity crisis, the air freight forwarding industry in Indonesia also encounters complex domestic challenges in managing its capacity. The growth in domestic and international air cargo demand in Indonesia after the pandemic shows a positive trend. Data from Angkasa Pura II recorded an increase in cargo volumes at several major airports throughout 2023, reflecting the recovery of national air logistics activities (Angkasa Pura II, 2023). However, this increase in demand has not been fully matched by the readiness of infrastructure capacity, including cargo terminals, warehouse facilities, and supporting transport connectivity.

The main problems still faced by the national air cargo industry include:

1. Limited cargo terminal capacity. Cargo terminals at major airports such as Soekarno Hatta and Juanda experience capacity constraints during peak shipping volumes, particularly in peak seasons (Ministry of Transportation, 2023).
2. Road access congestion to airports (first mile congestion). Traffic congestion and inefficiency in distribution routes to major international airports still exist, causing delays in cargo delivery to air terminals.
3. Final distribution inefficiency (last mile inefficiency). Domestic distribution systems from airports to end consumers are not yet fully optimized, especially outside the Greater Jakarta area and Java Island, hindering the overall effectiveness of the national multimodal logistics supply chain.

In the Indonesian context, the role of multimodal integration becomes increasingly important to bridge existing limitations. Land-air delivery strategies from various industrial cities to major airports, as well as the development of integrated logistics hubs that combine land, sea, and air modes, are among the strategic solutions being promoted by the government (Ministry of Transportation, 2023). Improving the efficiency of domestic first mile and last mile logistics management is crucial to the success of national multimodal integration, while also reducing pressure on limited pure air cargo capacity.

With the strengthening of the national multimodal system, it is expected that Indonesia will not only be able to overcome domestic capacity challenges but also play a more strategic role in international air logistics supply chains, particularly as a regional cross-border shipping hub in Southeast Asia.

CONCLUSION

This study concludes that the post-pandemic international air cargo capacity crisis was triggered by a structural imbalance between the rapid growth in shipping demand and the insufficient recovery of available carrying capacity. The cross-border e-commerce boom has significantly amplified demand pressures, particularly on major shipping routes such as Asia to North America and Asia to Europe. In addition to demand-driven factors, supply chain disruptions caused by geopolitical tensions and the diversion of maritime shipments to air transport have worsened the supply-demand imbalance, resulting in intense competition for shipping slots and rising global air freight rates. These findings directly address the research problem regarding the impact of the post-pandemic air cargo capacity crisis on the international freight forwarding system.

The findings also emphasize the importance of implementing multimodal strategies as an adaptive solution for capacity management. The integration of sea, land, and air modes serves as a key approach to reducing dependency on the limited capacity of pure air transportation. The application of demand forecasting and data analytics-based management systems enables freight forwarders to conduct flexible, optimal, and responsive capacity planning in line with the dynamic fluctuations of market demand. Operational strategies such as sea-air, land-air, cross-docking, and split shipment have proven effective in improving capacity allocation efficiency and expanding delivery route flexibility. This directly answers the research question on how multimodal integration contributes to addressing air freight forwarding capacity challenges.

In the national context, this study finds that air cargo capacity management in Indonesia faces not only demand-side pressures but also limitations in domestic logistics infrastructure. Issues such as limited cargo terminal capacity, first mile access congestion to airports, and last mile distribution inefficiencies remain the primary obstacles hindering optimal capacity management. Therefore, the development of integrated domestic multimodal systems, improvement of national logistics infrastructure, and strengthening of intermodal connectivity are essential strategies to enhance the efficiency of national air cargo capacity management. With the reinforcement of multimodal systems supported by data analytics and demand forecasting, Indonesia has the potential to expand its role in the international air logistics supply chain within the Southeast Asia region.

Theoretically, the results of this study contribute to the development of industrial engineering knowledge, particularly in the areas of multimodal logistics capacity management based on data analytics, adaptive freight forwarding strategies, and decision-making systems for logistics based on demand prediction. Practically, this study may serve as a reference for logistics industry players and freight forwarders in developing more flexible and adaptive capacity management models amid the uncertainties of global air cargo demand. This study also provides input for policymakers to encourage the strengthening of national multimodal infrastructure in order to improve the efficiency of domestic air cargo capacity management and enhance Indonesia's competitiveness in the global logistics arena.

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