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Strategic Decisions and Policies on Türkiye-Europe Air Cargo Transport

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Abstract

This study examines the air cargo traffic in terms of transported cargo weights between Europe and Türkiye in the 10-year period between 2012 and 2021. Annual data was obtained from EUROSTAT and then this data was processed by using R language and Minitab. Freight tonne kilometers (FTKs) growth analyses for the World, Europe and Türkiye were done by fitting exponential curves to the data. Forecast for cargo traffic between Türkiye and Europe were done using exponential smoothing with trend adjustment method. The results reveal the strategic decisions for determining airport pairs in air cargo transport between Europe and Türkiye. It has been determined that there is air cargo transportation between 11 airports from Türkiye and 90 airports from 31 European countries. The most striking result of this study is that while Istanbul IGA airport serves as the main hub for air cargo transportation with other airports in Europe, Sabiha Gökçen airport has been on the way to become a secondary hub in recent years with the strategic agreements between airports. The transported air cargo weight between remaining 8 airports (since Atatürk airport closed to air cargo in 2022) in Türkiye and European airports is negligible. Determinants of choosing these airports might possibly be geographic locations, political relations with these countries, specific products of these locations, closeness to the industrial regions.

1. Introduction

Significant studies on air cargo transport with the increasing demand for air cargo have boosted although it was not valued as much as passenger transportation until recently. The increase in the demand for air cargo services in recent years has also enlarged the volume of air cargo traffic all over the world (Akinyemi, 2023). Fitting exponential growth curves to the ICAO data, it can be seen that world Freight Tonne Kilometers (FTKs) grew by 3.1% between 2000-2021 shown in Figure 1 (The World Bank, 2022). Global growth rate took a major decrease in 2020 due to Covid-19 pandemic which resulted in vanishing of approximately half of the global air cargo capacity.

The European Union experienced larger fluctuations in its air cargo traffic in the same period (Figure 2) resulting in an average growth rate of only 0.9% (The World Bank, 2022).

On the other hand, Türkiye's air cargo traffic grew tremendously by 19.1% between 2000-2021 (Figure 3) when compared to the world (3.1 %) and Europe air cargo growth rate (0.9%) [The World Bank, 2022] due to the investments in air cargo capacity and facilities especially coming from Turkish Airlines in the last decade.

In light of these trends, this study aims to analyze the historical air cargo movements between Türkiye and European countries. Assessing the historical patterns, forecasts on the city, country and airport pair level will be made using the appropriate statistical models.

Air cargo business models and transported product characteristics (Hong et al., 2023) have a great impact on the strategic decisions on air cargo transportation. As there are dissimilarities in passenger and air cargo transportation (Hong et al., 2023), differences between air cargo business models, which are integrated, all-cargo, and combination carriers (Dewulf, 2014, p.21), affect the strategic decision-making mechanism on airports and route selection. Route selection in air cargo matters; thus, cargo transportation routes and aircraft scheduling need to be optimized (Zhao, 2020) in the application of different types of cargo business models to increase revenue while meeting multi-customer demands.

Integrated carriers, non-integrated carriers, and combination carriers are different types of air cargo operators based on their business models and the services they provide:

- Integrated Carriers (Integrators): Integrated carriers, also known as integrators, are air cargo operators that offer comprehensive door-to-door logistics solutions. They have a high level of vertical integration, combining air transportation with ground handling, sorting facilities, and last-mile delivery services. These carriers typically operate extensive global networks and specialize in time-definite deliveries and express shipments. Examples of integrated carriers include FedEx, UPS, and DHL.

- Non-integrated Carriers (All Cargo Airlines): Non-integrated carriers, also referred to as all cargo airlines, focus primarily on air transportation services. They specialize in the transportation of various types of cargo, such as general freight, perishables, oversized cargo, or specialized goods. Non-integrated carriers do not typically provide extensive ground handling or last-mile delivery capabilities. Instead, they rely on partnerships with ground handling agents and trucking companies for cargo handling and distribution. Examples of non-integrated carriers include Cargolux and MNG Airlines.
- Combination Carriers (Passenger+Cargo Airlines): Combination carriers are airlines that operate both passenger flights and cargo services on the same aircraft. These carriers utilize the belly space of passenger planes to transport cargo alongside passenger baggage. Combination carriers offer a mix of scheduled passenger services and dedicated cargo services, providing a wider range of destination options and capacity flexibility. Many major airlines fall into this category, including Emirates, Lufthansa, and Turkish Airlines.

This paper is designed with the literature review about air cargo transport, methodology, analysis, and discussion of the results, and then finalized with the forecast of air cargo traffic between Türkiye and European countries. The paper aims to achieve the following objectives:

- Calculate the magnitude of air cargo transportation between Türkiye and Europe between 2012-2021.
- Reveal the airport pairs and describe their significance for the air cargo network.
- Find out which strategies are taken into account in the selection of these airports.
- Make future projections for important parts of the network.

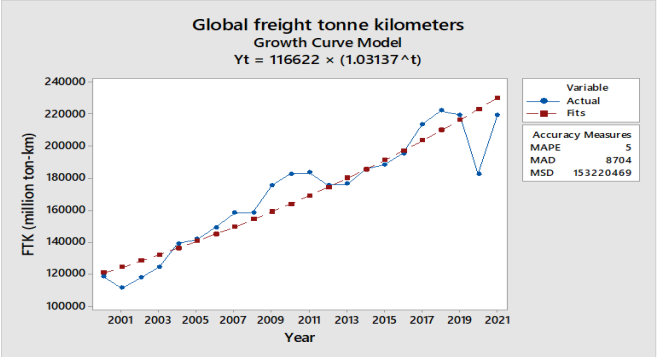

Figure 1. World FTKs between 2000-2021 (Source: The World Bank/ICAO)

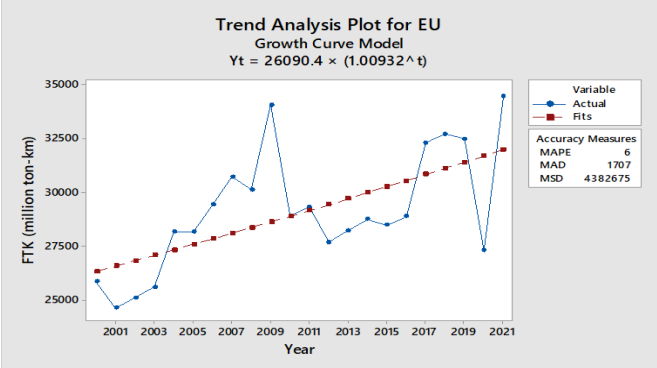

Figure 2. European Union FTKs between 2000-2021. (Source: The World Bank/ICAO)

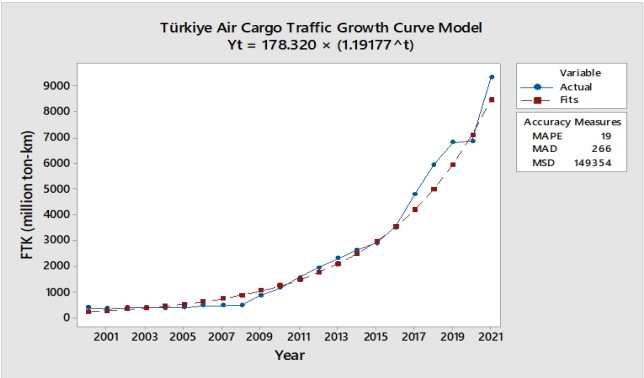

Figure 3. Türkiye's FTKs between 2000-2021 (Source: The World Bank/ICAO)

2. Literature Review

Airport network structures of the world (Guimera & Amaral, 2004), Italy (Guida & Maria, 2007), India (Bagler, 2008), USA (Xu & Harriss, 2008), China (Wang et al., 2011), Australia (Hossain & Alam, 2017), Argentina (Guillaumet, 2018), Spain (Trobajo & Carriegos, 2022), and Türkiye (Ersoz et al., 2022) were modeled and analyzed by using air passenger traffic data. On the contrary, Bombelli et al. (2020) brought a new perspective in analyzing the air transport network using air cargo data with complex network theory. Walcott and Fan (2017) compared the U.S. and Chinese air cargo network hubs by using FedEx and UPS data in the U.S. and air cargo data for the cities in China to reveal the strategically coupled airports and the characteristics of these hubs. Therefore, topology (degree distribution, average path length, clustering coefficient) and centrality measures (degree, betweenness, closeness) of the complicated airport networks have been revealed. The reasons behind the strategic decisions regarding the airport selection in air cargo transportation have not been investigated thoroughly yet. Moreover, although air cargo transport is a bigger business than ever before, it is still not as researched and valued as air passenger transport.

Zhou et al. (2019) proposed a metric to assess the weighted efficiency and robustness of air transport network. Wang et al. (2022) examined the robustness of air cargo network and represented node importance by considering topology and directionality of China's air cargo network and proposed a new model based on the TOPSIS method.

The development of air cargo transport demand was researched by using miscellaneous models and methods in different regions. Suryani et al. (2012) predicted air cargo demand in order to decide the airport terminal capacity expansion by using system dynamics simulation model. Totamane et al. (2014) forecasted air cargo demand on a given route of a specific airline to propose a new capacity plan by using Potluck Problem approach. Loaiza et al. (2017) estimated future air cargo demand in Colombia by using linear regression models and artificial neural networks. Alıcı and Akar (2020) determined the macroeconomic factors, which are GDP and inflation, having impact on air cargo demand by utilizing the panel data analysis method. Kasceev et al. (2022) forecasted the air cargo demand on five routes –two within Europe, two Europe-Asia, and one Europe-North America- by using Holt-Winter algorithm. Anguita and Olariaga (2023) predicted next 5-year demand of air cargo in Colombia using an artificial neural architecture approach, ConvLSTM2D model. Akinyemi (2023) searched the impacts of some variables on air cargo demand in four African Countries-

Egypt, Nigeria, South Africa, and Kenya- using cointegration and error correction modelling techniques. Karunathilake and Fernando (2023) identified key factors as airport and airline capacities, economic and market factors having impact on the air cargo demand growth in Sri Lanka case. Beside these studies on the development of air cargo demand for future projections; Chou et al. (2011) and Liu et al. (2020) had researches on forecasting air cargo volume. As seen from these researches, the nature of air cargo is so dynamic that demand and volume of air cargo have been studied to make more sound decision on capacity expansions of airports and facilities for the future projections.

There are plenty of factors and criteria having an impact on air cargo flows. Hwang and Shiao (2011) determined the factors having impact on international air cargo flows of Taiwan Taoyuan International Airport by using gravity model based on the panel data of scheduled air cargo routes. Oesingmann (2021) analyzed the determinants of air cargo flows and the role of multinational agreements by applying four different structural gravity models and concluded that Euro currency and Schengen membership had positive effect on air cargo flows. Aydın and Ülengin (2022) analyzed the domestic air cargo flows of Türkiye by applying gravity model to find the factors affecting the air cargo transport.

Air cargo transport has also significant impact on economic regional developments. Kasarda and Green (2005) modeled the factors, which are air service liberalization, corruption, and customs quality, to show the air cargo impact on economic development in 63 countries. While Brugnoli et al. (2018) studied the relationship between international trade and civil aviation from the Lombardy region in Italy to 30 European countries by applying a gravity-econometric model in the years 2004–2014, Allroggen and Malina (2014) investigated the role of air transportation in the regional economic development of Germany. Lakew and Tok (2015) searched the connections between regional economies and air cargo traffic at California's airports and attempted to estimate the socioeconomic determinants of air cargo traffic across California cities by using data from 2003 to 2009 on employment, wage, population, and traffic. The findings showed that the amount of outbound air freight is influenced by employment concentrations in both services and manufacturing. Zhou et al. (2022) searched the heterogeneous impact of air cargo on economic development by using manufacturing employment data in different Chinese cities between 2006 and 2019 and demonstrated that air cargo infrastructure development necessity in the interior cities was essential.

3. Methods

In this study, air cargo transportation between Türkiye and Europe is analyzed based on the air cargo weight data obtained from EUROSTAT for the 10-year period (2012-2021). Annual data was manipulated and processed by using R language and Minitab. With this aspect, this research is more of a descriptive and explanatory study.

Firstly, it has been determined which airports in Türkiye and Europe engage in cargo transportation. According to the FTKs, Türkiye's airports handling European cargo were ranked for the period 2012-2021. The total air cargo traffic between Türkiye and European countries was demonstrated. Then, European airports handling the largest cargo traffic with Türkiye were also revealed.

Secondly, air cargo traffic between 11 airports in Türkiye and 90 airports in Europe is tabulated and analyzed according to the weight of cargo transported. Thus, important airports in Europe for Türkiye have been revealed over the years and the 10-year change in the amount of cargo transported is presented on the basis of airport and route.

Finally, the reasons behind the selection of these airports in Europe and the change in cargo transportation within 10 years were investigated. As a result of this, a trend analysis was carried out to predict the course of cargo transportation between Türkiye and Europe in the following years. Forecasts for the years 2022 to 2024 were done using the exponential smoothing with trend adjustment method (Prolifidis & Botzoris, 2019).

4. Analysis and Discussion of Results

4.1. Turkish airports

Analysis of the cargo flow between Türkiye and Europe in the period of 2012-2021 reveals that 11 Turkish airports (İstanbul Atatürk, İstanbul, İstanbul Sabiha Gökçen, İzmir Adnan Menderes, Antalya, Tekirdağ Çorlu, Ankara Esenboğa, Eskişehir Anadolu University, Muğla Milas-Bodrum, Samsun Çarşamba, and Trabzon) are used for cargo transportation to Europe as seen in Figure 4.

Between 2012 and 2021, Istanbul Atatürk Airport ranked as Türkiye's top cargo hub cargo tonnage. The new Istanbul Airport started its operations in mid-2019 and the majority of the air cargo activities have moved from Atatürk Airport to the new Istanbul Airport, which has since begun operations and moved up to the second place in the ranking. Sabiha Gökçen, another airport in Istanbul, comes third in the list. The data indicates that Istanbul is Türkiye's air cargo hub. In this 10-year period, although other airports have been used for air cargo transportation in certain periods, they constitute a very small amount in terms of cargo weight.

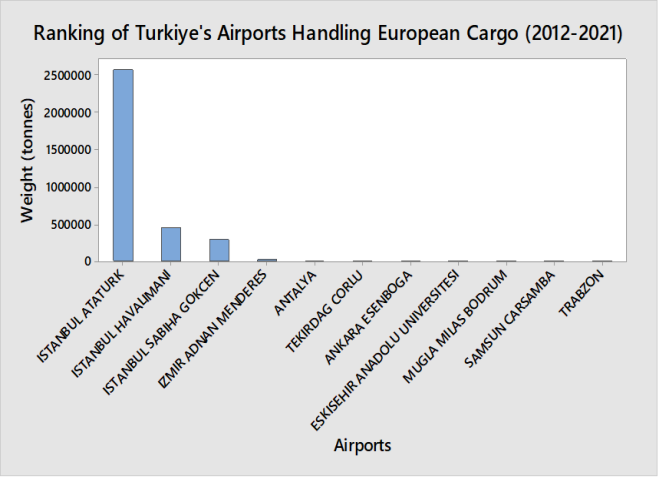

Figure 4. Türkiye's top cargo airports between 2012-2021

4.2. European countries

Figure 5 ranks the 31 European countries that engaged in air cargo transportation with Türkiye according to air cargo weight transported between 2012-2021. Germany was Türkiye's top air cargo partner country as the two countries have a long history of mutually beneficial economic and social relations. Germany was followed by the Netherlands, France, the United Kingdom, Italy, Belgium, and Spain. As seen in Figure 5, Türkiye had air cargo transportation even with the

smallest countries of Europe such as Latvia, Slovenia, Macedonia, Malta, Montenegro, and Slovakia.

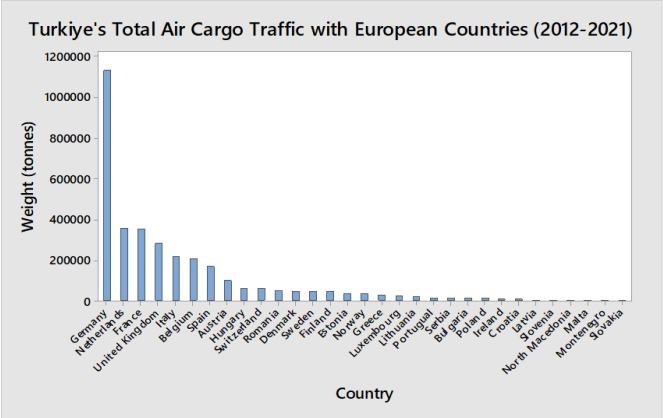

Figure 5. Türkiye's total air cargo traffic with European countries between 2012-2021

4.3. European airports

11 airports in Türkiye had air cargo transportation with 90 airports in 31 different European countries between 2012-2021. Figure 6 shows the breakdown of the European airports handling the largest air cargo traffic with Türkiye. Türkiye's airports had the busiest air cargo traffic with Frankfurt Airport (12.3%) in Germany which was followed by Paris Charles de Gaulle Airport (10%) in France. These two airports make up the 22.3% of Türkiye's European air cargo traffic. Both of these airports are known as cargo hubs in Europe and they are the home of major air cargo operators as well as freight forwarding companies. The third and the fourth airports in the ranking are Cologne (8.6%) and Leipzig (7.4%) airports. These two airports are integrator hubs serving DHL and UPS, respectively. Majority of the European integrator traffic flows through these hubs. The fact that three of the first four airports that operated air cargo transport with Türkiye are situated in Germany is the most notable finding here. These four airports were respectively followed by Maastricht Aachen (6.2%), London Heathrow (6.2%), Milano Malpensa (5.5%), Adolfo Suarez Madrid Barajas (4.8%), Liege (4.5%), and Amsterdam Schiphol (4.5%) airports. These 10 main airports constitute the 54% of Türkiye's air cargo traffic with Europe.

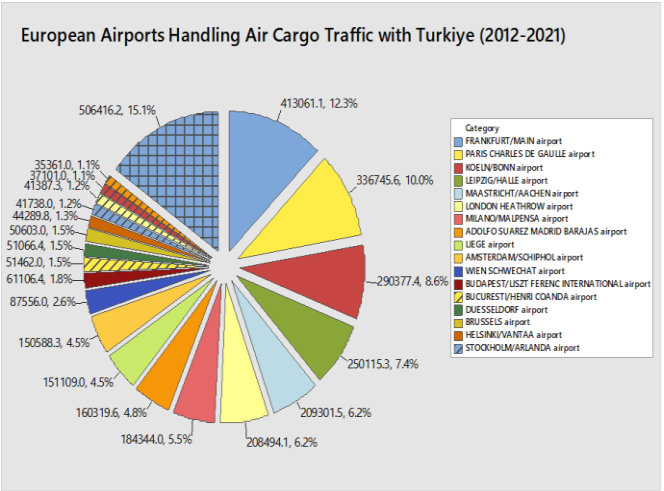

Figure 6. European airports handling the largest cargo traffic with Türkiye between 2012-2021

Figures 7 through 14 demonstrate the top cargo routes between Turkish and European airports for the years 2012 through 2021. With the UK's exit from the EU (known as Brexit) on 31 January 2020, EUROSTAT has excluded the data related to UK. For this reason, the incomplete 2020 data and the lack of 2021 data of UK airports appear as a constraint in our research.

4.4. Airport pairs

Atatürk Airport, being the busiest before 2021, offered routes to the main cargo hubs in Europe. By 2022, all of these routes had gradually switched from Atatürk to the new Istanbul Airport. Cargo flight operations from Atatürk Airport ended with Turkish Airlines Cargo's flight on 5 February, 2022 (FlyKargo, 2022). Although the passenger flights in 2019 and cargo flights in 2022 at Atatürk airport ended, it was the cargo hub of Türkiye during the examined period range and the cargo traffic was shown in Figure 7. Since Atatürk Airport was the main air cargo hub of Türkiye until 2018, the air cargo load transported gives an insight about which European airports have intensive air trade with Türkiye. It can be seen that the air cargo load carried between Frankfurt airport and Atatürk airport is approximately 1.5 times that of the second rank Cologne airport. From a country perspective, the fact that Germany's three airports—Frankfurt, Cologne, and Leipzig—are among the top four in the freight ranking demonstrates that Germany is Türkiye's main air cargo transportation partner.

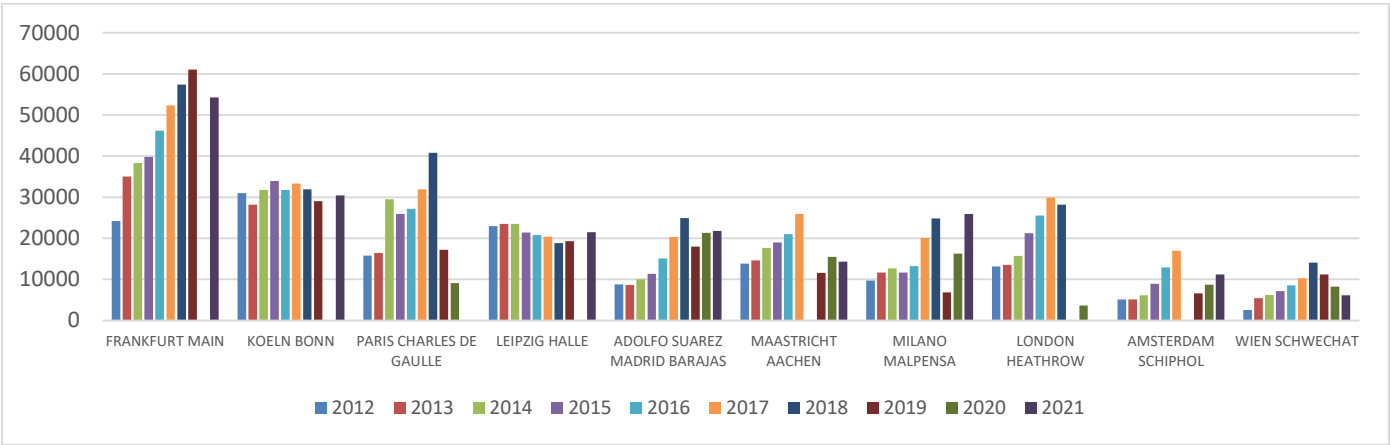

Figure 7. Top 10 European Origin/Destination of Atatürk Airport.

Istanbul Airport opened on October 29, 2018, but the complete transfer of passenger operations from Atatürk Airport was carried out on April 6, 2019. As the cargo terminal was not completed, Turkish Airlines, MNG, ULS and ACT's cargo planes continued to fly to Atatürk Airport. As of February 6, 2022, the cargo flights completely transferred to Istanbul Airport (Airline Haber, 2022). Figure 2 shows that the air cargo traffic of Istanbul Airport, where the hubs of Turkish Cargo and MNG Airlines, Türkiye's two main air cargo operators, are located (Brett, 2022). Integrators DHL and UPS are also based at this airport (IGA İstanbul Airport, 2023). The first airports, Schiphol, Heathrow, and Maastricht Aachen launched reciprocal cargo trade with Istanbul Airport as of 2018. Since Charles De Gaulle started to gradually transfer air cargo traffic since 2019 from Atatürk to İstanbul Airport and completely operated in 2021 before the Frankfurt, Cologne, and the other major airports, it was ranked first in terms of transported air cargo weight. Currently, Istanbul Airport serves as the main cargo hub in Türkiye.

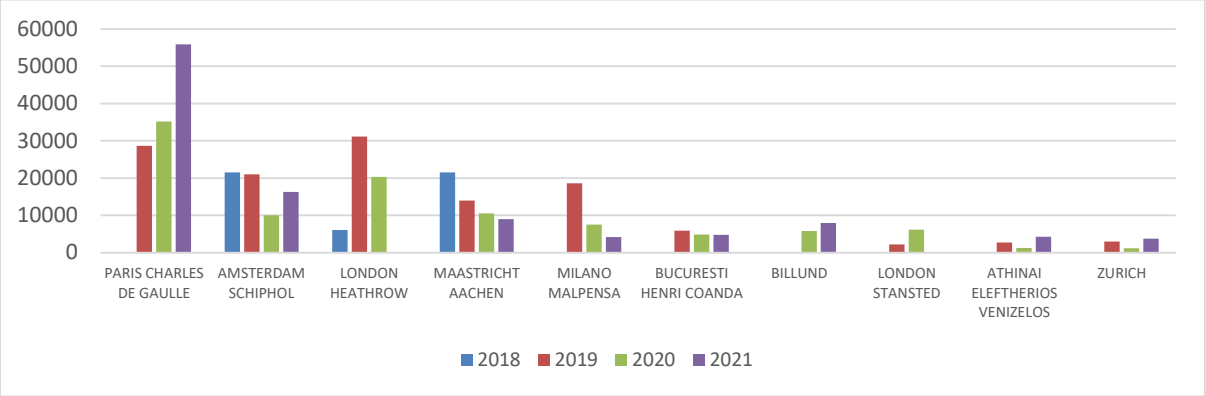

Figure 8. Top 10 European Origin/Destination of Istanbul Airport.

Figure 9 shows the air cargo traffic of Istanbul Sabiha Gökçen Airport. Figure 9 shows that Sabiha Gökçen airport is not truly an air cargo airport, but in recent years, airports in Europe, most notably Liege and Leipzig, have strategically preferred it because of its advantageous location and proximity to industrial districts. Sabiha Gökçen, the third largest air cargo hub of Türkiye in the period of research (currently the second cargo hub) has the busiest route with Liege airport. In order to strengthen their partnership and expand their economic potential, these two airports signed a strategic agreement. This route is served by TNT Airways using B767 wide body aircraft (Liege Airport Press Release, 2014). Another busy route of Sabiha Gökçen is with Leipzig which is flown by MNG Airlines feeding the hub of DHL. When Table 3 is analyzed, it is clear that Liege and Dusseldorf Airports have maintained a steady flow of air freight.

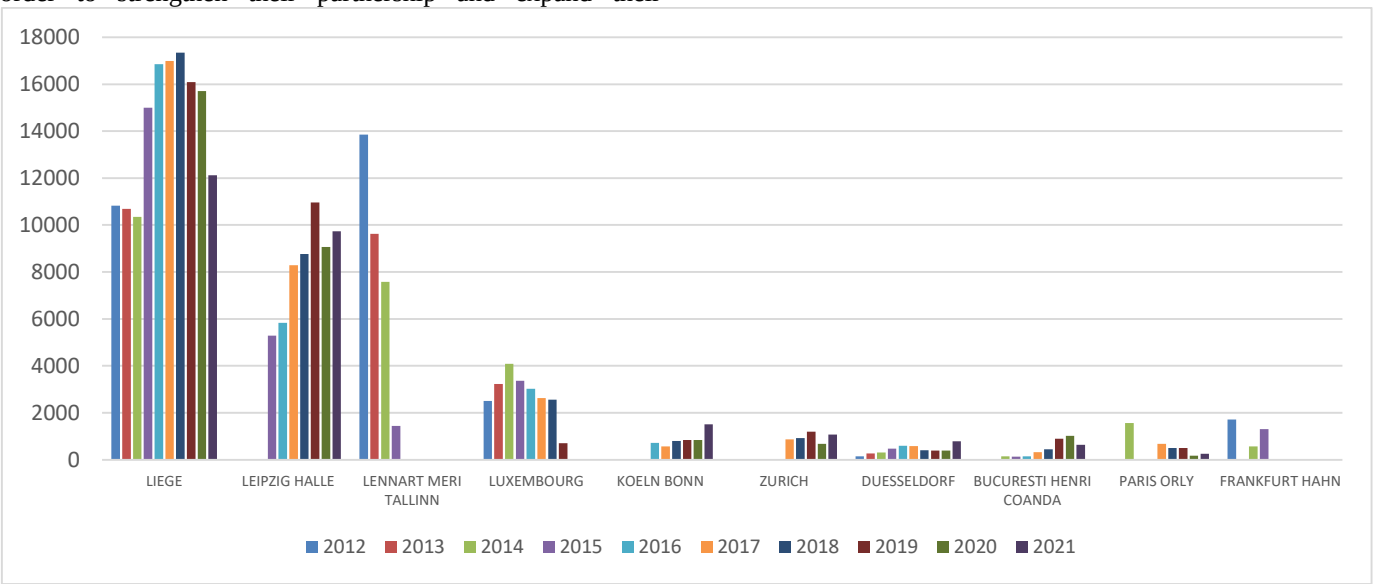

Figure 9. Top 10 European Origin/Destination of Istanbul Sabiha Gökçen Airport.

As seen in Figure 10, Izmir Adnan Menderes Airport does not have continuity in terms of cargo transportation. Limited amount of cargo was transported from various European airports over the course of several years even though there is a cargo terminal at the airport. It is interesting to note that in the 10-year evaluation, cargo transportation between Izmir Adnan Menderes and London Stansted Airport in the 2018-2020 period ranked first in the ranking. Because of the Brexit, the EUROSTAT excluded all UK airports data so 2021 year is blank for Stansted and Manchester airports. In 2023, Adnan Menderes Airport had cargo transportation with just Dusseldorf and Stuttgart Airports.

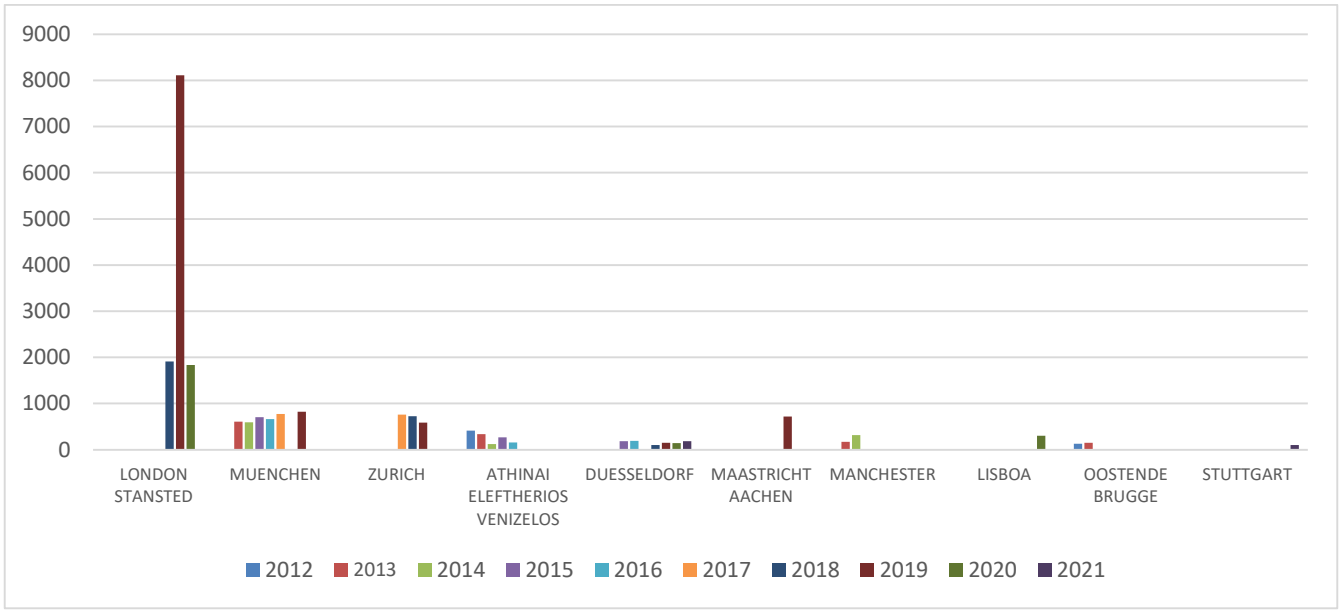

Figure 10. European Origin/Destination of Izmir Adnan Menderes Airport.

As seen in Figure 11, Antalya Airport didn't have any cargo transportation with European airports for the last two years of the research period.

When Figure 12 is analyzed, Ankara Esenboğa Airport had a little amount of air cargo transportation with just Dusseldorf Airport in 2021 for the last three years.

As seen in Figure 13, Tekirdag Corlu Airport had also insignificant amount of cargo transportation.

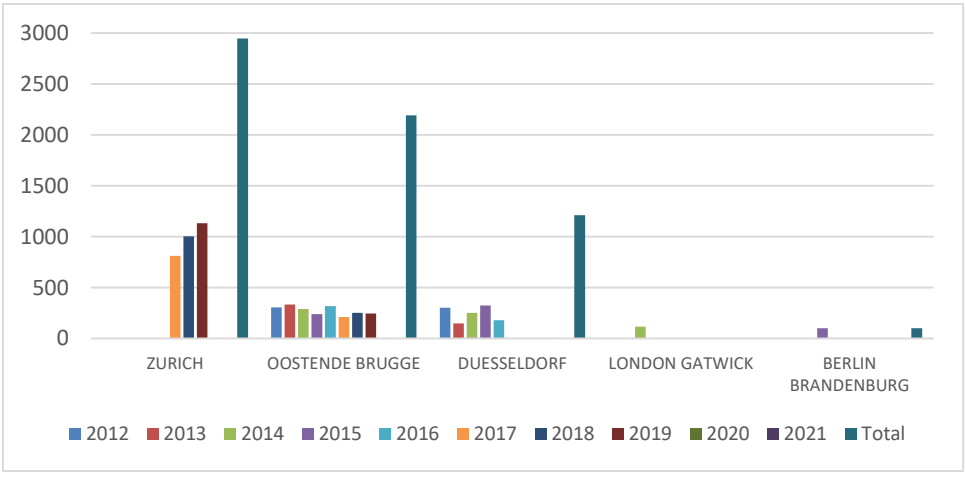

Figure 11. European Origin/Destination of Antalya Airport.

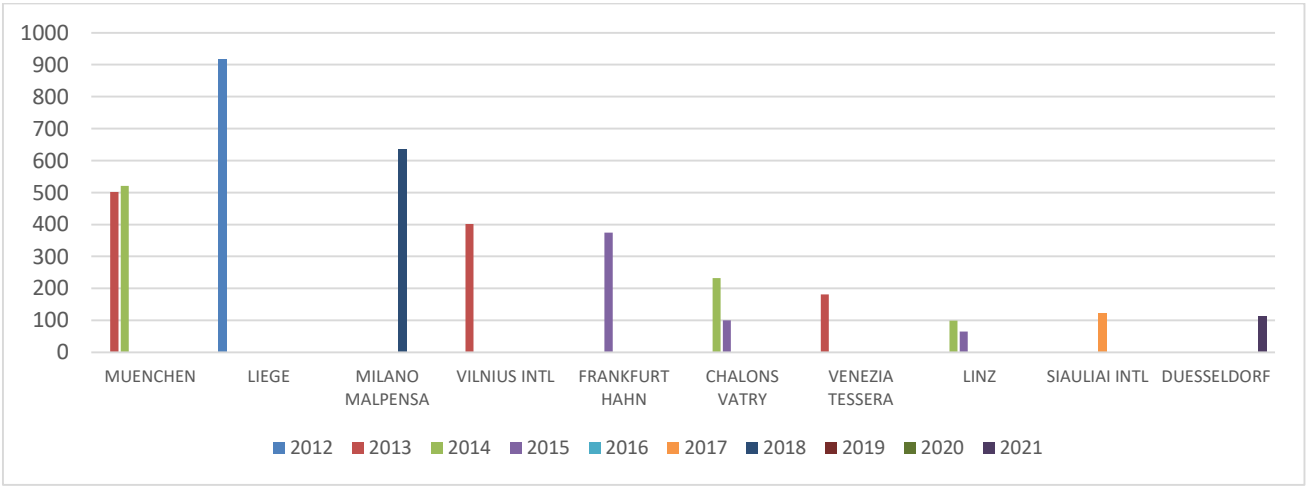

Figure 12. Top 10 European Origin/Destination of Ankara Esenboga Airport.

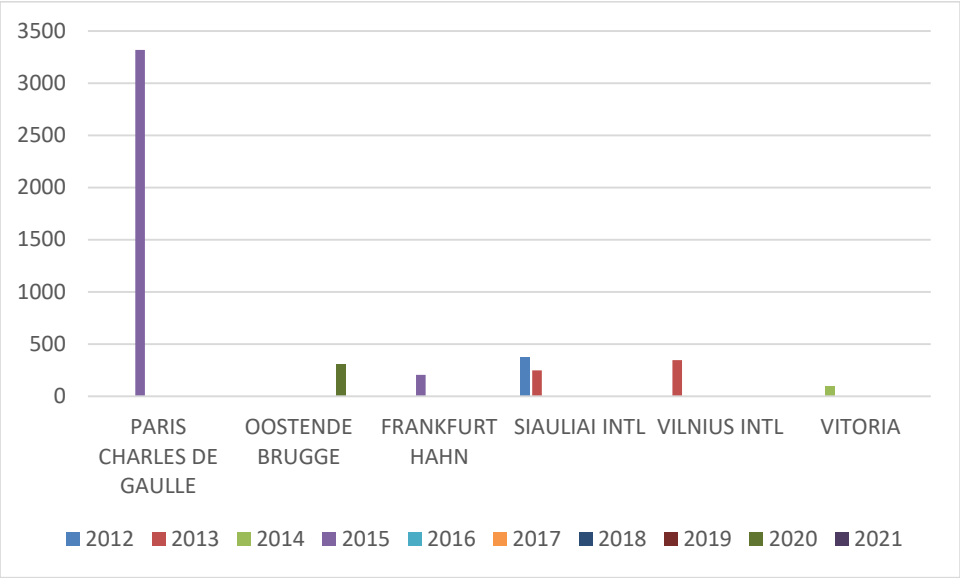

Figure 13. European Origin/Destination of Tekirdağ Corlu Airport.

Since the cargo transportation of the other four airports of Türkiye with European airports is trivial, it is shown in a single table. As seen in Figure 14, these airports had cargo transportation with just one different airport. As known very well, Eskisehir has ethnic charter passenger transportation with Belgium in summer seasons; thus, a cargo transportation has been carried out with Brugge airport since 2017. Milas-Bodrum airport hadn't had any cargo flights since 2017. Samsun Çarsamba and Trabzon airports had just one cargo transportation in the 10-year research period.

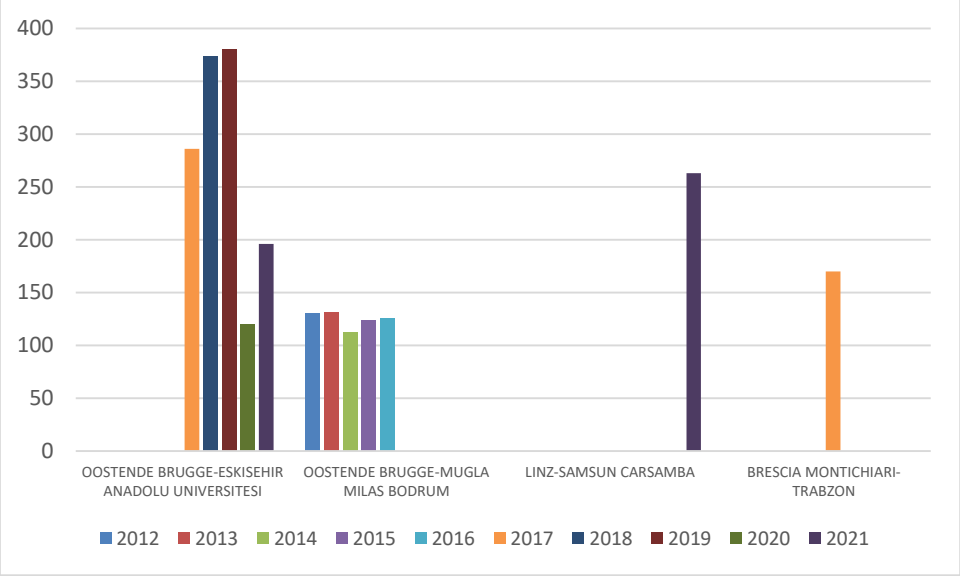

Figure 14. European Origin/Destination of the other airports.

When all tables are analyzed, Istanbul IGA airport emerges as Türkiye's strategic primary air cargo hub. Sabiha Gökçen might be considered as the secondary air cargo hub. The remaining nine airports in Türkiye were utilized for a few air cargo operations with various airports in Europe in different time periods; however, they cannot be counted as air cargo airports.

5. Challenges and Forecast of Air Cargo Traffic

5.1. Factors driving air cargo growth

Several factors contribute to the growth and facilitation of air cargo traffic between Türkiye and the European Union (EU). For instance, the EU-Türkiye Customs Union agreement promotes free trade, reducing trade barriers and facilitating the movement of goods. In addition, improvements in airport infrastructure, such as the expansion of Istanbul Airport, enhance the capacity for air cargo handling.

Technological advancements, such as digitization and electronic data interchange systems, streamline customs procedures improve efficiency and reduce transit times. Moreover, strong economic performance and increased consumer demand in both Türkiye and the EU drive the need for air cargo transportation to support trade flows, particularly for time-sensitive and high-value goods. However, certain factors can pose challenges to air cargo traffic between Türkiye and the EU. Changes in trade policies, such as the imposition of tariffs on specific goods, can disrupt established supply chains and affect air cargo volumes. Economic downturns, such as recessions or financial crises, reduce

consumer purchasing power and can lead to a decline in air cargo shipments. Capacity constraints at airports, especially during peak seasons, may limit the availability of cargo space for transportation. Political tensions or trade disputes between Türkiye and certain EU member states can create uncertainties, potentially impacting air cargo flows. Additionally, stringent environmental regulations aimed at reducing carbon emissions may impose additional costs on air cargo operators and necessitate adjustments in operational practices.

5.2. Three-year air cargo forecast

Forecast of the air cargo traffic between Türkiye and Europe is shown in Figure 15. Exponential smoothing with trend adjustment method was applied to the data to forecast 2022, 2023 and 2024 air cargo traffic. The lowest and highest weight transportation was also demonstrated with lower and upper confidence bounds. As can be seen in Figure 15, the trend shows that Türkiye's air cargo with European countries will continue to grow over the next three years.

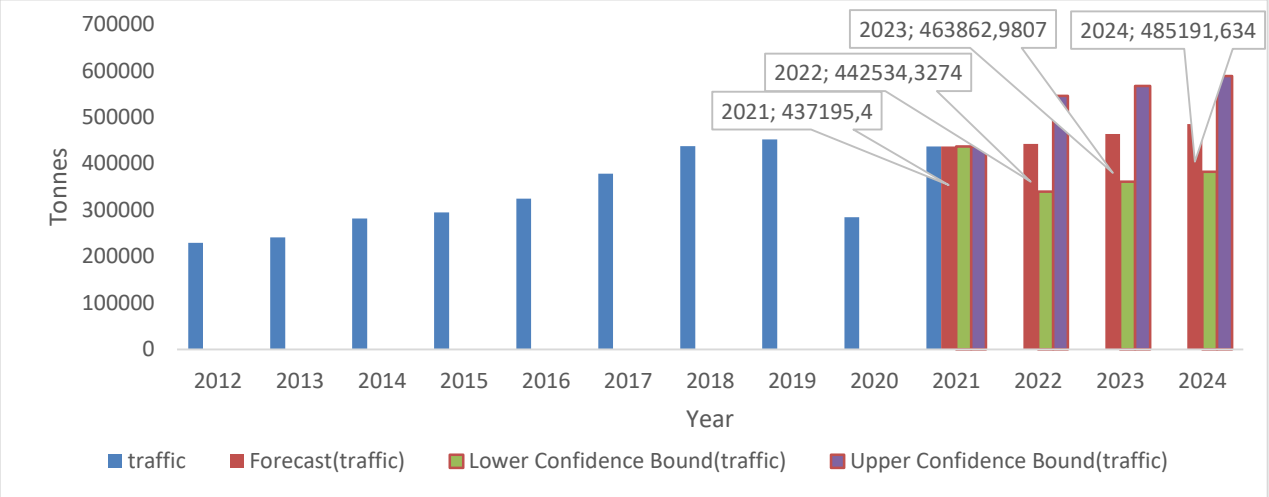

Figure 15. Forecast of Türkiye's air cargo traffic with all European countries.

A projection for the following three years (2022, 2023, and 2024) as shown in Figure 16 (a,b,c) was created using the same methodology for the top three countries (Germany, Netherlands, and France) with the most air cargo traffic with Türkiye. The thin vertical lines inside the bars in the Figure 8 (a,b,c) show the lowest and highest levels of the air freight transportation while the bars in the figures give the mean estimations.

Examining the mean estimate for air cargo traffic with Germany reveals that it is not realistic. Due to airport closures during the pandemic, there was significantly less air cargo transport in 2020, which causes the time series data to be disrupted. Since the drop is large in 2020, the standard error of the forecast is also significant. It is probable that due to the intense exports and imports with Germany, air cargo transportation will remain near its current level.

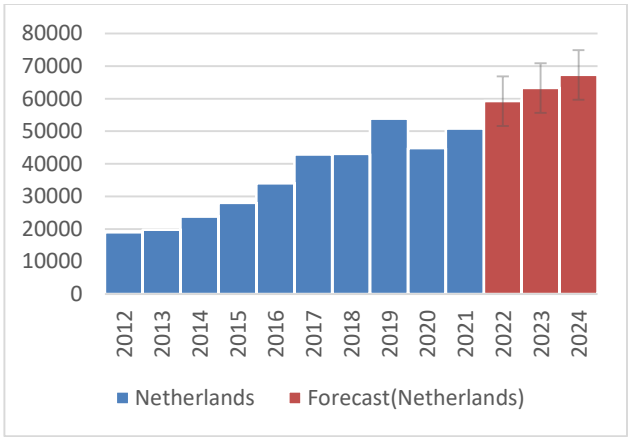

Figure 16 (b). Forecast of Türkiye's air cargo traffic with the Netherlands.

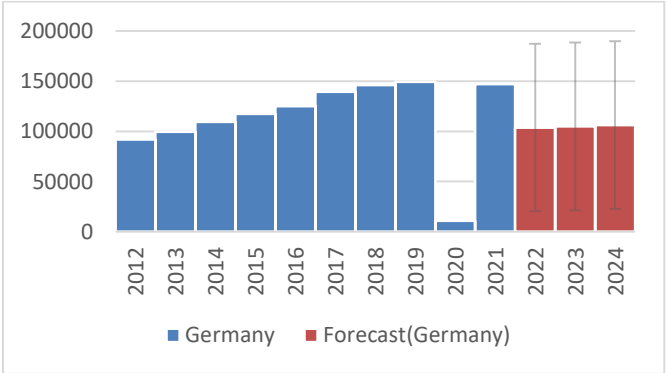

Figure 16 (a). Forecast of Türkiye's air cargo traffic with Germany.

When Figure 16 (b) and 16 (c) are analyzed, air cargo traffic with the Netherlands and France will increase slightly over the next 3 years.

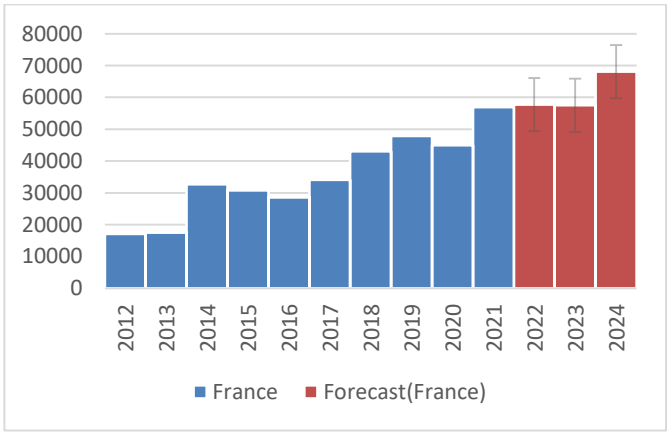

Figure 16 (c). Forecast of Türkiye's air cargo traffic with France.

6. Conclusion

This study has unveiled a decade-long narrative of air cargo transportation, spanning from 2012 to 2021, connecting 11 Turkish airports with counterparts across 31 diverse European nations. At the forefront of these interactions stands Germany, a natural leader in air cargo trade with Turkey, given their extensive trade relations. Following in rank were the Netherlands, France, the United Kingdom, Italy, Belgium, and Spain, reaffirming Turkey's widespread reach in the European market. Remarkably, even with lesser-known European nations like Latvia, Malta, and Montenegro, Turkey maintained a robust presence in the air cargo arena.

A closer examination of European airports involved in handling Turkey's air cargo traffic between 2012 and 2021 revealed that Frankfurt and Charles de Gaulle airports, accounting for 22.3% of Turkey's air cargo traffic, led the pack. These two aviation hubs were closely trailed by Cologne, Leipzig, Maastricht, London Heathrow, Milano Malpensa, Adolfo Suarez Madrid Barajas, Liege, and Amsterdam Schiphol, respectively. This top-tier decile collectively facilitated 54% of Turkey's air cargo exchange with Europe.

During this decade, Atatürk Airport assumed the mantle of Turkey's primary air cargo hub. However, this era came to a close on February 5, 2021, when Atatürk Airport handled its final cargo flight. The baton was officially passed to Istanbul Airport on February 6, 2021, marking a significant juncture in Turkish aviation history. Istanbul Airport, among the world's ten largest airports, took over the dual responsibilities of both passenger and cargo transport from Atatürk Airport.

Sabiha Gökçen Airport, though not conventionally a cargo-centric hub, metamorphosed into a strategically preferred gateway due to its proximity to industrial districts and advantageous geographical location. It established crucial agreements with various European airports, most notably Liege Airport, resulting in substantial cargo transit. This unique status enabled airports like Liege and Leipzig, not originally within the top 10 cargo destinations for Istanbul and Atatürk airports, to channel air cargo towards Sabiha Gökçen as part of a deliberate strategy.

Conversely, some Turkish airports such as Trabzon, Çarşamba, Milas Bodrum, Eskişehir Anadolu University, and Çorlu played peripheral roles, with sporadic regional usage and minimal cargo tonnage, rendering them inconsequential in the larger context of cargo transportation continuity.

Intriguingly, the study divulges that Turkey's air cargo sector exhibited resilience amid the pandemic. While the year 2020 witnessed a pronounced dip in traffic due to widespread airport closures, the subsequent year of 2021 bore witness to a recovery, marking a revival of pre-pandemic trends. Furthermore, forecasts painted a promising picture, indicating a continued upward trajectory in Turkey's air cargo industry, particularly concerning European routes.

In summation, this study underscores Turkey's enduring presence in the European air cargo landscape, resilient performance in the face of challenges, and a promising outlook for future growth in its air cargo sector.

Ethical approval

Not applicable.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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