ESTIMATING THE FUTURE ROLE AND SUCCESS OF THE ISTANBUL AIRPORT: A REGIONAL PLANNING PERSPECTIVE

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ABSTRACT

ESTIMATING THE FUTURE ROLE AND SUCCESS OF THE ISTANBUL AIRPORT: A REGIONAL PLANNING PERSPECTIVE

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Today, the aviation sector is considered as the driving force for the economies of countries, regions and cities and contributes not only to economic developments but also to social development. Every day, new air transport connections are being created all over the world and people's demand for air transport is growing. In order to get a share from the development of the aviation sector, which is a very important field in today's economies, countries all over the world are in harsh competition. Within the scope of this competition, countries want to create various advantages by developing relevant strategies. Within the framework of all the events and changes in the world, Turkey also carries out various actions to achieve their goals and develop some strategies for the aviation industry. Turkey has experienced quite quick and quite an advanced growth in the field of air transportation in the last 20 years. According to statistics of General Directorate of State Airports Authority, while 34 million passengers used air transportation in 2003 in Turkey, this amount has increased 6 times and nearly 211 million passengers used air transportation in 2018. Turkey is developing various strategies and implementing some actions in order to be more competitive in a rapidly evolving global aviation. The most important of these strategies can be considered as the new airport investment in Istanbul. This thesis mainly aims to develop predictions on the role of Istanbul Airport, the highest cost

investment in the history of the Republic, in the future and how it will play a role in the global aviation sector. Various quantitative and qualitative research methods have been used during the research and the future of Istanbul Airport has been evaluated by using the information obtained as a result of the workshops with the stakeholders.

Keywords: Forecast, Istanbul Airport, Scenario Development, Transportation

ÖZ

İSTANBUL HAVALİMANI'NIN GELECEKTEKİ ROLÜNÜN VE BAŞARISININ TAHMİNİ: BÖLGE PLANLAMA PERSPEKTİFİ

Karadoğan, Baran Can
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Havacılık sektörü günümüzde ülke, bölge ve kent ekonomileri için itici güç olarak kabul edilmekte ve yalnızca ekonomik açıdan değil sosyal açıdan da önemli gelişmelere katkı sağlamaktadır. Tüm dünya çapında her gün yeni hava ulaşım bağlantıları oluşmakta ve insanların havayolu taşımacılığına olan talebi artmaktadır. Günümüz ekonomilerinde oldukça önemli bir alan olan havacılık sektörünün gelişiminden pay alabilmek için tüm dünyadaki ülkeler sert bir rekabet içindedirler. Bu rekabet kapsamında ülkeler çeşitli stratejiler geliştirerek kendilerine çeşitli avantajlar yaratmak istemektedirler. Dünyada gerçekleşen tüm olaylar ve değişimler çerçevesinde Türkiye de havacılık sektörü için çeşitli stratejiler geliştirmekte ve hedeflerine ulaşabilmek için çeşitli eylemler gerçekleştirmektedir. Türkiyede havacılık sektörü son 20 yılda oldukça hızlı gelişmiş ve oldukça büyük bir büyüme yaşamıştır. Devlet Hava Meydanları istatistiklerine göre 2003 yılında tüm Türkiye genelinde 34 milyon yolcu taşınmışken 2018 yılında bu miktar 6 katına çıkarak yaklaşık 211 milyon seviyelerine ulaşmıştır. Türkiye hızla gelişen dünya havacılık sektöründe daha rekabetçi olabilmek adına çeşitli stratejiler geliştirmekte ve uygulamaktadır. Bu stratejilerden en önemli olanı İstanbul'a yapılan yeni havalimanı yatırımı olarak kabul edilebilir. Bu tez çalışması temel olarak Cumhuriyet tarihinin en yüksek bedelli yatırımı olan İstanbul Havalimanı'nın gelecekte küresel havacılık

sektöründe nasıl bir rol oynayacağı, başarılı olup olamayacağı konuları üzerine tahminler geliştirmeyi hedeflemiştir. Araştırma yapılırken çeşitli nicel ve nitel araştırma yöntemleri kullanılmış ve sektör paydaşları ile yapılan çalıştaylar sonucu elde edilen bilgiler kullanılarak İstanbul Havalimanı'nın geleceği değerlendirilmiştir.

Anahtar Kelimeler: İstanbul Havalimanı, Uzun Dönemli Tahmin, Senaryo

In loving memory of my grandfathers;
Sadettin ÇAKIR & Hayri KARADOĞAN

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LIST OF ABBREVIATIONS

ACI: Airports Council International

AHP: Analytical Hierarchy Process

ARIMA: Autoregressive Integrated Moving Average

ASEAN: Association of Southeast Asian Nations

ATAG: Air Transport Action Group

CAGR: Compound Annual Growth Rate

DNATA: Dubai National Air Transport Association

FTK: Freight Tonne Kilometers

GCI: Global City Index

GFCI: Global Financial Centers Index

HCI: HUB Competitiveness Index

IATA: The International Air Transport Association

IGA: Istanbul Grand Airport

LCC: Low Cost Carrier

OAG: Official Aviation Guide of the Airways

PWC: PricewaterhouseCoopers

RPK: Revenue per Kilometer

RTK: Revenue Tonne Kilometer

SATS: Singapore Airport Terminal Services

UNWTO: United Nations World Tourism Organization

YTM-MATPUM: Research and Implementation Center for Built Environment and Design

CHAPTER 1

INTRODUCTION

1.1. Aim

Throughout the history of civilizations, urbanization patterns and regional development strategies have always been in strong relations with transportation modes. While, in 18th century water transportation was shaping port cities, in 19th century urbanization was altered in accordance with the railways and railroad transportation. With the invention of automobiles and construction of highways, suburbs and urban sprawl has become the most prominent concepts of the 20th century urbanization. In this day and age the most influential driving force that is shaping the urban spatial structure could be assumed as air transportation. Air transportation is not only affecting the urbanization but also regional and national economic output. In one of the latest forecast report of AIRBUS(Airbus, 2011) experts are anticipating strong relations between urban areas and aviation sector in the future and a rapid increase in the number of airport cities in the world. Thus, many countries in the world have started to settle their development strategies accordingly, even some of them such as Dubai and Qatar have achieved significant economic and social development success thanks to air transportation. Through increasing world population and GDPs, growing middle class around the world it is surely beyond doubt that the aviation sector and air transportation in continuously evolving world will be deeply important than ever before.

In this respect, it is quite obvious that Turkey, which has a very important place in the global air transportation system, will take a series of measures to sustain its advantage and increase the competitive power in the developing market in the changing world. The most important investment made by the country for this goal is, of course, Istanbul

Airport. The airport, which started to operate in March 2019, will undoubtedly have considerable impacts on many different areas for the city, region and country.

In the view of such information, this study aims to find a satisfying answer to the question of "Will Istanbul Airport be successful in the foreseeable future?" In the scope of this study with the goal of finding an answer to the main question, some of sub questions will be tried to be answered which could be assumed as success indicators of Istanbul Airport. These sub questions are specified as:

In the future;

- Will Istanbul Airport play a role as a global hub in the global air transportation system?
- Will Istanbul stand out as just a transaction point? Or will it be a Point of Attraction?
- What will be the total passenger amount carried by Istanbul Airport?
- What kind of a World is waiting for Istanbul Airport?

Although the most important indicator of the success of an airport could be assumed as total passenger and aircraft amount; as a driving force of urban and regional development the role of an airport that plays in both regional, national and global levels are also important. It is obvious that an airport provide many benefits for both regional and national development by playing a role as a global hub, transforming the region into a major attraction for tourism, making a direct impact on finance and business areas, or not just transporting passengers but also being an important logistic center in terms of air cargo. Therefore, by finding answers to the sub-questions above, an efficient guiding light will be attained on the way of trying to find an answer to the main research question.

1.2. Justification

When the question of "why" came up upon this study, which is about estimating the performance of Istanbul Airport in the future global aviation, the best answer might be the importance of this state investment not only for the future of country and region but also whole world. It may argued that discussions that will be in this research would be important because this mega investment of our country will play an important role in re-shaping the structure of the global aviation. Rather than dealing with a lack in the literature or contributing a current debate which could be assumed as choked, this study maybe be assumed as a satisfier for curiosity about the future of this investment and the possible contribution to the region and country.

As all we know the world is developing in each passing day with an incredible pace. Undoubtedly that, this progress affecting our lives in many different ways and re-shaping our perception. All methods of production, trade, transportation etc. are improving and reforming swiftly, and it seems that people and states should keep up with the change instead of dissolving in it. So the Turkish Government in order not to lose its position in the global aviation market against rapid change, invested in the 3rd Airport in İstanbul. This investment was highly important for being more competitive against our opponents such as Germany, France, Dubai and other possible ones. While the increasing importance in aviation sector and world's population- so demand on air transport- makes this sector very important for the national and regional economies.

Moreover, not only the passenger transport but also air cargo is enhancing its important constantly. In the technologically developing world, most professions and business lines are losing their importance and even they are dying, air cargo is constantly improving and becoming more and more important. From this point of view, Istanbul has the chance of being an important center for air cargo too. In other words, this issue is getting more and more important because Istanbul wants to advance not only in the future of air passenger transport but also in the field of air cargo and logistics.

All regions of the world are making great efforts to take part in the future of the aviation industry and market. Europe, which is always in front of the aviation field up to this time, losing its advantage every passing day because of the fact that Turkey plays a significant role in this area, Dubai and Qatar has taken the stage in the sector and China has achieved a very important growth very rapidly. China, which has achieved high growth rates until this time, wants to change its economic structure due to the surplus production and sees the aviation industry as the biggest key of the diversification that it wants to create in economy. The world's changing patterns of production and trade will change the future of aviation and every plan to do so will deeply influence the fate of the countries. The reason that makes the study of this issue important is not only that it will affect our country and the Istanbul region but also that the whole world will be deeply affected by these developments.

In other words, as mentioned before, air transportation and airports, which are one of the most important tools of regional development today, will be one of the most important aspects in our future. Thus, the greatest motivation of this study is the curiosity about the future role of Istanbul Airport, which is one of the largest state investments ever made in the history of the republic.

1.3. Methodology

This research has mainly focused on predicting the success of Istanbul Airport in the future. Within the scope of study, the sub questions in the following were tried to be answered by using appropriate methods;

- Will Istanbul Airport play a role as a global hub in the global air transportation system?
- Will Istanbul stand out as just a transaction point? Or will it be a Point of Attraction?
- What will be the total passenger amount carried by Istanbul Airport?
- What kind of a World is waiting for Istanbul Airport?

The possibility of Istanbul airport to become a global transfer hub in the future has been examined by developing a competitiveness index and compared with the airports it competes with. In addition to this, various researches and literature reviews have examined whether Istanbul will serve only as a transfer center in the future or whether it will take place in the world as a point of attraction. Finally, what kind of future awaits Istanbul in the future is examined through the in-depth interviews with sector stakeholders and workshops organized within the scope of the project of "Air Transportation General Study". In this respect, research methodology composed by 4 steps;

- **Literature Review**

First, the literature review was conducted to strengthen the theoretical background about the research topic and the forecast studies conducted by major airline companies and institutions were examined. In addition, competitions in the world between global hubs have been examined and a comparison between hubs and Istanbul Airport has been made. World trends have been examined in tourism, finance and business and some predictions have been made about their future situation. Finally, the variables that will shape the world in the future and affect air transportation are analyzed during the literature review and future realizations and uncertainties are determined.

- **Competitiveness Index**

Within the scope of the research, Istanbul's competitors in the future as a global hub have been identified. A competitiveness index has been developed among competitors identified as Dubai, Doha, London, Paris, Amsterdam and Frankfurt. Four basic components were taken into consideration while developing this index which are market potential, infrastructure, past air traffic results and safety. While developing these components, population, GDPs, destination popularity, global city index, political stability index, public transportation, congestion, capacity and capacity growth potential, air passenger quantity and growth, connectivity index and its growth were taken into consideration.

- **Statistical Models**

Research has been carried out to find out the most appropriate prediction method according to the type of data available. As a result of this research, ARIMA and Exponential Smoothing methods are assumed as most appropriate ones for time series forecasting. Since the method is quantitative, the forecast study has been done for the next 10 years.

- **Scenario Analysis**

A variety of information has been gathered from a workshop attended by sector leaders to get tips on how the world will shape in the future and how global air transportation will be in the future. Within the scope of the workshop, driving forces that could shape the world air transportation in the future were discussed and the importance levels of these indicators were determined. In addition, the national objectives of government about air transportation system of Turkey and their priorities have been discussed and this discussion helped for understanding the importance of Istanbul Airport. According to these results, the axes for creating the scenarios according to different importance levels have been established. Scenario axes have been set up to identify possible scenarios for all information obtained from previous steps, and possible scenarios have emerged in this direction. In the scenario development process, analytic hierarchy process, which is one of the multi criteria decision-making methods, was used. Following the evaluation of the scenarios one by one, the most probable scenario to be realized has been decided with the participation of some experts in the sector. Finally, it is discussed how Istanbul Airport will play a role and what effects it will have under the most probable scenario to be realized.

1.4. Content

This thesis is organized into 7 chapters including introduction and conclusion chapters. In the first chapter, which is named as introduction, information about the aim and methodology of the thesis is given. In the second chapter, literature review has been conducted on the subject and the importance of aviation sector in the world,

aviation evaluation of important regions in the world and long-term forecasting models of important institutions are given. In the third chapter, the competitors of Istanbul Airport in the way of being a global hub were examined and a competitiveness index was developed in order to measure the competition between them. In the fourth chapter, it is discussed whether Istanbul will only be a transfer center or whether it can act as a point of attraction in the world. In this context, tourism potential of Istanbul has been examined in detail. In addition, Istanbul's business potential was examined and various studies on whether it could be a global financial center were examined. In the fifth chapter, it is tried to predict how many passengers Istanbul Airport will serve in the next 10 years. In the scope of this study, firstly, which estimation models will be used are determined, then 10 years estimation is obtained by using appropriate statistical estimation models. In the sixth chapter, a scenario analysis was conducted on what kind of future awaits Istanbul 20 years later. In this study, scenarios have been developed by using the results of two workshops organized by YTM-MATPUM within the scope of Air Transportation General Study project. Within the scope of the workshop, in-depth interviews were conducted with sector stakeholders and four scenarios were developed in the light of the information obtained from the interviews. Finally, the most likely scenario to be realized was determined by the stakeholders of the sector. In the last chapter, 4 sub-questions that are tried to be answered within the scope of the thesis are discussed. In addition, the effects of Istanbul airport on urban development and regional development in the future have been discussed and a conclusion has been tried to be reached.

CHAPTER 2

LITERATURE REVIEW AND THEORETICAL BACKGROUND

In this chapter, historical development of world air transport and its importance in terms of globalization are mentioned. In addition, Asia-Pacific, Europe, Africa, Middle East and North / South America, which are important regions of the world, were evaluated in terms of their future economic conditions and aviation sector. Moreover, global hub airport concept and its importance are discussed and the concepts of airport city and aerotropolis are examined. Finally, the future predictions and forecasting methodologies of companies such as Boeing, Airbus, IATA and Eurocontrol, which have very important positions in the aviation sector, were investigated.

2.1. Air Transportation in the World

The air transport industry, which has become a very important sector today, has a relatively short history but has become one of the most important development dynamics of the age in a very short time. As stated in World Bank's website; "Air transport is an important enabler to achieving economic growth and development. Air transport facilitates integration into the global economy and provides vital connectivity on a national, regional, and international scale. It helps generate trade, promote tourism, and create employment opportunities. The World Bank has financed aviation-related projects for over sixty years. Today, the WBG remains actively engaged in every region on projects related to air transport policy and regulation, safety, infrastructure rehabilitation, institutional strengthening, and capacity building(The World Bank, 2016)."

Although the aviation sector mainly consists of passenger and freight transport activities, the sector also includes a wide range of activities such as; R&D, aircraft

design and production, air navigation systems, airport systems and equipment production, ground and terminal services, safety and security systems, training and maintenance. Thus, it could be assumed that aviation sector has a great importance for both regional and national economies today.

Moreover, the importance of the aviation sector in increasing rapidly every passing day. As shown in the graphic below, although the sector has experienced some crisis such as Asian crisis in 1998, terrorist attack on 11 September 2001 and SARS outbreak in 2003 during its history it recovered fast and continues to grow exponentially(IATA, 2017b).

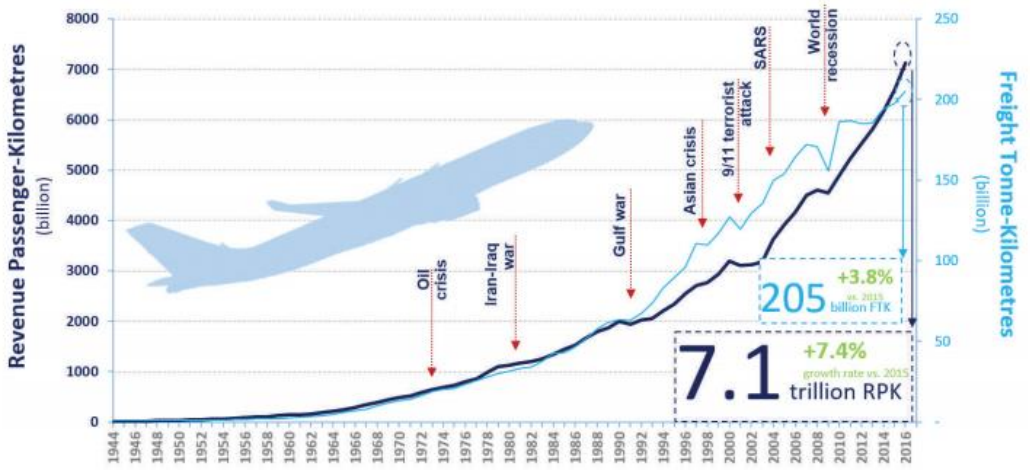

Figure 2.1. World Air Transportation between years 1944 and 2016 (IATA, 2017b)

IATA states in Aviation Benefits 2017 report, "Air transport has doubled in size every fifteen years and has grown faster than most other industries. In 2016, airlines worldwide carried around 3.8 billion passengers annually with 7.1 trillion revenue passenger kilometers (RPKs). Fifty-three million tons of freight were transported by air, reaching 205 billion freight ton kilometers (FTKs). Every day, more than 100,000 flights transport over 10 million 4 passengers and around USD 18 billion worth of goods."(IATA, 2017b). Within the same report, IATA has published some prominent indicators for global aviation sector. These indicators, shown in the Table 2.1., are demonstrating how global aviation sector expanded since 2015.

Table 2.1. *Prominent Indicators for Global Aviation*(IATA, 2017b)

3,8 billion Passengers carried by airlines (%6,8 increase from 2015)	53 million tonnes of freight carried by airlines (%4 increase from 2015)	35 million scheduled commercial flights flown by airlines (%3,7 increase from 2015)
54.000 Routes Worldwide (over 2.000 new routes from 2015)	49 billion kilometers flown by airlines (%5,3 increase from 2015)	76 billion hours flown by airlines (%5 increase from 2015)

In addition to providing rapid access all over the world, the aviation sector provides significant benefits to economic growth by increasing trade and tourism between countries and regions and by providing various jobs. According to a study conducted by ATAG (Air Transport Action Group) referred in the Aviation Benefits report, total economic impact of the global aviation industry reached $ 2.7 trillion in 2014, and it accounts for 3.5% of world GDP. It also provides a total of 62.7 million jobs worldwide, of which approximately 10 million are direct(ATAG, 2016). In addition to its economic contributions, the social benefits of the aviation industry are also recognized as very important. Today, it is the fastest and safest means of mass transport, as well as providing various social activities such as humanitarian aid and health services to many remote locations. It also stands out as the fastest means of emergency assistance, such as wars and natural disasters. It also provides students in developing and underdeveloped countries to travel long distances to reach a higher quality education and, indirectly, to share their cultural values(ATAG, 2016).

At this point, it can be assumed that the 21st century aviation sector, which has a globally significant importance, is one of the most important elements shaping the national and regional economies. For this reason, this part of the research will include

the relation between air transportation and the current and future economies of Europe, Africa, Asia-Pacific, America and the Middle East regions, which are the major regions accepted in the world. In order to predict the future role of Istanbul as a city which could be assumed as in the middle of the global world in many respects, comprehension of how the world will shape in the future and how different regions will play a role in this future in terms of air transportation is quite important.

2.1.1. Evaluation of Major Regions of the World in terms of Air Transportation and Economic Futures

This section will attempt to understand the current and future economic situation of the major regions of the world, as well as the future of the aviation industry of the regions.

2.1.1.1. Asia Pacific

With its massive population and rapid economic growth in recent years, one of the most important regions for both the global economy and aviation sector can be regarded as the Asia-Pacific region. Naturally, one of the most striking actors of this region might be assumed as China.

China

China, which has nearly %15 of the share of global GDP in 2016(The World Bank, 2017c), continues to be a major global power, with consuming more than half of the world’s coal, aluminum and nickel, more than %40 percent of global copper and zinc, and nearly %30 of the world’s soybeans(Sanderson, 2015). Many countries have also benefited from the hunger of China, which has undertaken more than 25% of world GDP growth in the last decade(Worstall, 2016). More than a third of Australia's 2014 exports went to China, with 25% of South Korea's exports and 20% of Brazil(IMF, 2017). The slowing growth in recent times has dented the emerging economies, which are heavily dependent on iron, coal and copper supplies, such as Brazil, Indonesia and Zambia. While some sectors question the long-term sustainability of China's

economy(Fourcade, 2016), especially with the burden of the aging population, a large segment predicts that China will increase its effectiveness in the world, especially in the finance and trade sectors, and even Renminbi took the first step towards becoming an international reserve currency, which was included as the fifth currency in the Special Drawing Rights in 2016(The Economist, 2016).

In these years, the Chinese economy is decelerating and trying to rebalance its economy shifts from the industrial sector to the service sector. In other words, the Chinese economy is undergoing a transformation towards consumption and service oriented economy from export and investment oriented one. This is a disturbing development for all world economies accustomed to very high growth rates based on manufacturing industry.

Along with these, Chinese exports have lost some of their dynamism in recent years and have regressed by 7.5% in 2016, while imports contracted by 8.2%If global economic growth slows down in the near future and demands in the world are more aggressive, total imports and exports are expected to contract further(PWC, 2017). Consumption, on the other hand, showed a strong stance with a 71% contribution to GDP growth, contributing 13% more than the previous year. By 2030, the services sector is expected to increase its share in GDP to 70% and form the world's largest consumer market with a strong middle-class of $ 6 trillion(Oxford Economic, 2010).

China is still one of the world's most attractive destinations for foreign investment. As seen in Figure 2.2, the amount of foreign direct investment, which was 243 billion dollars in 2010, rose to 249 billion dollars in 2015. These foreign investments contribute to China by providing important technological and management skills to strengthen modern industries. In this direction, as China moves up the value chain, more and more Chinese companies will try to get foreign brands, technology and market nets. As can be seen in the same chart, China's $ 48 billion foreign venture in 2011 proved to be a global investor by reaching $ 187 billion in 2015. These two-way

investment flows will undoubtedly not only enhance China's productivity, but will also accelerate its future economic growth.

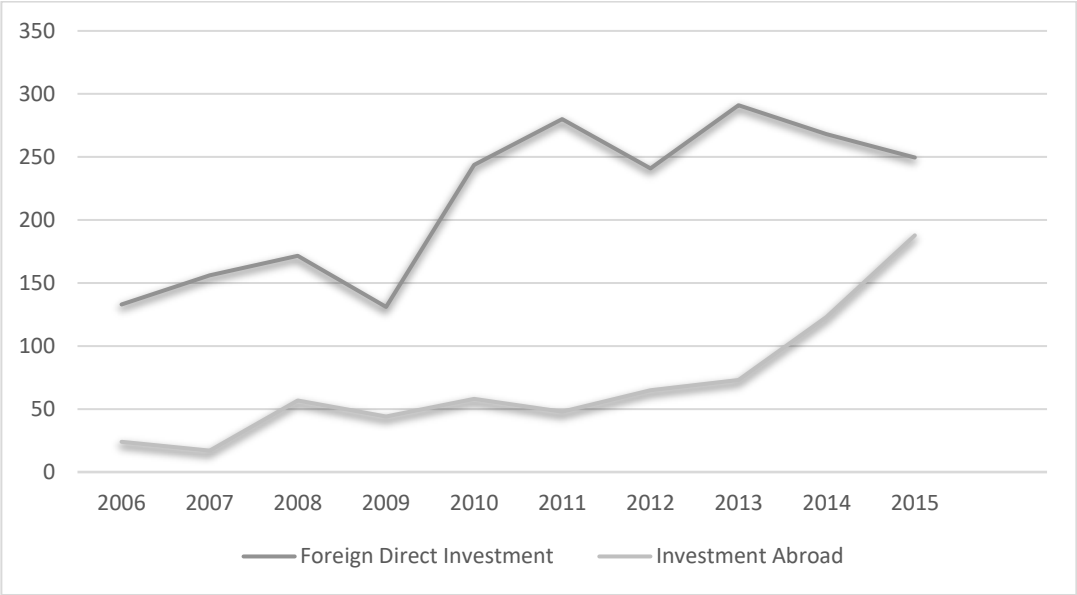

Figure 2.2. Foreign Direct Investments and Investments Abroad, Source: World Bank

On the other hand, it is anticipated that demographic changes will have some negative impacts on China's long-term growth. According to the United Nations "World Population Prospects" report, China's workforce population between the ages of 16 and 64 has entered a downward trend since early 2000s(United Nations, 2017b).

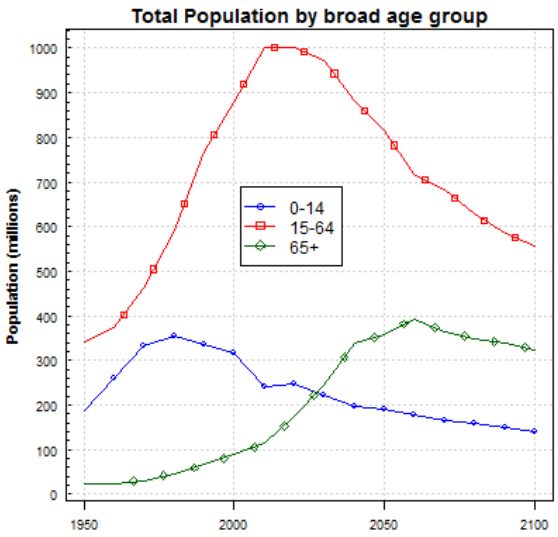

Figure 2.3. Total Population of China by Broad Age Group(United Nations, 2017b)

As can be seen from the Figure 2.4. (United Nations, 2017b), the number of people over 65 years of age by 2050 will increase significantly and the population in the work force age group will be reduced. The increasing aging of the population, the shrinking working population and the lack of strengthened technology-driven productivity will significantly impact China's competitiveness and economic vitality by drawing workers' costs upwards.

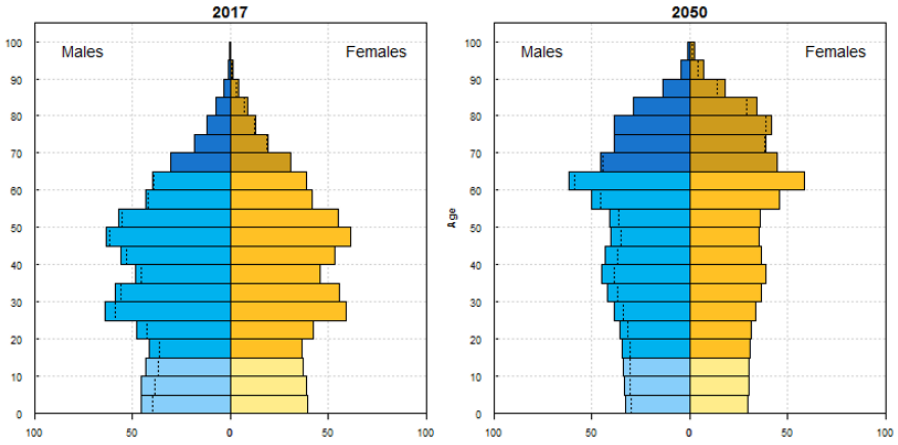

Figure 2.4. Population Pyramids of China(United Nations, 2017b)

Another risk factor for the Chinese economy is considered as rising debt levels. China holds the highest levels of the world's major economies, with total corporate debt nearly 160% of total GDP and total debt of country of 280% of total GDP(Rapoza, 2015). China's ongoing production-oriented structural reform will play an important role in improving the long-term growth potential and preventing the country from falling into the middle income trap. It should be recognized as an important measure to introduce structural reforms, to reduce operating costs, to create an innovative environment and to develop the strategic industry and services sector, to reveal the vitality of the private sector and to increase growth. Looking to the future, China is one of the countries with the greatest growth potential in the world. The urbanization process in the country is at a relatively early stage and there are many areas in which the service sector can develop in the logistics, information, marketing, financing and commercial issues in order to be able to reach the economies like USA in terms of quality development and business world.

Aviation in China

The aviation industry in China, where the economy is in a process of change, and which is now bordering on growing up, can be regarded as one of the cornerstones of this change. Especially in the Asia-Pacific region, the aviation sector and air transport are developing rapidly. According to Boeing's forecast report, in 2036, the world's most intensive air passenger transportation will be realized in intra-Asian flights (Figure 2.5), which is quite high compared to other parts of the world(Boeing, 2017).

Figure 2.5. Interregional Air Traffic 2017-2036(Boeing, 2017)

On the other hand, it is expected that the global aviation industry will need more than 28,000 narrow body passenger jet in the coming period in order to meet the aviation demands rising all over the world(Rowley, 2012). This undoubtedly stands out as an opportunity for China and is of great importance for the two countries that are targeting the aviation sector as a key sector to encourage economic growth. Civil aviation sector is pretty important for China due to diversifying its economic activities, reducing its dependence on foreign suppliers, and increasing development in other sectors. For China, which is committed to producing its own aircraft from the ground up, the local industry will be responsible for aviation electronics systems and engine production in the coming period. These two areas, which are the most difficult to specialize in aviation, can be used in civil aviation as well as in the military field. Given the campaign to modernize China's armed forces, the bi-directional functionality of these technologies is a source of great interest for countries.

Japan

Compared to China, Japan has been a senior member of the civil aviation industry with more than 40 years of experience. Considering years of experience and well-equipped technology sector, Japan is quite advantageous in terms of aircraft industry

according to China. Mitsubishi, Japan's most important carrier, is expected to serve the developed world in the future. Among all aircraft in the regional jet market, Mitsubishi Regional Jet (MRJ) is expected to have the lowest operating costs, lowest environmental impact and highest fuel efficiency(Stratfor, 2016).

Japan is very interested in civil aviation in order to encourage economic growth like China. This sector is considered quite suitable for a country like Japan where demographic decline is experienced. First, the industry can benefit from Japan's increasing demand for elderly population and elsewhere, regardless of the decline in the workforce. On the other hand, it could provide significant employment opportunities for Japan's manufacturing sector. And most importantly, aviation production, an increasingly important sector because most countries in the region do not have the experience and capital to enter the aviation industry, represents an important opportunity for Japan to provide a regional monopoly(Stratfor, 2016).

India

India is one of the star economies of the new era for a very meaningful population pyramid for the future, a gigantic domestic market, a growing middle class, increasing entrepreneurship/expertise in information technology, and the concentration of multinational private companies. There is no doubt that this irregular future will be one of India's world economic leaders in the long run, even if social irregularity, complexity, political unrest are important obstacles. In line with this goal, India has major objectives such as increasing exports of goods to 900 billion dollars per year by 2020 and increasing its share in global trade from 2% to 3.5%(Warrier, 2019). India joined the Regional Comprehensive Economic Partnership (RCEP), which will create a free trade agreement between the 16 ASEAN economies in August 2016(ASEAN, 2018). The goal is not only to make India one of the world's most important export destinations through free trade, but to establish trade transfer points in the countries of the region. The most important of these countries is the United Arab Emirates which has already become an important place in the international cargo transfer center. It is

also clear that this relationship will be reciprocal: while India is one of the most important export destinations in the world, it can be expected that the role of the regional trade transfer center, which the United Arab Emirates takes on, will become stronger. At this point, this kind of partnership is an important issue for Turkey because of the competition between UAE and Turkey in the region.

2.1.1.2. Europe

Europe, one of the most important actors in aviation in the world, is now struggling with economic and political problems. The future of the euro is becoming negative from day to day. It is envisaged that a possible "multi-currency" fragmentation and the formation of different free trade blocks would lead to a decline in Europe's influence on global trade(Moravcsik, 2016). It is thought that the region will be unpeaceful because it will have to struggle with growth problems, disappointing growth rates, high unemployment rates and debt problems that are constantly on the agenda. In these circumstances, the region still has hopes for global leadership, but the future does not seem so lucid. As long as there will not be any solution to problems such as rising populism and racism, Brexit, immigration and refugees, it may be difficult to find hope in the future of Europe(Rawnsley, 2019).

Especially after global financial crisis, it seems that things have become relatively bad in the Eurozone. As can be seen in the Figure 2.6, since 2008 GDP per capita in European Union has decreased more than %15(The World Bank, 2017c). Greece's economy has shrunk by 25% compared to 2008, and Italy, which is almost 10% shrink since 2008, is the closest candidate for the financial system to collapse(The World Bank, 2017c). The large financial loss faced by Europe (almost 3 trillion euros since 2008)(The World Bank, 2017b) has led to an increase in youth unemployment, which has damaged the lives of young people, causing business owners to go bankrupt and unable to protect the standard of living of fragile citizens.

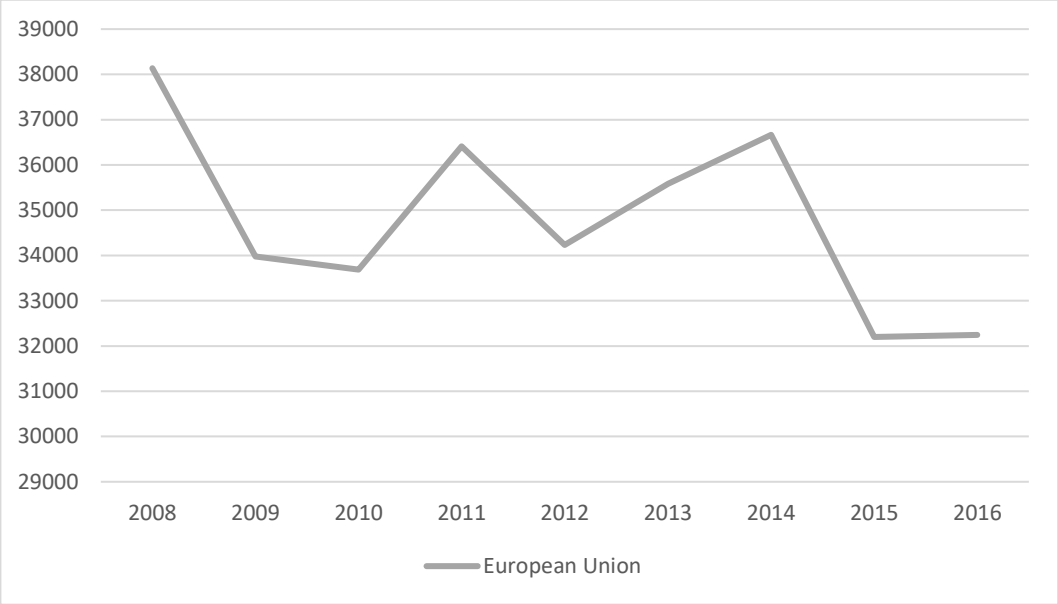

Figure 2.6. GDP per Capita (US$), 2008-2016 (The World Bank, 2017c)

Emerging markets around the world are growing day by day and the majority of global regimes are changing. For an interesting foresight, according to PwC, in 2050 the sum of the European Union countries will constitute only 10% of the world GDP. The main reason for this economic recession is that it is estimated that China and India will be the world's two largest economies in the coming period. According to PwC, the rise of China and India will gradually reduce the share of Europe's world GDP. It is estimated that in 2035 India will have a larger share than the whole of Europe(Hawksworth & Chan, 2015).

In addition to the economic strains that European countries have experienced in the past years and possibly in the future, the population issue poses some serious risks for countries in the future. According to estimates of EUROSTAT, as can be seen in the Figure 2.7, the population will increase with low growth rates until 2050 which will be the highest population level that year and decrease in the following period(Eurostat, 2015). The decline in the population of some countries like Germany, Spain and Poland has already begun. Besides, Europe's population is aging rapidly(Silver Economy, 2018).

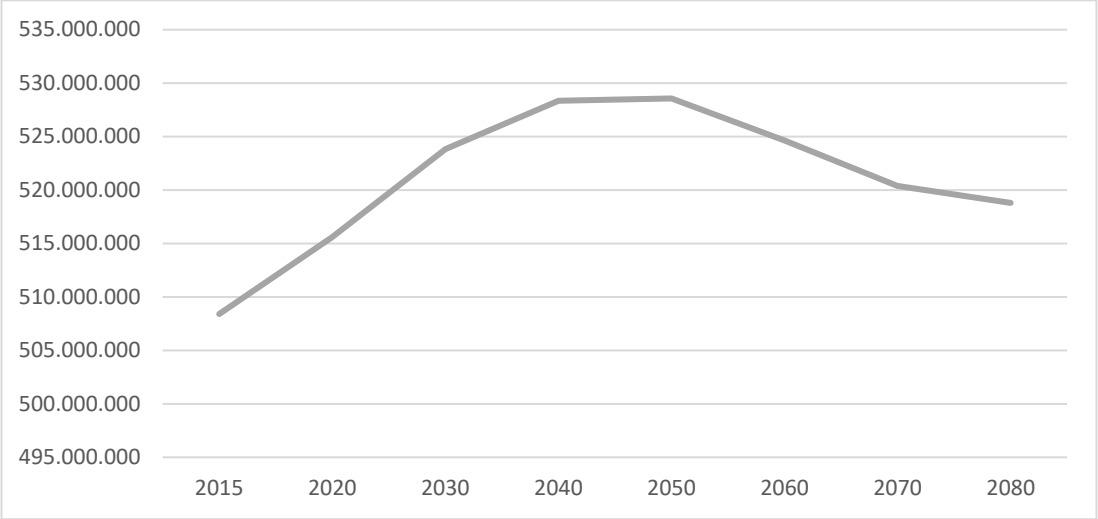

Figure 2.7. Population Projection of European Union (2015-2080) (Eurostat, 2015)

Aviation in Europe

Despite the many economic uncertainties that exist within the region, the aviation sector in Europe has shown a strong image in 2015. It is estimated that European GDP, which grew by 1.9% in 2015, will grow by an annual average of 1.7% by 2036 (Boeing, 2017). On the other hand, passenger traffic is expected to grow with an annual rate of 3.3% till 2036(Airbus, 2017).

According to Boeing's forecasts, the European aviation market is expected to grow to $ 1.1 trillion in value and 7.500 new aircraft over the next 20 years. It is estimated that in the direction of this growth, the majority of new planes will be acquired with 78% of the single corridor planes(Boeing, 2017).

According to estimates by Boeing until 2036, the majority of new aircraft deliveries in Europe will be single corridor aircraft at a rate of 78% as can be seen in the graphics below. Although growth in the European aviation market is slower than in emerging economies, the most important reason for the future demand of the region will be the need of renewing the old aircraft of Europe, which could be assumed more than 4,600 planes. This renewal will account for 56% of Europe's new aircraft market. Europe's

difference from other regions is that low-priced airlines are close to 47% of total traffic(Boeing, 2017). Low-cost airlines are particularly passengers between Europe and CIS and Latin-North American countries. This situation is expected to further develop in the coming years. As you can see, this is the reason why single-corridor planes, which are the type of airplanes most used by low-priced airlines in the present and in the following period, occupy such a great place.

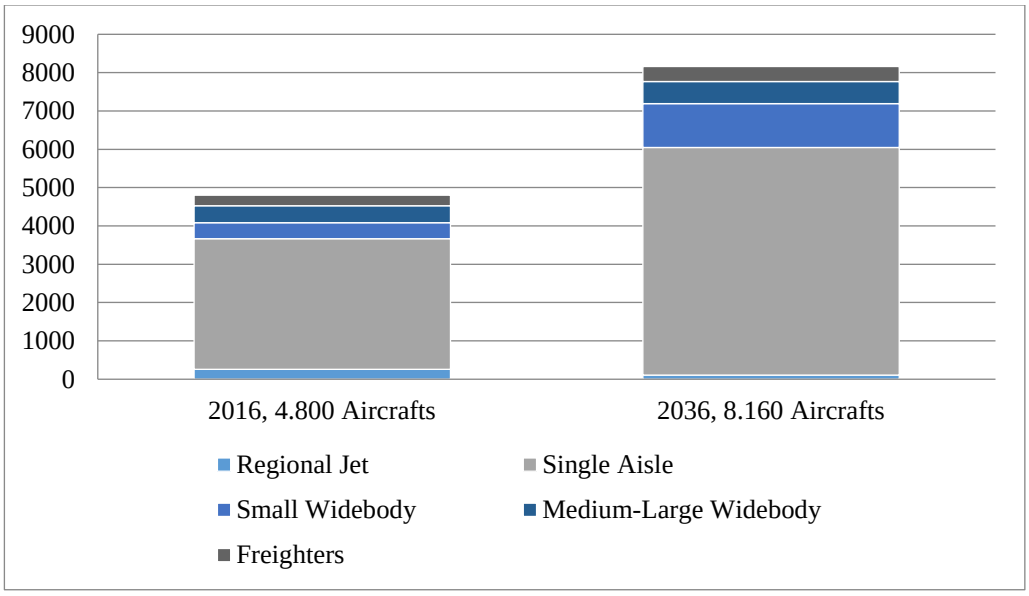

Figure 2.8. Shares of Aircraft Types(Boeing, 2017)

The European aviation market continues to evolve with new airline operations and business strategies, roots and initiatives. Developments such as the expansion of Lufthansa and Norwegian Airlines long-haul low-cost flights(Goldstein, 2018) and the announcement that Ryan-Air could pass free tickets in the upcoming years(Topham, 2016) show how Europe wants to keep its power in the aviation sector and continue its competition.

Low-priced airlines in Europe are considered the fastest growing segment in the market, serving 47% of all intra-European flights in 2015 via short-haul flights. In this

direction, the main airlines are focusing on long-haul flights in Europe through specific hubs and focusing on low-cost subsidiaries, airlines and passengers.

Major Middle Eastern airline companies such as Emirates and Qatar Airways have used their geographical advantage through airports to deliver single-stop routes from Europe to regions such as India, Australia and Southeast Asia, to pass on significant long-distance shareholdings owned by European companies. In this direction, European companies have shifted their long-haul capacities to the North Atlantic market, which is more profitable and has grown by more than 20% since 2010(Boeing Commercial Airplanes Market Analysis, 2016). Ultimately, the sector's reports give the lowest future aviation growth for Europe.

2.1.1.3. USA and Latin America

Since World War II, the United States is at the center of the global trade framework, although its dependence on international commercialism is lower than any advanced economies. In this regard, the country has used its influence in a very good way to both support growth and reduce the risk. One point of view suggests that the US will continue on this path in the near future and another point to an increasingly important turning point for the world to import the focal point of the US that supports its own trade and energy(Puspitasari, 2016). As a result, the economic fluctuations that can be experienced in many different regions of the world are considered as a matter of concern.

As an unpredictable outcome, US presidential election results led to Donald Trump being elected president of the United States, which in turn began to affect the global economy even on Election Day. While the US presidential elections are extremely important for the global economy, the changes that will take place on the global international trade and global monetary system stand out as the most important feature that will lead the world to a very different process.

Donald Trump, who founded his economic strategy on a highly nationalist-centered view in his presidential campaign, intends to protect US corporations and their

employees with by cancelling the North American Free Trade Agreement and imposing some restrictions on Chinese imports in line with this objective. The implementation of these policies has significant negative effects not only on the global economy but also on the US as well. Policies aimed at protecting trade through restrictions are often used to attract middle-low class workers for elections. However, these limitations can be disadvantageous for two important reasons. First, it is more affordable for producers as the imported products used by US consumers and producers are over low import taxes. However, these limitations can be disadvantageous for two important reasons. First, it is more affordable for producers as the imported products used by US consumers and producers are over low import taxes. Secondly, establishing trade restrictions and disrupting trade contracts can cause trading partners to apply similar policies and start trade battles on this retaliation as it is nowadays. As stated in The Guardian, *"Global markets have dropped sharply after China retaliated against Donald Trump's decision to impose tariffs on steel and aluminum, fuelling fears of an all-out trade war between the world's two largest economies. Hours after the US president announced moves to tackle what he believes are unfair trade practices, China signaled it would hit US goods such as pork, apples and steel pipe with higher duties."*(Fletcher, Farrer, & Haas, 2018) At this point, this kind of trade war will not just affect the economic growth of China but also it could be cause a recession in USA's economy. It may be argued that, a China with a slow economic growth and a protectionist USA would have negative effects on global economy. In terms of air transportation, this kind of trade war and restrictions between countries and blocks would have serious impact on air freight transportation. For China's integration into the world market, air cargo stands out as one of the most important vehicles. According to the IATA report, the Asia pacific region in the world air cargo market accounted for 37.4% share in 2017 while the North American region received 20.7% share(IATA, 2017a). Given the fact that these two regions have more than half of the world's air cargo market, it is quite clear how the trade battles will affect the global air cargo.

Having a strong competitive advantage in the sector based on its powerful fleet and aviation infrastructure, the United States stands out as a defender of liberalization of the aviation sector in order to be able to earn more economically from this advantage. Especially with the "Open Skies Agreement", the US has concluded bilateral agreements with many countries, which have allowed them to move to free market conditions by removing regulations on routes, capacity and wages(U.S. Department of State Bureau of Economic and Business Affairs, 2017). However, the American aviation sector which has been suffering from competition issues, has become more demanding for protectionism strategies rather than liberalization with Trump period. Although USA has suffering from some negations, the country still adopting strategies that sustain the competitiveness, also in terms of aviation. As can be seen in the Figure 2.5, in the future air transportation in North America will take the second place in the world after China.

On the other hand, Latin America's aviation growth is estimated at around 6%(Boeing, 2017). In fact, the Latin American economy began to slow down in 2011, with a gradual drop in global commodity prices. This has led to a deterioration in the growth of exports, a decline in investment, and capital outflows that weaken currencies. Although Brazil continues to be seen as one of the countries that will be influential in the future, it is predicted that the fall in commodity prices may reduce growth and lead to stagnation. It is estimated that for the next decade the future growth will be nearly 3%(Boeing, 2017). Although the country has rich natural resources and an expanding population, future growth will be limited due to the slowdown in China and the lack of internal reforms. In the coming period, Brazil will continue to be one of the most closed economies in the G20, a major external debt.

Mexico has greatly diversified its commercial and industrial policies over the last 30 years, during which the greatest importance has been devoted to liberalization, liberalization and the role of the private sector in the economy. A serious set of structural reforms approved by the Mexican Parliament between 2012 and 2014 is based on a strong political consensus on the need for change(Valenzuela, 2016). At

the moment, Mexico is at the application stage, one of the most complex stages. The most important challenge for the country to live in the near future is that the legal / structural reforms are not transformed into activities that can provide concrete results. The most important challenges in implementing the reforms are undoubtedly considered to be inertia, corruption, inefficient and excessive bureaucracy, and low labor productivity. On the other hand, Mexico's significant demographic power, abundant natural resources and production infrastructure stand out as important advantages that will enable reforms to be transformed into stable and high economic growth in the future. According to the report of PwC, it is expected that Mexico will be the seventh country in the world in terms of purchasing power parities by getting a higher rank than Germany and UK(Hawksworth & Chan, 2015).

2.1.1.4. Africa

Africa, which has grown its economy by an average of 5% per year in the last decade, is becoming more and more important in the global agenda with increasing trade and future aviation potential(Leke, Lund, Roxburgh, & Wamelen, 2010). The continent, which is as urbanized as China already, includes many cities with more than 1 million people. With a growing population which is more than 2 billion already, Africa is projected to have the world's largest workforce by 2040 with 1.1 billion people(African Development Bank, 2014). On the other hand, there are many different African senses since there are countries with more diversified economies such as Egypt, South Africa and Morocco as well as oil exporter countries such as Nigeria, Angola, Libya and Algeria. Other countries, such as Kenya, Tanzania, Ghana and Cameroon, which could be assumed as agricultural bases, are living through different transformations.

Africa's growth has always been shaped by commodity prices for over a decade, as a third of the planet's mineral resources are produced, with 10% of world oil reserves and 70% of global diamond trade. Although this was considered as a good quality for growth in the past, dependence on a few main products has led to high levels of

uncertainty, and for this reason many countries have sought to diversify into areas of production, service and tourism in the region(The Economist, 2015).

While the Nigerian economy still stands out as an oil exporting economy, the service sector accounts for 60% of GDP. The $ 3 billion film industry "Nollywood" is the world's second largest. Some African countries, including Kenya, Nigeria and the Democratic Republic of Kongo, are considered mobile technology leaders to offer innovative health and financial platforms while South Africa maintains its strong role in the region(Zoe Flood, 2016).

Despite long-standing trade ties with Europe, Africa now operates half of its trade with the developing region, also called South-South trade(Leke et al., 2010). China has doubled its share of African trade in the past decade, reaching 17% and has broad connections in Asia, South America and the Middle East. India has a share of 6% and Brazil has a share of 3% and is expected to grow significantly(Leke et al., 2010). Bilateral agreements, cross-continental agreements, growing trade and infrastructure investments are some of the indicators that intra-African trade is developing and growing.

Although some African countries are now considered to be economically inadequate, these countries will also show economic and political progress, along with the cancellation of trade restrictions and the development of infrastructures over the next few years. Since the majority of African countries have gained their independence, the African continent has been constantly shaken by civil wars, political instability, epidemics, chronic food insecurity and serious poverty. But in recent years Africa has experienced a significant resurgence in economic terms. In particular, emerging economies such as Brazil, India, South Africa and China has realized that the African continent is an investment center and a significant location of natural resources. Despite the global food and financial crises that have lived in recent years, Africa continues to grow surprisingly. Although this seems to be the way to Africa to solve the poverty problems, there is a growing optimism over the potential of the continent.

Having the most abundant natural resources in the world, Africa has significant potentials not only in terms of oil and minerals but also in clean energy. The whole world is unanimous that natural resources are no longer the only advantage of Africa, although it is considered different from today. As Western countries assume the burden of aging population, Africa stands out as the youngest continent in the world. Africa can become one of the most dynamic and productive regions of the world's economies if educational and training activities are undertaken to improve the youth potential.

In this rapidly changing global environment, Africa should be thinking well and developing proper strategies about how to tackle with the challenges that will arise and how to benefit from opportunities to be born. In this direction, Africa needs political and structural changes to transform its potential into advantages. In addition to this, the need for investment in young population and infrastructure, the need for skilled and sound institutions, leaders and business community who want to contribute to the development of Africa are the most important issues. At this point, the future of Africa could be seen clearly although, expecting future could be hard in most of the cases.

Future of Africa

According to some studies, Africa will be a peaceful and stable region that has resolved the extreme poverty with its dynamic, diversified and competitive economic structure over the next half century(African Development Bank, 2012). This vision foresees that the fragile and vulnerable African economies today will turn into more robust and developed markets and opportunities for the poor in this regard. Developments in recent years It has been seen that the economic growth of Africa in general is strong and that the agreements that will facilitate the establishment of business in large numbers depend on improvements in commodity prices and in peace and security resulting from a marked improvement in peace and security, especially in the western and southern-central regions.

When considering extremely dynamic social and economic conditions in Africa and around the world, it is difficult to make long-term accurate estimates for Africa. But the results of current economic performance indicate a positive future. According to the African Development Bank estimates shown in Figure 2.9, “both GDP and GDP per capita will steadily increase over the period 2010-2020. In the direction of this increase, in the coming years, most African countries will come to a mid-to-upper income level and the level of extreme poverty will be abolished(African Development Bank, 2012).”

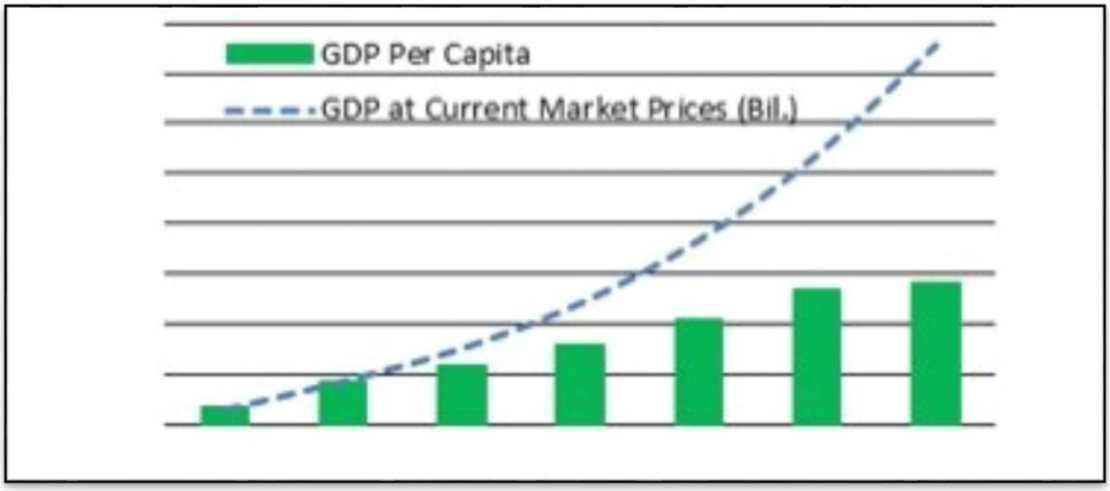

Figure 2.9. GDP per Capita of Africa between 2010-2020(African Development Bank, 2012)

Possible Effects of China’s Future on Africa

China's growth has caused a number of positive effects for Africa over the past decade. In particular, China's investment-oriented growth model, which created high demand for energy and minerals, has significantly increased its trade and export volumes in Africa. But now the Chinese economy is making a difficult transition from innovation in terms of supply to productivity and efficiency to demanding more consumption-dependent new models. The remaining ones from the investment-focused growth model create excess capacity in the economy. This tendency causes a direct and immediate effect on Africa. The slowdown in investment means that for now, China has more capital to send abroad than in the recent past. While consumption rates of

the country will increase steadily, the accumulation of China's investments for the foreseeable future will provide capital to the rest of the world with a significant measure. A soft economic transition in this direction will allow China to grow at a rate of 6-7% over the next ten years. Although it will not constitute a demand in the past years for energy and mines, it will be a stable direct investment source for other countries. In this context, Africa needs to compete by strengthening its human resources, infrastructure and human capital in order to get a share from these investments.

However, there is also the risk of creating more negative consequences. If the investments slow down too heavily, the outflow of Chinese capital will increase so much that it may cause a devaluation in currency. This result may lead to devaluation of other emerging market currencies. In general, if China does not make a smooth transition to the new growth model it will adopt, it will still grow in the medium to long term, although it will still be a large capital resource in the short term, and therefore will not be a source of capital or demand for other countries. The bright future of Africa also depends in part on the fact that China is in a moderate slowdown.

In the future, one of the strongest sides of Sub-Saharan Africa will be its rapidly growing youth population and consumption market. In 2050, it is estimated that one of every five people in age group of 15-25 will be living in Sub Sahara(Okonjo-Iweala, 2010). Moreover, the urbanization process in the region is keep going rapidly. The urbanization rates of the region between years of 2000 and 2008 have recorded as two times higher than the world average(United Nations, 2018). According to United Nations, the rate of Sub-Saharan people live in urban areas will be rise from %35 (300 million) to %67 (1 billion) between years 2005-2050(United Nations, 2018).

In this respect, rapid urbanization and growing youth population will have important effects of production, consumption, demand and economic growth. If proper infrastructure investments will be made by decision makers and human resource will be strengthen, Sub-Saharan Africa might be the most charming region for labor

intensive industries. Increasing production cost in Asia region will be an important opportunity for Sub-Saharan Africa. Increasing labor cost in Asia will make this opportunity to shift to the region.

Aviation in Africa

Sub-Sahara

As mentioned in many sector reports, Africa will be one of the most developing regions in the future in terms of air transportation(Boeing, 2017)(Airbus, 2017). Although, level of development of the region is still below than the rest of the world, an important increase in air transportation demand has been recorded in past years. As can be seen in the Figure 2.10, between the years of 2010 and 2015 air passenger amount had increased %18 and reached more than 45 million passenger in 2015(The World Bank, 2017a).

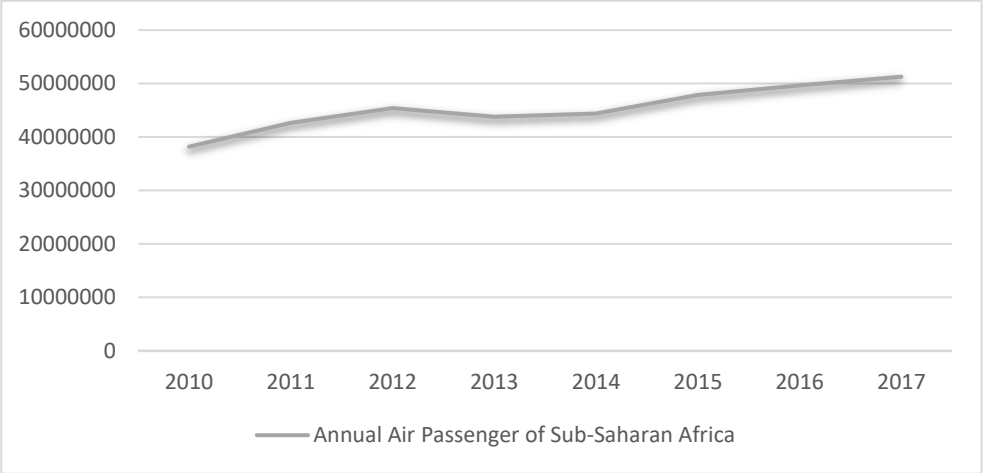

Figure 2.10. Annual Air Passenger of Sub-Saharan Africa(The World Bank, 2017a)

As mentioned before, urbanization process in Africa is rapidly continuing. In 2015 it is recorded that there were 56 cities in Africa with a population of more than 1 million while this number was 38 in Europe(United Nations, 2018). United Nations estimates that there will be 22 cities with more than 4 million population in 2025. Thus, this will bring the need of strong connections in terms of infrastructure, wealth, trade and finance. Besides the rapid urbanization, with the economic growth, increasing

population and occurrence of middle class, the air transportation demand is expected to be increase rapidly in the future(United Nations, 2018). In this respect, the most important point for Africa is to increase the number of people can afford air transportation.

Although region is promising hope for future in terms of air transportation, this development is delayed because of some reasons such as, security and safety problems, limited connections and insufficient administrative capacity. Safety is coming forward as one the toughest problems for Africa. In year 2011, the average of air traffic accidents had recorded as 9 times higher than world average(African Development Bank Group, 2012). The reason behind the high frequency of these accidents is assumed as insufficient application of international security regulations and standards. In addition, Africa is also facing with inadequate airport infrastructures, physical and human resources, limited connections and transit possibilities.

Egypt

Egypt is home to one of the oldest air transport sectors in the Middle East and Africa. EgyptAir, the most important airline in the country, was established in 1932 and holds the title of being the first commercial airline in the region(Institute of Developing Economies, n.d.). Over 80 years since its establishment, the airline has faced many challenges. In addition to the political uncertainties that have been going on since 2011, EgyptAir has been forced to withstand the competition that has come through the state-financed airline companies in North Africa and the Middle East region over the past few years.

Despite these obstacles, it is quite possible for the aviation industry in Egypt to move forward in Egypt, which has a considerable sense of economic and touristic attraction in the region if the political instability within the country is over. Although air traffic has decreased due to incidents, Cairo International Airport is still one of the busiest airports. With its population of more than 95 million(United Nations, 2017b) and one

of the major economic centers in the Arab world are the most important driving forces that Egypt will have in the long term.

Morocco

Morocco is undoubtedly becoming an important strategic location in Africa. An increasing number of global companies have chosen to be located in Morocco in order to gain quicker access to other African markets. Its geographical proximity to Europe, its political stability and its competitive power create a strong advantage.

This is especially true for aviation markets. Although the country still needs time to become one of the main players in the aviation and defense industry, the Moroccan aviation sector has an annual growth rate of between 15% and 20%. Today, there are more than 100 companies in the aviation sector and a total of 8000 people employed(Larmandieu, 2015). According to the Moroccan Aerospace Industry Group, it is likely that the industry will be doubled in 2020(Oxford Business Group, 2017).

Another effective factor for the future of Morocco's aviation industry is Bombardier's current organization. The first plant on the African continent allows the company to sell aircraft that are very suitable for the needs of the continent. In 2012, Morocco's aviation exports exceeded imports for the first time(The World Bank, 2012). The country has already attracted many big global players but it is not seen that the country has yet planned to go into production of an entire aircraft. Morocco must come from above the challenges in the education sector and create more added value to be successful in the aviation sector. If it succeeds, the aviation industry will secure North Africa's position in the world market as a top priority.

Tunisia

Nearly two-thirds of Tunisia's air traffic is produced by tourism flights, which means that the aviation industry tends to be heavily influenced by the fluctuations and flows of visitor numbers. For example, in the first half of 2015 - after a series of terrorist incidents in popular tourist areas - the number of passengers in Tunisia airports decreased by 21.5% compared to the same period in 2014(Oxford Business Group, 2016). The country is made up of 8 airports that provide direct access to five aviation destinations abroad.

2.1.1.5. Middle-East

The structure of Middle East is very complex because of hosting many kind of parts, geographies and qualities in itself. While there is extreme wealth and prosperity on the one side, there is war and high political instability on the other side of the region. The current state of the Middle East and how it will play a role in the future is very important for the aviation industry. Because, in fact, United Arab Emirates and Qatar are already acting as important actors in world aviation. For the Middle East region, both the present day and the most important elements that will affect the future can be listed as follows:

- For many OPEC countries, the need to stand out from oil-dependent economies, to promote economic diversity, to improve education and to provide more employment opportunities for citizens(Gregory, 2015),
- In addition to climate change problems due to long-term demand for oil and natural gas, perhaps even more important is the need for educated and motivated citizens to turn to alternative careers outside the well-financed public sector(Macit, 2016),
- It has the potential to act as an important transit point not only to China and India, but also to Africa in the long run, thanks to its potential to benefit from geographical location and trade routes

Among these factors, of course, oil plays the most dominant role for now. It is very difficult to distinguish between cyclical and structural trends in the Middle East, where many industries have their fate over oil. When the oil prices are high, the star of the region shines, while when the prices fall, things do not go so well. But perhaps the

Middle East is at the crux of the major trends that will reshape the world instead of other regions.

Undoubtedly, in the upcoming period, the Middle East will be deeply influenced by demographic and social changes, global economic power shift, rapid urbanization, climate change and increasingly scarce resources, and finally technological innovations. The rapidly growing population has supported the economy at the same time, causing resources to become more restrictive and youth unemployment problems to be occurred. Part of the increase in population is due to the fact that other countries are rapidly coming to the country because Dubai, which is one of the fastest growing markets in the Middle East, transforms itself into a global "transfer center" in the direction of global economic power.

For the future, it is possible to adopt an optimistic scenario on behalf of the region when it is assumed that the gunmen in the region will end up with an agreement between Iran and the Gulf countries. The shift in global economic power with Asia, Africa and Latin America is evolving at a rapid pace with the production of more than half of the global GDP by these regions and the rapid flow of trade and investment between regions. This shift has not only allowed the Middle East, located between Africa and India, to be take place in the middle of many fast emerging markets, but also above the new Silk Road route between China - Central Asia - Europe. In the direction of changing trade patterns, many Middle Eastern companies are investing not only in Asia but also in Africa and Latin America in large quantities.

Investment flows fluctuate strongly in the region due to oil-focused investment cycles, investors' sense of stability and predicted power regulatory regimes. The investment flow to the Gulf Arab States, undertaken by the United Arab Emirates in mid-2014, was only $ 20 billion, which is four times lower than 2008 investments(PWC, 2016). The end of sanctions imposed by the EU and the US on Iran has led to the interest of many investors and it seems that countries such as Saudi Arabia and Egypt are going

to improve their governance, transparency and accessibility in order to attract foreign investors(Aljazeera Turk, 2016).

Within this period Dubai has used the advantages of the region to attract global talent and turn it into a global hub of aviation, tourism and logistics, and at the same time become an institutional base for operations in the Middle East. Dubai International Airport has become one of the biggest airports in terms of international passenger traffic in the world in 2014(ACI, 2018a) and contributed up to 37.5% of the total GDP of Emirates(Emirates, 2014).

Air Transportation in Middle-East

Dubai

Dubai International Airport, which was not even on the world's busiest 30 airport list in 2006, has grown by 10.7% per annum for 2015, had become the world's third busiest airport with a total passenger capacity of over 78 million(ACI, n.d.). The most important advantage of Dubai International Airport, which owns more passenger very busy and big airports like Tokyo, London Heathrow, Los Angeles and Chicago O'Hare in the world, is its location as Europe's easternmost and Asia the westernmost transfer hub. The United Arab Emirates, a very important trading point between Europe and Asia, plays a key role in the new silk road of aviation. Dubai has rapidly become an excellent air transportation link, as it lacks the negative weather conditions for aviation such as snow or fog and is within an 8 hour flight distance of two thirds of the world. In this respect Emirates Airlines, Qatar and Etihad had captured significant air traffic from Singapore and Cathay Pacific Airlines. At present, Eastern Asia, Australia and New Zealand are forming the biggest market of Emirates Airlines which is nearly %30(Robehmed, 2014).

Daniel Tsang, one of Aspire Aviation's Hong Kong consultants stated that; 25% of Australian-European traffic has shifted from Hong Kong and Singapore to Dubai in recent years in terms of unscheduled aircraft traffic. In the last decade, the global aviation business world has evolved from being transatlantic to a structure that is more

or less oriented towards Asia. This has put Dubai in a very important position in the context of being on all existing trade routes. With the expansion of Emirates in Asia, DNATA (Dubai National Air Travel Agency) has become an important force in the region in terms of ground operations. Emirates and DNATA have drawn significant lessons from strong relationships with Singapore Airlines and Singapore Airport Terminal Services, helping Singapore become an important hub for this process(Robehmed, 2014). Since 2010, DNATA has increased its annual sales by 75% to $ 2.9 billion(DNATA, 2016), making it the most important competitor in the region. The SATS (Singapore Airport Terminal Services) annual sales rose by only 5.2% to $ 1.45 billion in the last three years(SATS, 2016). DNATA in the region is not only competing with SATS, but is also in competition with Cathay Pacific's catering, cargo and ground services departments. In the coming years, China's more than 30 airport construction planning is also turning DNATA into the Chinese market. With the opening of the El Maktoum airport, which is scheduled to be in 2020 and will be able to serve 160-220 million passengers and 12 million tons of cargo per year with 5 runways(Dubai World Central, n.d.), Dubai might be at the top of the list in the future.

Iran

For Iran, which has been locked in the international sanctions regime for almost 40 years, the most important question that comes to mind these days is that is it too late to be effectively involved in the rapidly changing aviation sector. Until this time, Tehran has always been the most suitable location for airlines connecting Europe, the Middle East and Asia. However, although Tehran's central position-based appropriateness is a very important value, it has not been evaluated for a long time, mainly for political reasons. If Iran were not in such an internationally isolated position, Tehran would be the most important rival of Dubai in the region today, perhaps owns the role of Dubai. Having an advantageous position geographically like Dubai, Tehran could be seen one step ahead of Dubai as it is further north and closer to the flight corridors between traditional Europe and Asia. Moreover, Tehran could

stand out as a more important point because it was one of the most beautiful gates that opened up to the ancient world on earth.

Today, Iran's most important and urgent priority is the need to replace old Airbus and Boeings, which range from 20 to 35 years old, with new ones. On the day the international sanctions were lifted, Iran-Air has announced that 114 new orders had been ordered from Airbus(The Guardian, 2016), and a similar deal was signed between Iran and Boeing over 80 aircraft(Erdbrink, 2016). The Iran Air Airline says it needs at least 580 new planes over the next ten years and plans to acquire 300 of them in the next five years(Poon, 2016).

Another important development for Iran is the establishment of an independent aviation market planned by the country with Russia. Manouchehr Manteghi, President of the Iran Aviation Industry Association, said that if Russia and Iran continue to cooperate in the aviation sector, significant results could be achieved. Referring to this issue at the Iranian Aviation exhibition, Manteghi brought this plan to the agenda with the following words: "Iran is in a good position in aviation as much as it is in the aviation sector. There are too many companies in this area to conduct AR-GE work. It is also important to recognize our potential abroad. The fact that Russia and Iran know each other's potential will increase the trade volume in the field of technology. Russia ranks 11th in the field of technological development and 9th in Iran. Think about how strong our collaboration is and what its consequences can be(Sputnik, 2016). "

In the coming period, Iran Air has the opportunity to enter major markets by oversea flights through its citizens from California, Canada and Europe. Undoubtedly, it will be surprising to see that under current regime Iran Air will operate as an international competitive airline. In this respect, the aviation industry has emerged as a new stage for centuries of competition between Arab and Iranian cultures. Looking at any period in history, with its prominent structure, Iran can stand out as an important player on

the international scale in the coming period. For this to happen, Iran's relations with the US need to be normalized. This is a difficult situation to solve in a short time.

Qatar

Qatar, stands out as a country that is at a very advanced level in terms of economic and cultural prosperity in the world. Along with famous GDP per capita levels(The World Bank, 2017c) and prominent Doha global city, Qatar is making significant strides in various economic sectors. Qatar, which has transformed into a global tourism hub and has made significant progress in the world, is also growing considerably in the aviation sector. With the ever-increasing flow of foreign passengers, growth in Qatar's aviation does not seem to slow down in the coming period.

The aviation development has accelerated in 2014, especially with the opening of the Hamad International Airport, which is now available to passengers at extremely modern facilities. In 2016 the airport has served more than 37 million passengers with an increase of 20,4% and It is predicted that the airport will grow rapidly in the coming period(ACI, 2018a). With the rapid development in Qatar, the future of the aviation market will look bright in the coming years. It is likely that Qatar will gain a significant share of the aviation market among all Gulf Arab States in the coming period. Qatar Airways is also developing more and more every day by adding new stops and connections and growing its fleet.

On the other hand, the main obstacle that is encountered all over the world in order to increase the income of a sector, to create job opportunities and to increase the profit rates is considered as the provision of compatibility with existing policies. For Qatar, which stands out as a country among the Gulf countries, the "Open-Sides" policy has made considerable strides for the country to grow in the aviation industry.

2.1.2. HUB Airports and Their Importance

One of the most important components of global aviation system could be assumed as hub airports which are mainly used by an airline company in order to concentrate its passenger traffic and handle flight operations in that airport. Although there are some hub airports in the world which can differentiate by their roles like passenger traffic, air cargo or regional hubs; the most important and famous ones could be assumed as global hubs. This chapter will mainly focus on what an aviation hub is and why they are significant for aviation system and world. In addition, the major hubs of the global aviation system will be examined and important competitors of Istanbul will tried to be identified. By this means, the competitiveness of Istanbul among its rivals in terms of being a global hub will be discussed. Since the most important goal of Istanbul Airport is to be a mega global hub, the competition between Istanbul and its rivals should be well comprehended in order to think on the future of the airport and its success.

There are two types of route architecture in aviation which are Hub-Spoke and Point-to-Point networks. Point-to-point transit is mainly refers to a travel that realize between two points rather than using a transfer center in order to reach the desired destination. Unlike point-to-point travel, hub and spoke network plans the traffic upon a hub and distributes the travels to different points. The Figure 2.11 could be more explanatory to understand the difference between these two systems. As it can be seen in the Figure 2.11; in point-to-point networks 10 routes are required, while in hub and spoke network 4 is enough in order to link 5 different destinations.

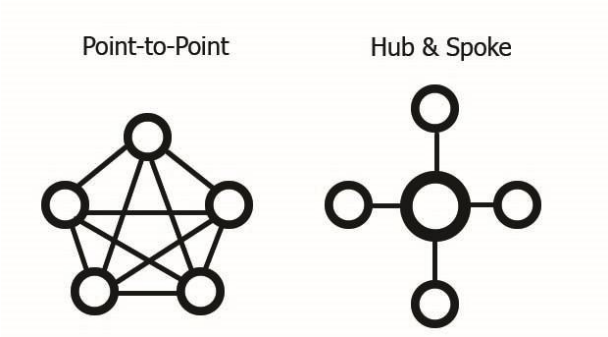

Figure 2.11 Point-to-point and Hub-Spoke Networks

The concept of hub airport or airline hub was revealed with the fact that the airline companies intensified all their operations to a small number of airports with the purpose of lowering their expenses, making their operations easier and providing more intensive air transportation services. Hub and spoke networks has been developed after the deregulation of airlines in US which was in 1978 and this had provided a rapid growth in the airline business(Cook & Goodwin, 2008). Moreover, this kind of a network also provided a way of using transportation resources more efficiently. By using fewer routes and airplanes, countries and regions had linked many different destinations to each other. The hub & spoke networks provides significant economic benefits not only for airlines but also some advantages for passengers. As Cook and Goodwin stated in their article; *"The advantages of the H&S system derive from consolidating the travel demand of each spoke city to most or all of the destinations in the network. Economic advantages increase with passenger density and network growth, positively affecting both supply and demand. Passengers prefer to use a single airline for their entire journey, so the ability to serve many cities of varying sizes confers a competitive advantage. Passengers making hub connections benefit from closely timed flights, single check-in, more convenient gate and facility locations, and reduced risk of lost baggage. Knowing that an airline likely serves a desired destination saves the passenger search and transaction costs. Familiarity with the airline's product lessens uncertainties and increases loyalty, particularly when linked to loyalty programs."*(Cook & Goodwin, 2008).

Despite these important advantages of hub and spoke networks and hub airports, naturally there some disadvantages also. First and foremost disadvantage could be assumed as traffic jam and delays. Because of serving many routes and dealing with high amount of airplane operations, hub airports are mostly over populated and this brings one of the most bothering issues for passengers in air transportation, delays. Secondly, the cost of operation and the inefficient use of resources can be considered as one of the main disadvantages. Although the hub-and-spoke network provides some financial advantages for airline companies, the cost of operation at the selected airport can be quite high. Since the landing and taking-off takes place at certain peak times in hub airports, all kinds of resources, such as ground handling services, catering etc. are used at certain time periods, while at other times they are used at very low levels. Cook and Goodwin indicates that *"Typically about 40% of all network carrier passengers have the hub as their origin or destination. The remainder only passes through the hub(s) to make outbound connections. Extensive facilities and substantial personnel are needed solely to accommodate these connecting passengers. The passenger service agents, gates, lounges, baggage facilities, ramp and maintenance personnel dedicated to passenger connections are not necessary if flights operate non-stop between passengers' origin and destination(Cook & Goodwin, 2008)."*In addition, due to the transfer of baggage of transfer passengers should be very quick, high-tech products have to be used, and this is another factor that increases costs. Regardless of some drawbacks, hub and spoke networks provides many benefits and makes the airline companies more profitable and efficient.

In addition to its direct contributions to air transport, the hub airports have also made significant contributions to urban and regional economies. The spaces created by the transfer centers can be considered very important for cities and regions, with creating various sectors, trade and tourist potential and providing job opportunities in a wide range of sectors. In addition, airport-oriented urban designs such as the airport city and aerotropolis, which have an important place in today's literature, are generally developed through hub airports. In the global world, airports are not just linking

different destinations to each other, but the regional and national economies. ATAG (Air Transportation Action Group) specified the economic benefits of air transportation as;

- Facilitating the world trade,
- Significant for tourism,
- A booster across the global economy for productivity,
- Improves the efficiency of the supply chain,
- An enabler of investment both into and out of countries and regions,
- Can act as a spur to innovation
- Provides consumer welfare benefits to individuals.(ATAG, 2004)

In addition to national economies, the impacts of hub airports on regional economies are also important. Two studies which are mainly aiming to measure the regional economic impact of Amsterdam Schipol and Frankfurt airport shows that hub airports have made significant contributions to their regions. Hujer and Kokot states in their article of "Frankfurt Airport's Impact of Regional and National Employment and Income" that; *"International airports are entities that have a central economic meaning for the surrounding region. Apart from their original function as suppliers of aviation services, they also produce goods and services that are more or less tightly connected to their main function. Indeed, airports have become locations for a wide range of businesses, including airlines, freight forwarders, flight catering, fuel services, restaurants, hotels, car rentals, aircraft maintenance services, retail and others. These economic activities are carried out by the airport operating company, airlines and other companies that are located on the airport site. None of these activities can persist without any links to the economic environment outside of the airport site*."(Hujer & Kokot, 2000). In the article of "The Regional Economic Impact of an Airport: The Case of Amsterdam Schipol Airport", authors assumes the hub airports as important assets for regional development because of providing a gateway to global market, in other words promoting import and export capacity.(Hakfoort,

Poot, & Rietveld, 2001). In more detail, Hujer and Kokot classifies the impacts of an airport on regional economies into 4 which are;

- "Direct impacts result from production, income and employment associated with the economic activities located on the airport site.
- Indirect impacts are generated in the surrounding economy through the chain of suppliers of goods and services to the direct on-site activities.
- Induced impacts result from the expenditure of incomes paid to workers employed on the airport site or in the chain of suppliers.
- Catalytic impacts are generated by the attraction, retention or expansion of economic activities within the regional economy as a result of the accessibility to markets due to the airport. The basic assumption here is that many companies choose to locate in an area precisely because of its proximity to an international airport."(Hujer & Kokot, 2000)

2.1.3. Airport City and Aerotropolis

More specifically, as a part of regional impact, global hub airports are bringing the concepts of airport city or aerotropolis with itself. While the airports are just the spaces for airplane operations and transfer of passenger and cargo in the past, now they have break the rules and offering a wide range of services and changing its perception of space for urban areas. Airports are not just hosting for duty free areas or food courts, but cinemas, wedding halls, hospitals, museums, art galleries etc.(Kasarda, 2006). In other words, the concept of airport city accepts the airport as the most important center of a city rather than a space just for travel operations located in the periphery of the urban area. In the concept, airport is an urban space which provides variety of services and connected all over the city with strong transportation network.

The concept of aerotropolis developed by Dr. John Kasarda can be considered as a concept in which the effects of airport city concept as urban space spread to larger areas. It can be considered as an urban model that takes the concept of the airport city out of the fence and has different urban uses shaped around the airport and ultimately forms the city around the airport. The airport, which is located in the center of the city and which is the most important focus, is considered as the most influential factor

shaping aerotropolis and it is accepted as a city center rather than just a transportation point. The most important reason accepted by Kasarda in the development of this concept is that modern cities have always been shaped and developed by the transportation network throughout the history. Kasarda described this development process as 5 different waves. It is stated in the book of "Aerotropolis- The Way We'll Live Next" that "John Kasarda sees the history of cities as a rising tide of breaking waves. Ocean harbours were swept away by river ports, which yield to railroad terminals that were in turn exploded by highways and suburbia. Transportation is destiny. The fifth wave is here, and while we won't commute to work George Jetson-style anytime soon (though rest assured there are dreamers working on this), how we measure and meter our personal velocity has already begun this shift."(Kasarda & Lindsay, 2011).

In his own words, Dr. John Kasarda described the aerotropolis as follows: " The more dispersed airport-linked development is giving rise to a new urban form – the Aerotropolis. Similar in shape to the traditional metropolis, made up of central city and its commuter-linked suburbs, the Aerotropolis consist of an airport city core and extensive outlying areas of aviation-oriented businesses and their associated residential developments. A synthesized model of the Aerotropolis based on development features around major international hub airports."(Kasarda, 2006). The spatial features of an aerotropolis can be seen more clearly from the Figure 2.12.

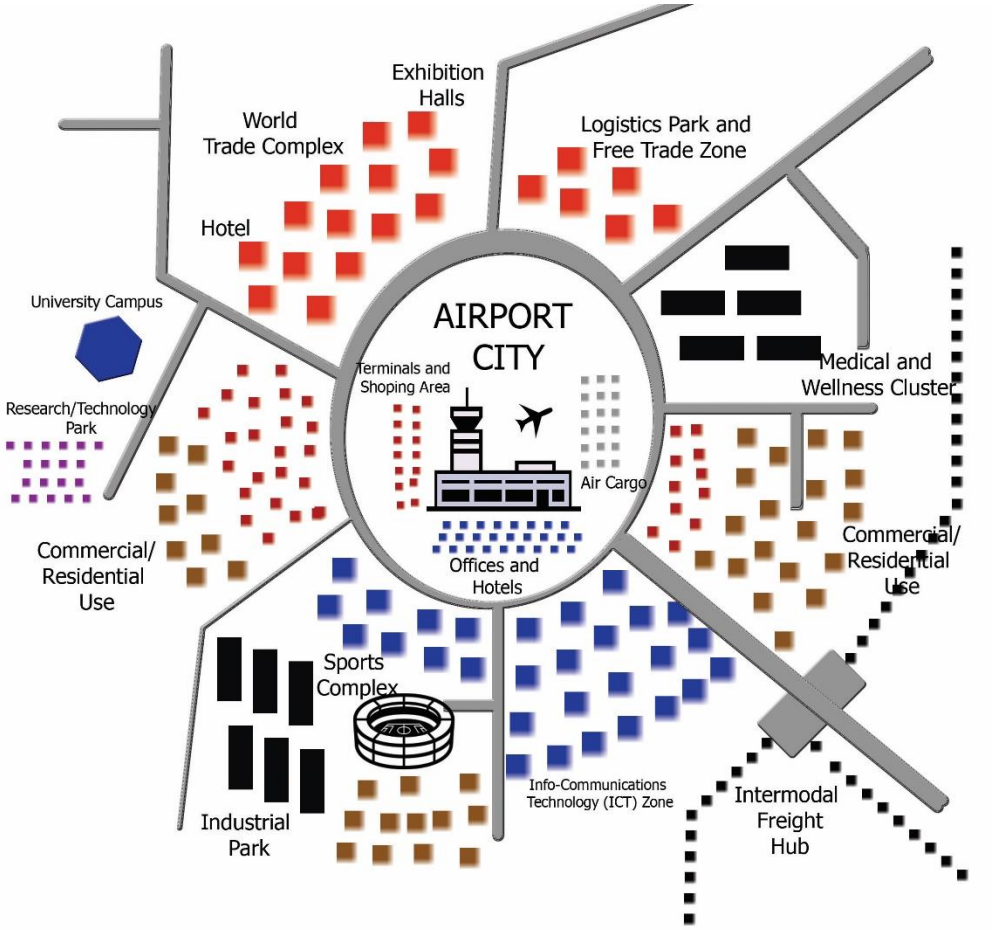

Figure 2.12 Aerotropolis(Kasarda, 2006)

As it mentioned before, the hub airports have important contributions to the both regional and national economies. Beyond that, the airport city and aerotropolis concepts also bring significant benefits for cities, regions and countries. In addition to the direct economic contribution provided by the intensive air traffic, the airport cities and the aerotropolis also provide many new business opportunities and employment. Dutch aerotropolis designers in Amsterdam states that; "The airport leaves the city. The city follows the airport. The airport becomes a city."(Kasarda & Lindsay, 2011). This kind of flow points out a formation of new central business district and at the end generation of new employment opportunities. Memphis International Airport, by this means, is an important example by providing 160.000 jobs in its metropolitan area. In the Memphis region, one of every four jobs are related with the airport and in 2007

had an annual economic impact of 29 billion dollars(*Global Airport Cities*, 2010). But perhaps the most important feature of the airport cities can be considered as the region's strong and fast integration into the global network. Together with its strong transportation benefits, by having meeting centers, headquarters, representative offices of different companies, conference halls and financial institutions, Aerotropolis is an attracting factor for business world.(*Global Airport Cities*, 2010). In the Global Airport Cities report prepared by ACI, it is stated that; "Chicago's O'Hare International Airport area has become the second-largest office market in the US Midwest, while the Dulles region, centred around Washington DC's Dulles International Airport in the northern Virginia suburbs, contains more Class-A office space than downtown Washington DC."(*Global Airport Cities*, 2010). This indicator can be regarded as an important sign that the business world is willing to be positioned around the important airports. Moreover, as it mentioned in the report of Airbus, significant portion of air traffic in the future will be among the aviation mega cities, thus airport cities could be assumed as one of the most important tools to be competitive in the global aviation sector(Airbus S.A.S., 2016). On the other hand, airport cities also have significant benefits for production economies. In today's global world, the most important issues in terms of being competitive for manufacturers can be accepted as rapid and qualified transportation of goods. In this context, the fastest and safest way to deliver goods produced by a manufacturer to the desired destination is the air cargo. An airport city integrated with other modes of transportation can increase the competitive power of the manufacturers who are in strong relationship with it. In other words, airport city or aerotropolis could be regarded as the most important gateway opens to global market in future.

One of the most important aims of the Istanbul airport is to realize the concept of the airport city within the region. İstanbul Airport City whose masterplan project work carried out by international design firm Perkins + Will, planned to be a first for Turkey and a role model for future airport cities all around the world. The project is planned to have a comfortable and fast transportation network with Metro station and train line

which will provide express access to Istanbul center. Within the boundaries of Istanbul Airport, the Airport City project will be developed in three main zones and 10 million square meters area, which has direct connection to the terminals of the city and within walking distance of the central areas, hotels, offices, hospitals, retail units, service buildings, social living areas, training and exhibition areas. In addition to these, the project will be supported by a Cultural Center with museums, exhibitions and conference halls. The Logistics Center is planned for the project with a strategic location. It is aimed to contribute to the development of the related sector and the national economy, which will have unprecedented position with direct access to the North Marmara Motorway and the port connection, the internal roads. The most important of the three main regions in the airport city project is the core zone. The region, which is planned simultaneously with the airport terminal building, is the most valuable and important region of the city. Within the region, there are hotels, hospitals, Turkish Airlines Headquarters, shopping center, offices, residential areas, mosque and metro station. The second region is the east zone which is the closest region to Istanbul city center. In the zone which will be built in the second phase, there will be expo center, designer outlet, hotel, office area, education, health care, residential area, Turkish Airlines Campus, mosque and metro station. The T2 zone to be constructed in the third phase will be carried out simultaneously with the second airport terminal. Within the zone there will be a hotel, office area, shopping center, serviced apartment, residential area, mosque and metro station.(IGA, 2017)

2.2. Future of Global Air Transportation – Forecasts of Major Corporations of Aviation Sector

2.2.1. Boeing – Current Market Outlook 2017-2036

In Boeing's forecast report, basically it is stated that the world air transportation has grown swiftly throughout its history, and in the last 5 years, it has grown by 6.2%. The underlying causes behind this growth are; the rise of living standards, the growth of the middle class in the rising markets of the world, and the increase of tourism and travel relations. Countries such as China and India, which are one of the most important emerging markets, stated that they increased the total number of passengers by more than 10% per year on average and found that they have contributed significantly to the growth of world air transportation. According to the report, India is expected to become the world's 3rd largest commercial aviation market by the early 2020s.

In addition, spending for travel and tourism in the world is increasing, according to the World Tourism Organization, these spending increased by 3.9% in 2016, more than GDP growth. As stated in the report, according to the report of the World Tourism and Travel Council, the increase in tourism travels will continue with an average of 4% over the next 10 years. In 2016, the region's strongest tourism growth was realized by the Asia Pacific region.

Besides the main factors affecting air transportation; regulations, infrastructure investments and technological developments under the forecast are also considered as factors that will shape the future of the air transportation. Market liberalization, Open Sky agreements and developments such as LCC have been stated to be the most influential factors in the growth of air transportation up to this time, and it is predicted that consumers will continue to demand more options and lower prices in the future. It is estimated that the Asia Pacific region will dominate this growth in the next 20 years, while airport infrastructure investments will continue at a significant pace. By the end of 2021, nearly 1 trillion $ was invested in the world's existing and future

airports, of which 40% was undertaken by the Asia-Pacific region. In the report it is acknowledged that airport investments will develop the access capacities of the markets, they will be very important for the modern business world and will link countries to global value chains. Due to this reason, it is estimated that the aviation industry will continue to develop over the next 20 years.

Long Term Passenger Forecast

It is predicted that the global aviation market as one of the strongest markets in the world will continue to grow in the future. The total number of passengers, which was 100 million in 1961, surpassed 3.5 billion passengers in 2016 and has grown rapidly. It is predicted that this growth trend will continue in the future and the most important growth will be in China, India and Southeast Asia.

According to Boeing's report, the world's average RPK growth in the next 20 years will be 4.7%. The growth that will be experienced in China is predicted to make Asia-Pacific region the largest transportation market in the world, while in the future China will be the largest national aviation market. At this point, Boeing predicts that the airports in the Middle East will be the most important regions to benefit from growth in the Asian region. Boeing foresees that these points will also grow above the world average due to their geographical advantage that they will be able to provide up to 1 stop flight from anywhere in the world. It could be assumed that this foresight is very important for Istanbul. The new airport, which will provide connections all over the world and will be one of the largest airports in the world, is likely to benefit from the growth of air traffic in the Asian region. According to Boeing's forecast report, air traffic in regions around the world will be shaped in the next 20 years as follows:

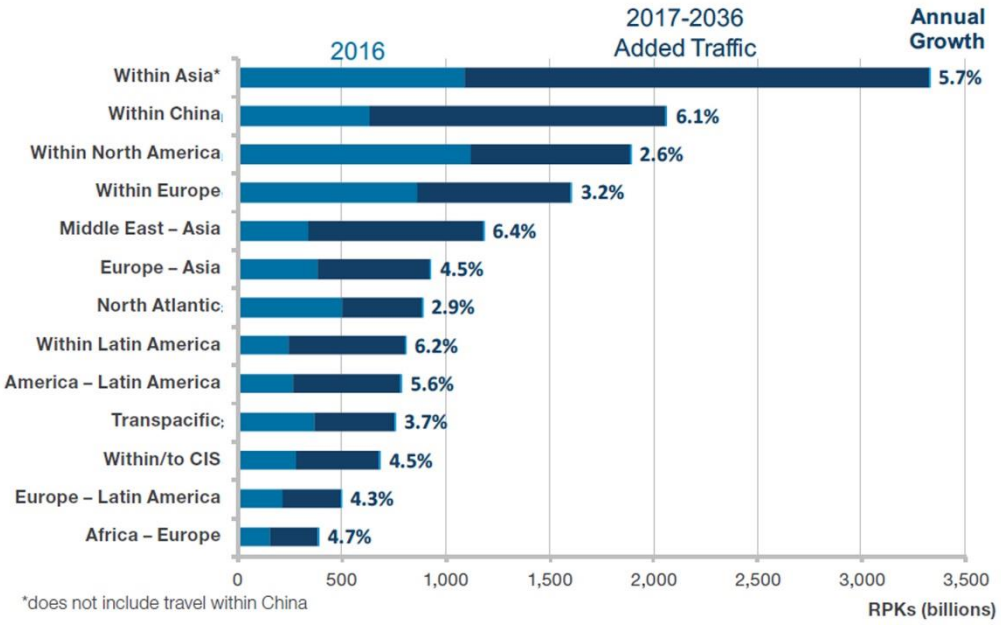

Figure 2.13. Interregional Air Traffic 2017-2036(Boeing, 2017)

Boeing has also predicted how will be the GDP's, air traffic, new aircraft and market value of the important regions of the world in the next 20 years. These estimates are as follows;

Table 2.2. *Boeing's Foresights for Regions*(Boeing, 2017)

2017-2036	GDP	Air Traffic	Deliveries	Market Value
Africa	%3,5	%5,9	1.220	180 Billion $
Asia-Pacific	%3,9	%5,7	16.050	2.500 Billion $
China	%4,9	%6,2	7.240	1.085 Billion $
CIS	%2,0	%4,3	1.230	140 Billion $
Europe	%1,7	%3,7	7.530	1.110 Billion $
Latin America	%3,0	%6,1	3.010	350 Billion $
Middle East	%3,5	%5,6	3.350	730 Billion $
North America	%2,1	%3	8.640	1.040 Billion $

The implications for key regions in Boeing's forecast report can be summarized in the Table 2.3:

Table 2.3. *Summary of Forecast* (Boeing, 2017)

Africa	• While positive developments in African aviation are on the way, the region needs to go even further in areas such as liberalization, aviation infrastructure, visa policies and legal regulations. • The aviation sector will play an important role in the future development of the region, which strengthens the links of cities in the African region with each other and with the outside world.
Asia-Pacific	• The Asian region is expected to grow by 5.7% per year in the future and will constitute 40% of global air traffic in 2036. • The main reason behind this growth, which will be experienced in future, has been recognized as economic growth and the growing GDP in the region. • On the other hand, air cargo has been accepted as one of the most important points in the Asian region. Considering that the world's most important cargo operators are involved and trade in many places overseas, the annual average of 4.7% is expected to increase.
Europe	• The European aviation market in 2016 has been a strong image despite uncertainties such as the stagnant economy, Brexit, and security and terrorism. • Despite lower growth than expected in emerging markets, European aviation will play an important role in the future thanks to its robust infrastructure. • In the coming period, the most important development for Europe is accepted as business models that allow LCCs to fly long-haul flights.
Latin America	• Economic reforms in countries like Argentina and Brazil are predicted to provide a 3% increase in regional GDP in the future. In addition to this, it is expected that there will be a GDP growth above the average of Chile, Colombia and Peru, and that these developments will increase the demand for air transport in the region. • In addition to economic growth, the competition among airline companies in the region is increasing, and this competition is expected to shape the Latin American aviation market. According to these developments, it is estimated that the Latin American aviation market will grow 6% annually over the world average over the next 20 years.
Middle East	• The Middle East region, which performs air traffic operations in the middle of Asia, Africa and Europe, stands out with a flight time of up to 8 hours to 80% of the world population. Growth estimates for this region are quite strong. • On the other hand, political instabilities, terrorism and wars in the region have made the region uncertain, and this situation poses a significant risk.
North America	• In-region air traffic in North America is the world's largest intra-regional air traffic market, and in 2016, 16% of global air traffic was in this region. • It is predicted that the intra-regional air traffic will grow by 2.6% in the future and the international air traffic will grow by 4% per year.

2.2.2. Airbus – Growing Horizons

Airbus, one of the leading companies of the aviation industry has published long-term forecasting study in the "Growing Horizons 2017/2036" report. This study focuses on future air traffic demand, traffic and network forecasting, aircraft demand and freight transport. The study, which considers one of the most important factors affecting air transport, as GDP, uses 15 different explanatory variables in estimates including this variable such as GDP, population, oil prices, unemployement, labor force etc.

Although the future economic growth in the various regions of the world is expected to be somewhat downward for the next twenty years, Airbus predicts a 4.4% increase in global air traffic. According to estimates, global air traffic is expected to grow by 4.9% over the next ten years.

In the forecast study, the region where the world air traffic will be most concentrated in 2036 is determined as Asia-Pacific. It is estimated that the RPK data of 2016 will be tree times higher by 2036. It is predicted that the air traffic between developing countries will grow by 6.2% per annum, and it is predicted that by 2016, 29% of world air traffic will reach 40% by 2036. On a national basis, it is estimated that US domestic flights will increase by 50% in the future and China domestic flights will be the largest air traffic in the world. It is estimated that 50% of the Top 20 traffic flow will be based on the Asia-Pacific region and 25% on the Middle East. This can be regarded as an indication of the importance of future for Istanbul.

Table 2.4. *Airbus's Foresights for Regions* (Airbus, 2017)

2017-2036	**Air Traffic Growth**	**Real GDP Growth**	**Fleet(20 year new deliveries)**
North America	%2,4	%2,1	5.620
Latin America	%4,1	%3,0	2.666
Europe	%3,4	%1,7	6.820
Africa	%5,3	%3,6	1.055
Middle East	%6,7	%3,4	2.526
CIS	%3,9	%2,0	1.203
Asia-Pasific	%5,6	%4,1	14.276

2.2.3. IATA – Future of Airline Industry 2035

The IATA's long-term forecasting report has identified uncertainty as the key issue to be considered before starting the forecasting study. The sudden and overwhelming changes that may occur in the future, as well as the gradual and unrecognizable changes, stand out as important obstacles to forecast the future for the airline industry as well as for all sectors of the world. As mentioned in the IATA report, answers to questions such as who the airline industry's customers will be, which routes will come to the fore, how the recipes will look, and how the preferences of customers and governments will be shaped in 2035 are crucial for the actors in the sector. There are some steps that can be taken in order to be prepared for the things that your future will bring, even though the future is full of ambiguities, as it has been stated.

In this respect, IATA's basic question is: "What will be the dynamics of change that will reveal the opportunities and challenges that IATA and its airlines need to overcome in the next 20 years?" In this direction, IATA has identified some indicators that will affect the industry, prioritized these indicators within themselves and developed 4 scenarios based on these variables and developed suggestions against future situations. To examine step by step in detail the work being done:

A. Determination of the dynamics that will affect the future aviation

Within the scope of the study, IATA identified 50 drivers of change on the basis of interviews with global trend experts and experts in the field of air transportation such as; infectious diseases, rising sea levels, terrorism, global aging, circular economy, cybersecurity, oil prices, robotics, internet of things etc.

B. Prioritizing the Drivers of Change

The 50 variables identified within the scope of the project were scored by the IATA Industrial Affairs Commission and 500 sector experts according to their importance and uncertainty. Later, these variables were grouped under 11 themes and converted to be used for scenario development. The following 11 themes are:

- Geopolitics
- Africa and Asia-Pacific
- Security and Borders
- Environment
- Economy
- Privacy and Thrust
- Values and Communities
- Technology
- Data
- Government
- Business models

C. Scenario Development

As a result of a workshop organized by IATA and participated by sector representatives, 4 alternative scenarios for 2035 were identified within the framework of this study. While the 2-axis method is used in the scenario development work process, each axis is defined on the themes which have both serious importance and high uncertainty for the sector's future. For axes, these two themes have been accepted as "Geopolitics" and "Data". Four different scenarios have been developed based on these two uncertainties and the remaining 9 themes have been included in the scope of future scenarios.

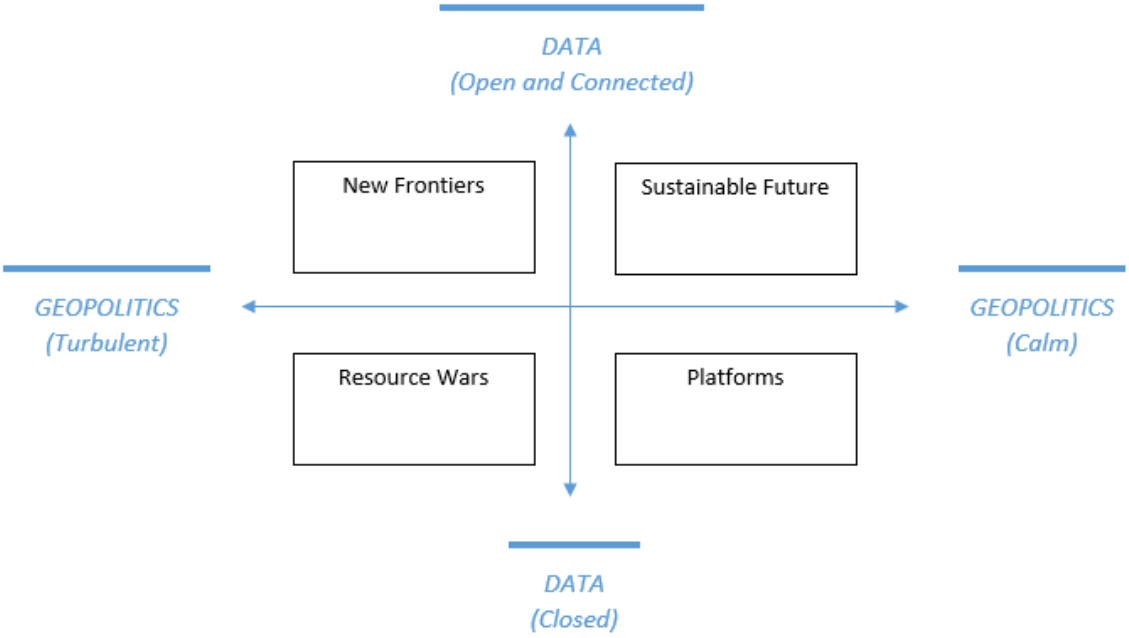

Figure 2.14. Scenario Axis of IATA (IATA, 2018a)

Scenarios;

- ✓ New Frontiers

In the context of this scenario, IATA anticipates a world in which “the power” is shifting towards the East with the creation of alternative institutions in the future. It is thought that China will be the most prominent country in the world in terms of sustainability in this scenario, while economic and military power competition is expected to move into new fields such as "space technologies". It is also expected that while the whole world will have open access to information and money, it will strengthen democratization processes and at the same time will empower people, companies and organizations. But on the other hand, cybercrime, state surveillance and other difficulties continue under this scenario.

- ✓ Sustainable Future

With the scope of the second scenario, IATA estimates a peaceful and multi-polar world with strong international governance that gives priority to infrastructure

decisions. Gaining access to knowledge and developments towards large data, predictive analysis and artificial intelligence has had a positive impact on society. While rapid technological developments have helped people achieve sustainability goals, new trade routes have opened up between the global South and the Asia-Pacific.

- ✓ Resource Wars

In this scenario, IATA predicts a turbulent world over the ongoing tensions between China and the US, which are adopting an aggressive and nationalistic stance in the future. Regional conflicts and territorial conflicts in the Middle East and Asia have emerged and world trade has reshaped through resource trade. The mobility between the regions is limited due to the inequalities between the rich and poor regions in terms of resources. From the data point of view, asymmetry between countries is estimated, governments use more data every day to monitor and control their citizens.

- ✓ Platforms

In the final scenario, IATA estimates a peaceful world in which China and the United States start international trade and cooperate. As the role of companies in the economy continues to grow, data and data platforms are under the dominance of the dominant class. In this scenario, Africa has not been able to enter the global stage due to the collapse in commodity prices.

D. Determination of Implications and Recommendations

At this stage of the work, some inferences resulting from the inputs obtained through detailed studies on the scenarios and negotiations with industry experts have been produced. In line with these conclusions, some suggestions have been developed in order to prepare for the future for IATA and its members.

2.2.4. EUROCONTROL – Challenges of Growth 2050

EUROCONTROL's forecast study for 2050 European air traffic has focused on the factors that can shape the challenges and opportunities that will shape the future air traffic rather than predicting future air traffic numbers. Within the scope of the study, they have analyzed the planning strategies and the variables that will help to identify risks within the framework of different scenarios and tried to determine their possible future impacts. Possible trends in the future of European air traffic identified as;

- Global and European labor markets
- Demographics
- Global economy
- Technology
- Environmental impact
- Air traffic demand
- Developments in land traffic

Within the scope of the forecasting study, four scenarios were developed in a workshop event by the attendance of EUROCONTROL employees and various industry experts. These scenarios are; (1) Global Growth, (2) Regulation & Growth, (3) Happy Localism, and (4) Fragmenting World. Scenarios are fundamentally differentiated from each other according to what Europe will adopt in the future at the global level from "outward" or "inward" perspectives, and will be able to adapt to future economic, political and technological changes or not.

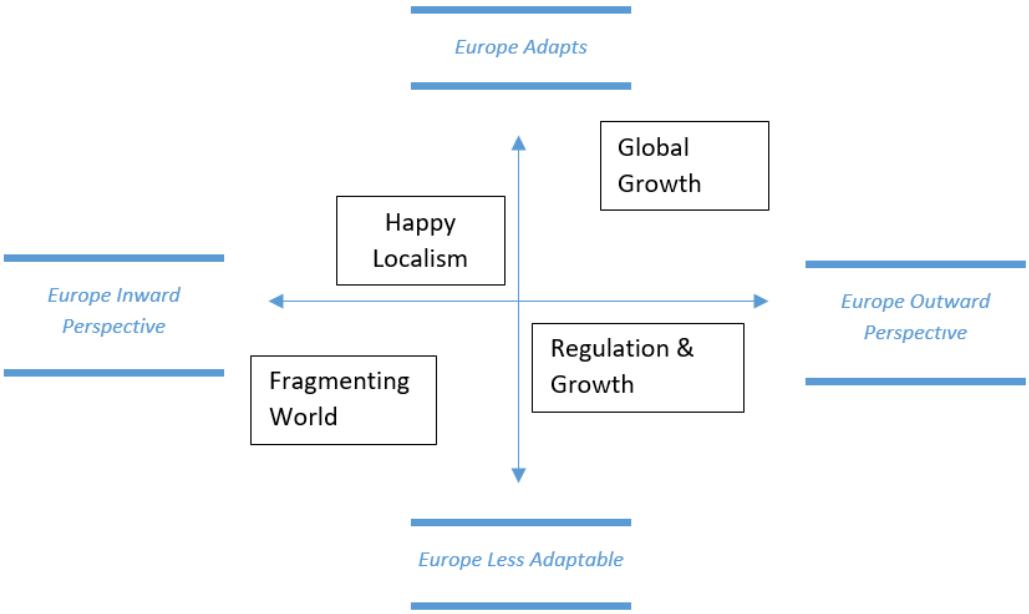

Figure 2.15. Scenario Axis of EUROCONTROL (EUROCONTROL, 2013)

Global Growth

This scenario is based on strong economic growth and decreasing sustainability problems which are solving thanks to developing technology. Moreover in the scope of the scenario globalization is increasing, environmental impacts and resource problems are decreasing. Thanks to the second generation fuels to be used in the future, costs will be reduced in the air transport sector, which will be less dependent on expensive emissions. In the future these improvements that make aviation sector sustainable also helps the sector to become socially acceptable. This scenario acknowledges that although the high-speed trains are developing, the most feasible way of linking European regions is air transport.

Regulation & Growth

The regulated growth scenario predicts moderate economic growth, which includes regulations aimed at balancing environmental, social and economic demands that are being developed to address increasing global sustainability concerns. In 2035, the gap between Europe and the rest of the world increased, the growth of Europe was slow,

and the position of the European Union was relatively weak. Although the aviation sector has made progress as always, Europe has not embraced the developing aviation technologies in the East because it is contrary to their sustainability goals. Moreover, because of the fact that the aging phenomenon in Europe has not been fully addressed, economic instability has been experienced and the completion of the European market has not yet been achieved.

Happy Localism

In this scenario, European economies have become much more fragile, costs have increased, environmental constraints have become quite rigid, and Europe has adopted a politically inward approach. While globalization is declining, intra-European trade has increased. While this scenario is based on features very similar to Scenario 2, the air traffic in the Happy Localism scenario is basically growing slower than in Scenario 2. In terms of air traffic, travel to and from Europe has decreased and travel from point to point has increased in Europe. For this reason, the Middle East and Turkey under this scenario has emerged as important global hubs. Faced with such a situation, the European Union membership of Turkey is gaining more importance.

Fragmenting World

The "Fragmenting World" scenario is based primarily on increased tensions across the globe, security threats, declining trade and less integrated modes of transport. Due to the lack of economic integration in the political sector, there is a stagnation in air traffic and this stagnation causes lower GDP growth and higher operating costs for airline companies. It is estimated that in this scenario there will be a 6% decrease in air traffic between 2035 and 2050, as air travel is expected to increase and prices will be socially less acceptable due to environmental impacts.

Under these scenarios, Eurocontrol considered the most likely scenario as the 2nd scenario. In 2018 Eurocontrol published another report for the forecast report and developed scenarios prepared in 2013 and interpreted the expected air traffic and

actual air traffic within the scope of that report scenario. As can be seen from the chart below, Eurocontrol stated that the most likely scenario is proceeding.

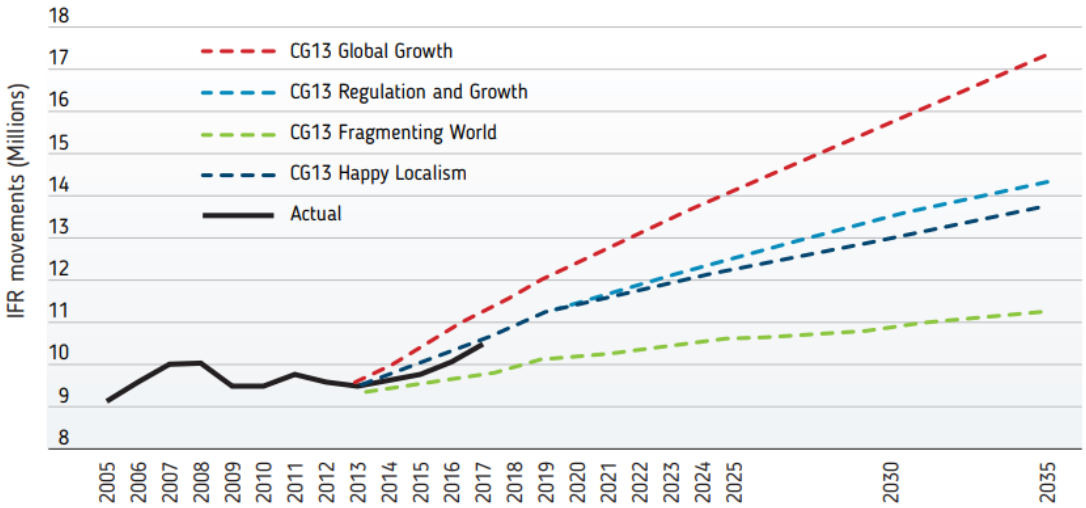

Figure 2.16. IFR movements in terms of Scenarios (EUROCONTROL, 2013)

Both in 2013 and 2018 reports EUROCONTROL states that Turkey and Istanbul are going to play crucial roles in both first three scenarios. In the 2018 report which is has paid regard to the new airport of Istanbul, EUROCONTROL states that the most increase in daily flights will be realized in Turkey in 2040 according to the scenario of Regulation and Growth.

CHAPTER 3

COMPETITION OF GLOBAL HUBS

In this section, the competitors of Istanbul Airport have been tried to be determined through the global hub airport concept mentioned in the previous section. Competitors identified as Amsterdam, Paris, London, Frankfurt, Dubai and Doha were examined through various parameters. Afterwards, a competitiveness index was developed for these airports and the competition between them tried to be comprehend better.

3.1. Rivals of Istanbul Airport on its Way of Becoming a Mega HUB

Istanbul Airport aims to increase its competitiveness by introducing the concept of airport city on its way to become a global hub. As with all competitions on the world, competitors are undoubtedly a natural part of this phenomenon. In other words, the Istanbul airport is in competition with some of the airports around the world. Due to its geographical location, Istanbul is in a dispute with the airports in Europe and the Middle East which have developed rapidly in recent time like Dubai and Doha. Istanbul, which is at an important crossroads between the East and the West, is not prone to be in competition with the hub airports located in Asia or Americas. In order to determine which airports in Europe and the Middle East will be in competition with Istanbul Airport, the amount of passengers carried at the airports and the connectivity indices determined by some international institutions may be useful. In addition to the passenger carried by hub airport, the amount of connections it provides is a very important indicator too. Considering only the number of passenger carried in an airport may be misleading if the airport is just serving for the inland air traffic.

To begin with the passenger carried in airports, in the chart below, according to ACI data, the amount of passengers carried in airports in the world in 2017 is shown. According to the data, Istanbul Atatürk Airport became the 14th airport in 2017 in

terms of total passenger traffic in the world. Moreover, Istanbul Atatürk Airport has got the 5th rank in Europe.(Airports Council International, 2018)

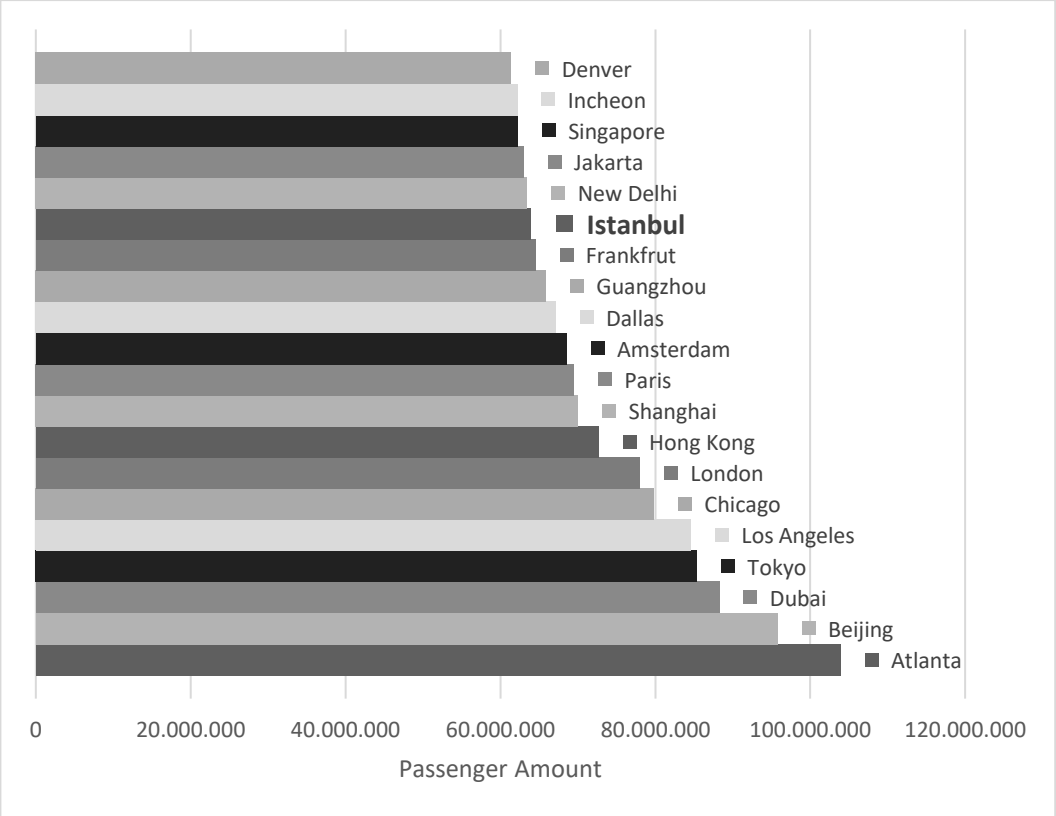

Figure 3.1 Total Passenger Traffic of Top 20 Airports in the World, 2017 (ACI, 2018a)

Considering the international passenger traffic, Istanbul is the 11th International Airport in the world and the 5th Airport in Europe. As can be seen from the graph, the airports that are at the top of the total passenger traffic may fall to the back when looking at international passenger traffic. This may indicate that airports such as Atlanta, Beijing, Tokyo or Los Angeles are more used airports for the inland air traffic rather than international passenger traffic. Almost all of the passenger profile of Dubai airport constitutes international passengers and shows that the airport is an important global hub.

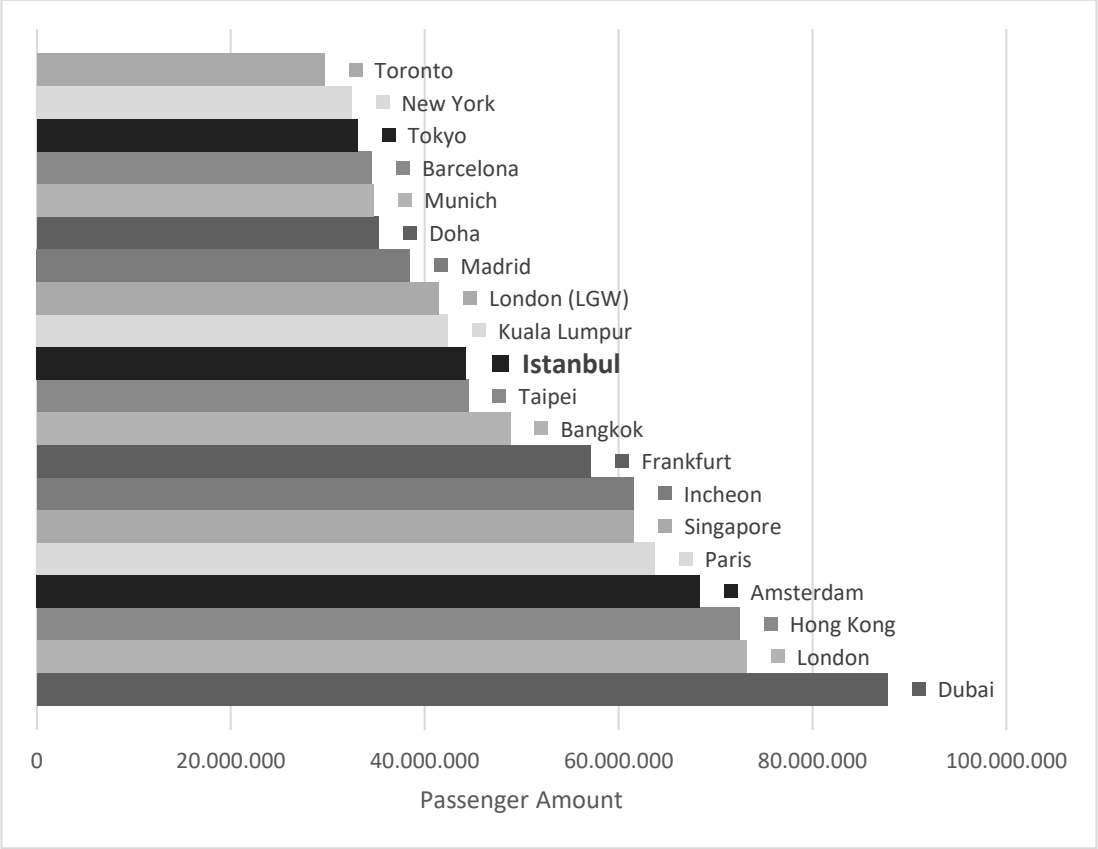

Figure 3.2. Total International Passenger Traffic of Top 20 Airports in the World, 2017 (ACI, 2018a)

As mentioned earlier, not only the amount of international passengers, but also the connection opportunities offered by the airports is another important factor that helps to define a global transfer center. In this direction, the connection index reports prepared by ACI and OAG may be guiding. In the "Megahubs International Index, 2018" report prepared by OAG, 50 most internationally connected airport has tried to be determined. The methodology used in the report is summarized as follows: "OAG has calculated the total number of all possible connections between inbound and outbound flights within a six-hour window, where either the inbound, outbound, or both flights are international, at the largest 200 airports in the world (based on total scheduled seats in July 2018) and at the largest 200 international airports (based on total international scheduled seats in July 2018) on the busiest day for global aviation over the 12 months to July 2018."(OAG, 2018).

The top 50 Megahubs specified in the report and the first 20 of them are shown in the Table 3.1. According to this, Istanbul Atatürk Airport is in 17th place. From the European point of view, it ranked 6th.

Table 3.1. *Top 20 International Megahubs* (OAG, 2018)

Rank	**Airport**	**Country**	**Connectivity Index**
1	London Heathrow	U.K.	333
2	Chicago	USA	306
3	Frankfurt	Germany	302
4	Amsterdam Schiphol	Netherlands	286
5	Toronto	Canada	271
6	Los Angeles	USA	257
7	Atlanta	USA	256
8	Singapore	Singapore	253
9	Paris Charles De Gaulle	France	250
10	Jakarta	Indonesia	249
11	Munich	Germany	237
12	Kuala Lumpur	Malaysia	233
13	Hong Kong	Kong Kong (SAR) China	230
14	Bangkok	Thailand	230
15	Incheon	South Korea	216
16	New York	USA	207
17	Istanbul	Turkey	205
18	Dubai	United Arab Emirates	194
19	Miami	USA	192
20	Mexico City	Mexico	181

A similar study was also carried out by the ACI (Airports Council International) in 2018. In the "Airport Industry Connectivity Report", ACI tried to measure air connectivity for airports. Within the scope of the study, the concept of connectivity has been examined via three different types which are direct connectivity, indirect connectivity and hub connectivity.(ACI, 2018b). These different kind of connectivities are explained as follows:

Table 3.2. *Various Types of Air Connectivity* (ACI, 2018b)

Direct Connectivity	**Indirect Connectivity**	**Hub Connectivity**
"These are the direct air services available from the airport – measured not just in terms of destinations, but also factoring in the frequency of flights to the same destination (so for example, an airport with 5 daily flights to another airport, will register a higher score than one with only 4)."	"This measures the number of places people can fly to, through a connecting flight at hub airports from a particular airport. For example, if you fly from Cork to a hub airport such as Amsterdam Schiphol, that's a direct flight from to A to B. But with the vast choice of onward destinations you can fly to from there – the large number of available onward connections from these airports expands the range of destinations available from the airport of origin. Indirect connections are weighted according to their quality, based on connecting time and detour involved with the indirect routing. For example, a flight from Manchester to Johannesburg via Paris–Charles de Gaulle will register a higher score than an alternative routing via Doha."	"As the name suggests, this is the most comprehensive metric for airport connectivity – taking into account both direct and indirect connectivity from the airport in question. Airport connectivity is defined as the sum of direct and indirect connectivity – thus measuring the overall level to which an airport is connected to the rest of the World, either by direct flights or indirect connections via other airports."

Most related connectivity type of these three is hub connectivity for Istanbul Airport. In this context, in the ACI report the maximum and minimum links that hub airports can provide have been evaluated and the quality of these connections are taken into

account. As a result of the study, top 20 airports and growth rates in the world are shown in the Figure 3.3.

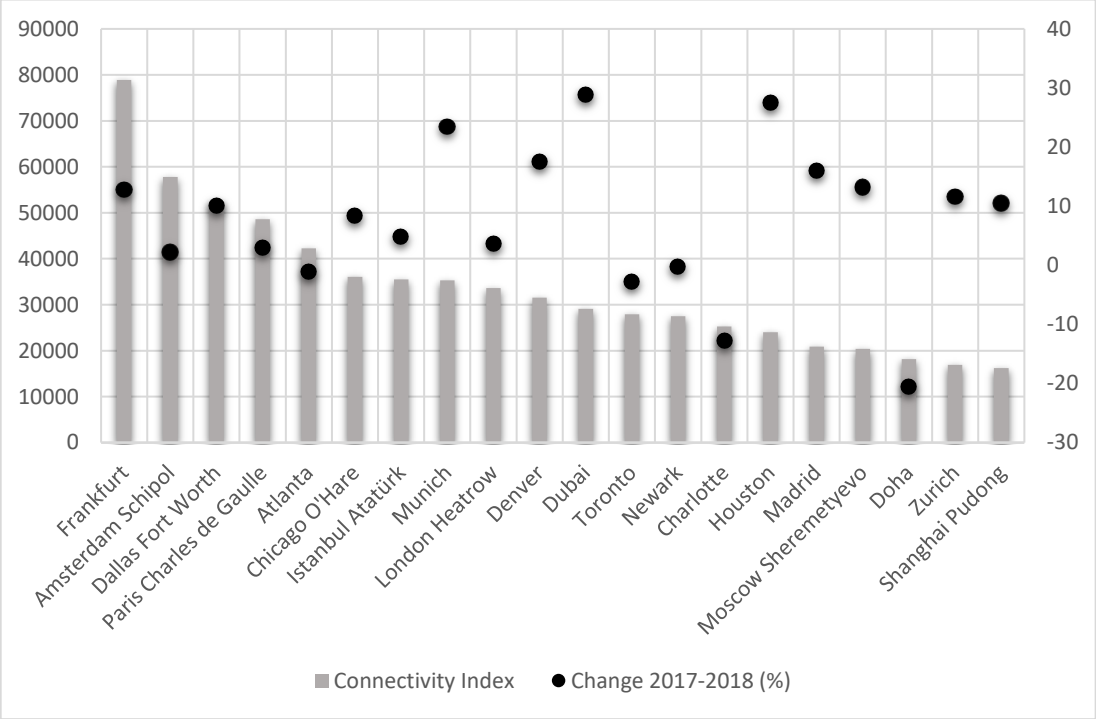

Figure 3.3. HUB Connectivity and Growth over 2017 - Top 20 Airports Worldwide, 2018 (ACI, 2018b)

The results suggest that Frankfurt Airport is the best hub airport not only in Europe but also in the world. The Istanbul Ataturk Airport is the 7th in the world and has grown above the average when compared to the previous year. From a European perspective, Istanbul stands as the fourth best transport hub in Europe.

In the light of these information, considering the geographical locations, passenger amounts and connectivities, it is possible to say that, the most important competitors in the way of being a mega hub, the most important competitors of Istanbul Airport are London Heatrow, Amsterdam Schipol, Paris Charles De Gaulle, Frankfurt, Dubai and Doha airports.

3.1.1. London Heathrow Airport

One of the most important competitors of Istanbul Airport in the future could be assumed as London Heathrow Airport. Heathrow Airport, one of the most important transfer centers in the world, is also the most important airport in England and London. The airport is located in the western part of London, about 23 km from the city center. Founded in 1929 as a small airfield, Heathrow took its first steps in 1944 to become a major airport. The airport, which was called London Airport in 1946, was renamed Heathrow in 1966. Today the airport is the primary hub for British Airways. Heathrow Airport has a very strong access infrastructure. Along private cars, the airport can be reached by trains, metro and buses. Moreover there is also a cycle routes which provides to reach airport by bicycles.(Heathrow, 2016)

There are 5 terminal buildings in total and 4 terminals are actively used in the airport. The first terminal was closed in 2015 and used as an extension for the second terminal when needed. The airport has two parallel runways in east-west direction. The construction of the third runway has been on the agenda for nearly 10 years and it has been approved by the parliament in 2018.(BBC, 2018)

In terms of passenger traffic, Heathrow airport was the world's seventh and the first airport in Europe in 2017 with 78 million passengers(Heathrow, 2017). Passenger traffic between the years 2002-2017 is shown in the graph below. In terms of air cargo traffic, Heathrow Airport stands out as the 19th of the world and 4th airport of Europe in 2016.(ACI, 2016b)

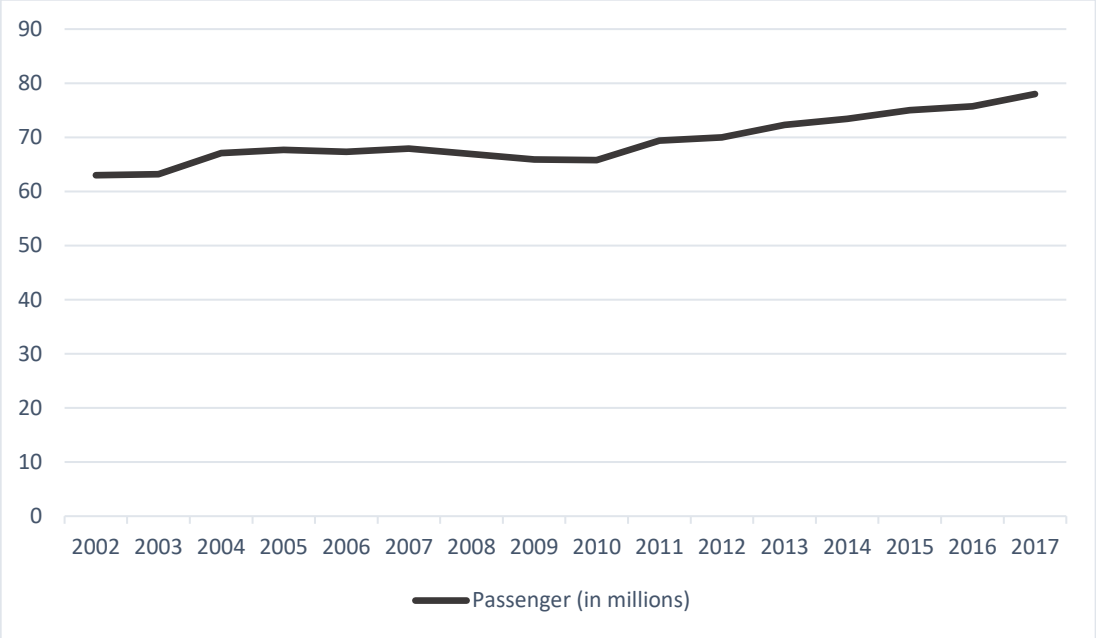

Figure 3.4. Passenger Traffic at London Heathrow Airport (2002-2017) (Heathrow Airport Holdings Ltd., 2018)

In 2017, most international passengers traveled to New York JFK Airport from Heathrow Airport. The 20 busiest routes from Heathrow Airport are shown in the Table 3.3.

Table 3.3. *Busiest Routes to/from London Heathrow Airport* (CAA, 2017)

Rank	Airport	Total Passenger
1	New York–JFK	2.945.744
2	Dubai–International	2.873.011
3	Dublin	1.803.497
4	Amsterdam	1.689.924
5	Los Angeles	1.600.587
6	Hong Kong	1.588.805
7	Frankfurt	1.501.134
8	Madrid	1.382.478
9	Doha	1.287.225
10	Singapore	1.234.806
11	Paris–Charles de Gaulle	1.207.929
12	Munich	1.190.441
13	Zürich	1.139.638
14	Chicago–O'Hare	1.062.328
15	Geneva	1.056.478
16	Toronto–Pearson	1.047.947
17	New Delhi	1.023.509
18	Istanbul–Atatürk	1.021.532
19	Newark	1.020.678
20	Stockholm–Arlanda	1.013.192

According to the report prepared by ACI, London Heathrow is ranked 9th in the world with 33.643 index points in terms of the airport hub connectivity. Hub connectivity is described in the report as follows: "HUB Connectivity is the key metric for any hub airport big (such as London Heathrow) or smaller (such as Keflavik). Essentially, it measures the number of connecting flights that can be facilitated by the hub airport in question – taking into account a minimum and maximum connecting times, and weighting the quality of the connections by the detour involved and connecting times."(ACI, 2018b). In addition to this, Heathrow Airport was ranked as the third with 4.669 points in terms of direct connectivity. Direct connectivity is defined as: " Direct Connectivity means the direct air services available from the airport – measured not just in terms of destinations, but also factoring in the frequency of flights to the

same destination (so for example, an airport with 5 daily flights to another airport, will register a higher score than one with only 4).”(ACI, 2018b).

Expansion projects for Heathrow Airport have been discussed for many years. Dr. John Kasarda states in his book that: “Heathrow is the closest thing we have to a truly global hub. And it’s falling apart. In 2008, the British government announced plans to build a third runway, evoking screams of protests. Prime Minister Gordon Brown was unmoved. “We have to respond to a clear business imperative and increase capacity at our airports,” he said. “Our prosperity depends on it: Britain as a world financial center must be readily accessible from around the world.””(Kasarda & Lindsay, 2011). The long-term expansion debates have ended with the adoption of the vote on 25 June 2018 in the British Parliament(BBC, 2018). The construction of the third runway, which was expected to cost 14 billion pounds, was expected to be completed in 2026 at the earliest(BBC, 2017). The need for expansion on Heathrow's website is as follows: “Heathrow’s runways are full. We have been operating at 98% capacity for over a decade. This has meant airlines have not been able to grow at Heathrow, choosing instead to fly to other European airports like Paris and Frankfurt. Research shows that direct air connectivity between two countries helps to facilitate greater trade.”(Heathrow Airport, 2017) After the expansion, the airport, which currently has an annual capacity of 80 million passengers, is expected to have 130 million passengers and 740,000 aircraft capacity(Heathrow, 2017).

3.1.2. Amsterdam Schiphol Airport

Airport Schiphol Airport is one of the important rivals of Istanbul Airport with its airport city concept and cargo-logistic infrastructure. Located 16 km southwest of the city center, the airport owns an area of total of 2.787 hectares(Schiphol, 2017a). The airport, which was opened in 1916 as a military airfield, became the main airport of the Netherlands in 1949 as the Schiphol airport(Schiphol, 2019a). Designed with a single terminal building concept, the airport has a large terminal building with 3 departure halls. There is also a general aviation terminal. There are 6 runways at the

airport. One of these runways is generally used for general aviation. As the main hub of KLM airlines, the airport is also the European hub of EasyJet, one of the famous LCCs. Transportation from the city and other cities to the airport is also very comfortable. In addition to private cars; the airport could also be accessed by train, bus, shuttle, taxi and bicycle(Schiphol, 2019b).

In 2017, Amsterdam Schiphol was the 11th airport in the world in terms of passenger traffic and it became the third airport in Europe(Airports Council International, 2018). Amsterdam Schiphol Airport Passenger traffic between the years 2002-2017 is shown in the graph below. In terms of air cargo traffic, Heathrow Airport stands out as the 17th of the world and 3th airport of Europe in 2016(ACI, 2016b).

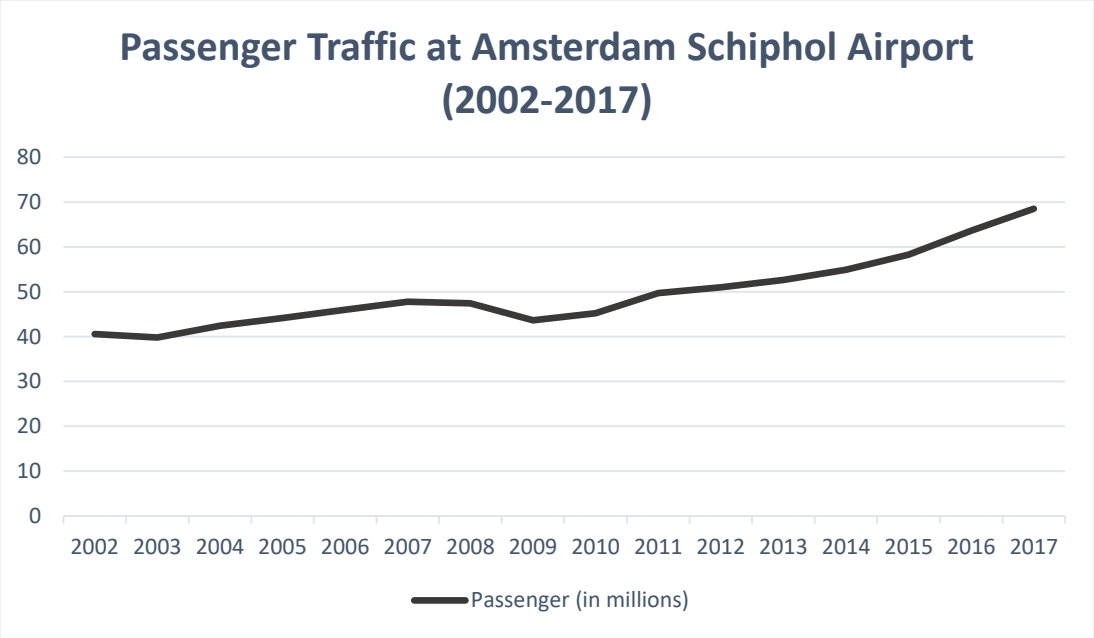

Figure 3.5. Passenger Traffic at Amsterdam Schiphol Airport (2002-2017) (Schiphol, 2017b)

In 2017, most international passengers traveled to London Heathrow Airport from Amsterdam Schiphol Airport. The 20 busiest routes from Heathrow Airport are shown in the Table 3.4.

Table 3.4. *Busiest Routes to/from Amsterdam Schiphol Airpt.* (Schiphol, 2017b)

Rank	Airport	Total Passenger
1	London Heathrow	1.689.314
2	Barcelona	1.361.452
3	Paris Charles de Gaulle	1.264.921
4	Rome	1.111.831
5	Dublin	1.080.715
6	London	1.074.382
7	Manchester	1.048.471
8	Copenhagen	1.033.491
9	Madrid	1.021.861
10	Munich	954.602
11	Zurich	939.9
12	Dubai	889.962
13	Stockholm	866.407
14	Lisbon	856.73
15	Frankfurt	842.801
16	Istanbul Atatürk	807.779
17	Atlanta	802.550
18	London Luton	785.704
19	Vienna	768.585
20	Milan Malpensa	743.496

According to the report prepared by ACI, Amsterdam Schiphol is ranked 2nd in the world with 57.781 index points in terms of the airport hub connectivity. In addition to this, Schiphol Airport was ranked as the second with 4.859 points in terms of direct connectivity(ACI, 2018b). The terms of hub and direct connectivity are described in the previous part.

Amsterdam Schiphol Airport plays an important role in the world in terms of air cargo traffic. Schiphol Airport, which is one of the rare airports that can manage both passenger and air cargo traffic at the same time, carried 1.75 million tons of cargo in 2017 and became the third airport with the most air cargo transportation in Europe. In

addition to carrying large amounts of cargo, the airport has an important role as a transfer hub in world air cargo traffic. The most important market of Schiphol airport is the Asian region. 35% of the cargo travel to the airport from and to this region. Flower, electronic products and fashion products constitute the majority of cargos transported. The flower is the most important product transported from Amsterdam Schiphol Airport. 25% of the exports from the airport are flowers. As an important cargo hub, there are three major flows at the airport. First one is the products travel from rest of the world and enters to the Europe, second one is the products coming from rest of Netherlands or produced in Amsterdam and the third one is the products coming from other European countries and travels to the world. In addition, strong connections with the ports of Amsterdam and Rotterdam, which have important roles in world trade, increase the logistics power of the airport(Schiphol, 2018b).

In order to increase the capacity at Amsterdam Schiphol Airport, a new pier is being built with an area of 55,000 square meters. The pier is expected to be articulated at the existing terminal. There is also a new terminal building is being built(Airport Technology, 2016). The new pier is expected to be ready for use at the end of 2019, and the terminal is expected to be ready in 2023. According to Schiphol Group, the expectations from these new investments are as follows: “The pier will have 8 new gates which will allow a much smoother flow of travelers than today. And the new terminal, which will come into use in 2023, will ensure short wait times, fast service and optimal safety (Schiphol, 2018a).” Airport passenger capacity is expected to increase by 14 million after the investments.

3.1.3. Paris Charles de Gaulle Airport

Paris Charles de Gaulle Airport is another important hub in the European region. Charles de Gaulle Airport, the largest international airport in France, ranks second in Europe. The airport is located in the north-eastern region, 25 kilometers away from the city center of Paris. The construction began in 1966 and was renamed Charles de Gaulle in 1974. There are 3 terminal buildings and 4 runways at the airport. The airport

is the main transport hub of Air France. In addition to private cars the airport can be reached by train, metro, bus, shuttle and taxi.

In 2017, Paris Charles de Gaulle Airport was the 10th airport in the world in terms of passenger traffic and it became the second airport in Europe(Airports Council International, 2018). Paris Charles de Gaulle Airport Passenger traffic between the years 2002-2017 is shown in the graph below. In terms of air cargo traffic, Heathrow Airport stands out as the 9th of the world and 1st airport of Europe in 2016.

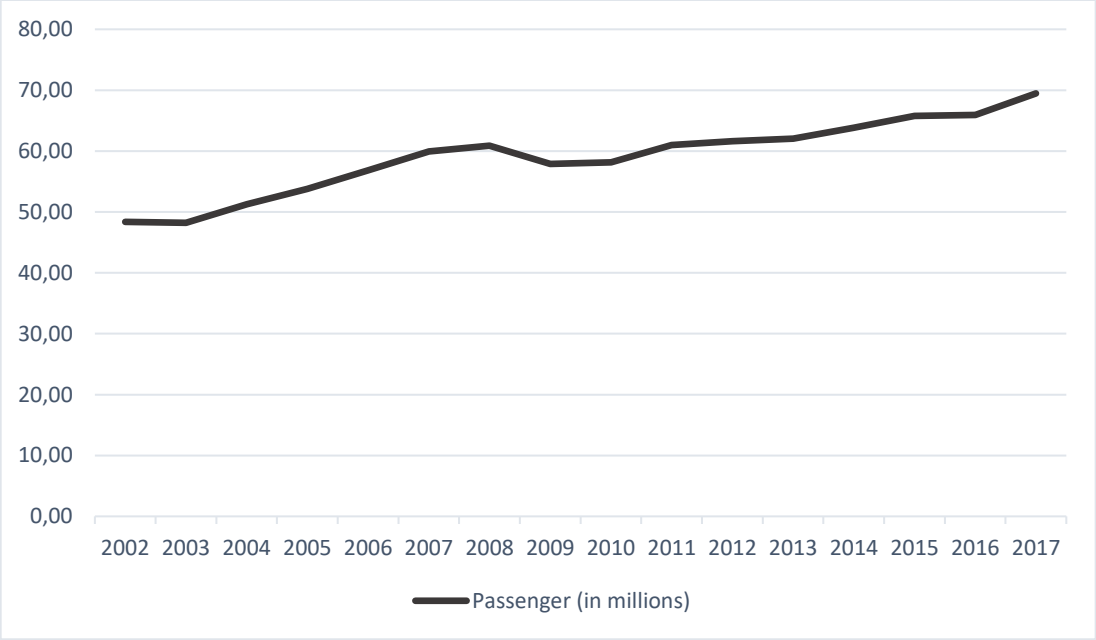

Figure 3.6. Passenger Traffic at Paris Charles de Gaulle Airport (2002-2017) (ACI, 2018a)

According to the report prepared by ACI, Paris Charles de Gaulle Airport is ranked 4th in the world with 48.694 index points in terms of the airport hub connectivity. In addition to this, Charles de Gaulle Airport was ranked as the 4th with 4.611 points in terms of direct connectivity(ACI, 2018b). The terms of hub and direct connectivity are described in the previous part.

Paris Charles de Gaulle, the European leader in terms of air cargo, has 317 hectares of land. Last year, a total of 2.29 million tons of cargo and mail is carried from the airport to 319 destinations worldwide. The majority of the air cargo products transported from

the airport comprise of pharmaceutical, luxury and e-commerce(Groupe ADP, 2018). The airport handles approximately 90% of the air cargo transported to/from France. The logistic potential is very strong due to the fact that it is connected to other European cities and cities of France by strong railway and highway connections(Groupe ADP, 2017).

A fourth passenger terminal, which is expected to be completed in 2025 at the Paris Charles de Gaulle airport, is on the agenda. The passenger terminal, which is expected to start to operate after reaching 80 million annual passenger capacity, is expected to host 30-40 million passengers(Gliszczynski, 2014).

3.1.4. Frankfurt Airport

Frankfurt Airport, one of the busiest airports in the world and Europe, is another most important competitors in the global aviation market of Istanbul. The airport is operated by Fraport and acts as the main transfer hub of Lufthansa airlines. The airport has an area of 2,300 hectares, 2 passenger terminals and 4 runways. The airport is located in the south-west direction, 14 km away from the city center. In addition to private cars, the airport provides transportation by urban trains and long distance trains, buses, taxi and shuttle.

In terms of passenger traffic, Frankfurt airport was the world's 14^{th} and the 4^{th} airport in Europe in 2017 with 64,5 million passengers(ACI, 2018a). Passenger traffic between the years 2002-2017 is shown in the graph below. In terms of air cargo traffic, Frankfurt Airport stands out as the 10^{th} of the world and 2^{nd} airport of Europe in 2016(ACI, 2016b).

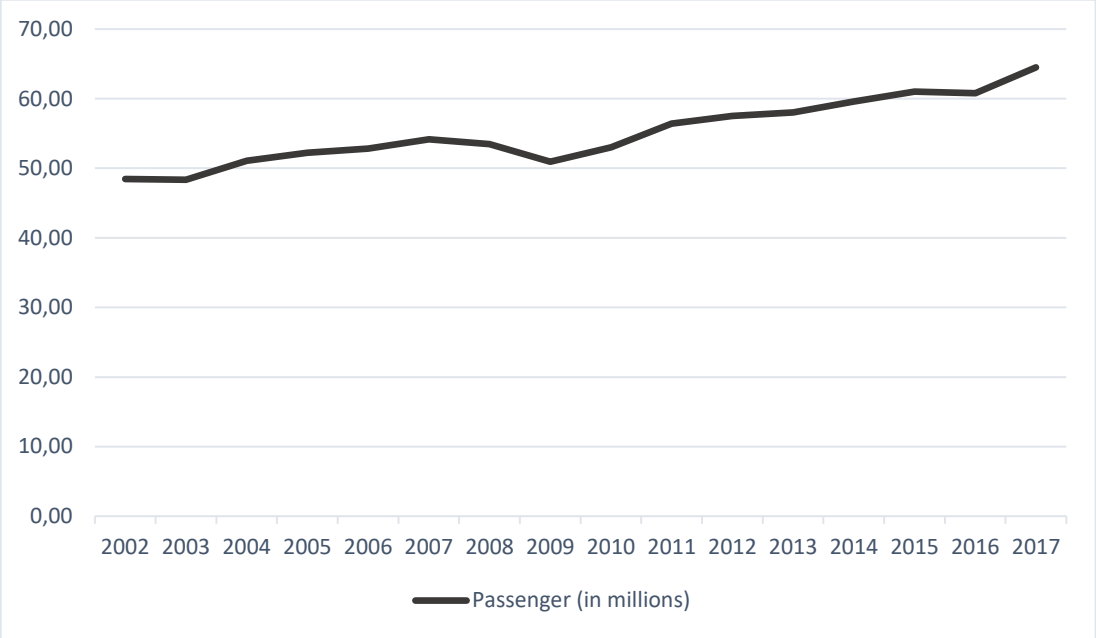

Figure 3.7. Passenger Traffic at Frankfurt Airport (ACI, 2018a)

According to the report prepared by ACI, Frankfurt Airport is ranked 4th in the world with 78.914 index points in terms of the airport hub connectivity. In addition to this, Frankfurt Airport was ranked as the 1st with 5.096 points in terms of direct connectivity(ACI, 2018b). The terms of hub and direct connectivity are described in the previous part.

After Paris Charles de Gaulle Airport, Frankfurt is the largest airport in Europe in terms of air cargo traffic. Approximately 2.2 million tons of cargo was handled in 2017 and it is indicated that the airport is an expert in transportation of many products. Various products such as pharmaceuticals, valuable and fragile products, perishables, dangerous products and animals are transported from the airport(Frankfurt Airport, 2018). The two regions where cargo operations are carried out at the airport are named CargoCity North and CargoCity South.

Figure 3.8. Frankfurt Airport Cargo Cities (Frankfurt Airport, 2018)

The construction of a third terminal building, which is expected to be put into service in 2023 at Frankfurt Airport, continues. The new terminal building is expected to host 21 million passengers annually(Frankfurt Airport, 2019).

3.1.5. Dubai International Airport

Along with the transfer centers in Europe, one of the most important rivals of Istanbul can be considered as Dubai, the star of the Middle East region with its serious growth has been experienced in recent years. Opened in 1960s, the airport was a small-scale airport up to 2000s. With the opening of the Sheikh Rashid passenger terminal in 2000, a new page was opened in the history of civil aviation for Dubai. With the opening of the third passenger terminal in 2008 and the special use of the terminal by Emirates airlines, passenger traffic at the airport has increased considerably(Dubai Airports, 2013). There are three passenger terminals and 2 runways at the airport. At the airport, which is the main transfer hub of Emirates airlines, more than half of the passenger traffic is carried by this airline(Cornwell, 2018). The airport is about 13 km from the city center and can be reached by metro, bus, private cars and taxis.

Dubai Airport, the 20th airport in terms of passenger traffic in the world ten years ago, has been up to third in today's world. In terms of number of international passengers, it ranks first in the world. In 2017, more than 88 million passengers traveled from the

airport(ACI, 2018a). The passenger traffic at Dubai International Airport between the years of 2003 and 2017 is shown in the graph below. In terms of air cargo traffic, Dubai airport is one of the world's leading airports. In 2017, it is the sixth in the world with 2.65 million tons of cargo(ACI, 2017).

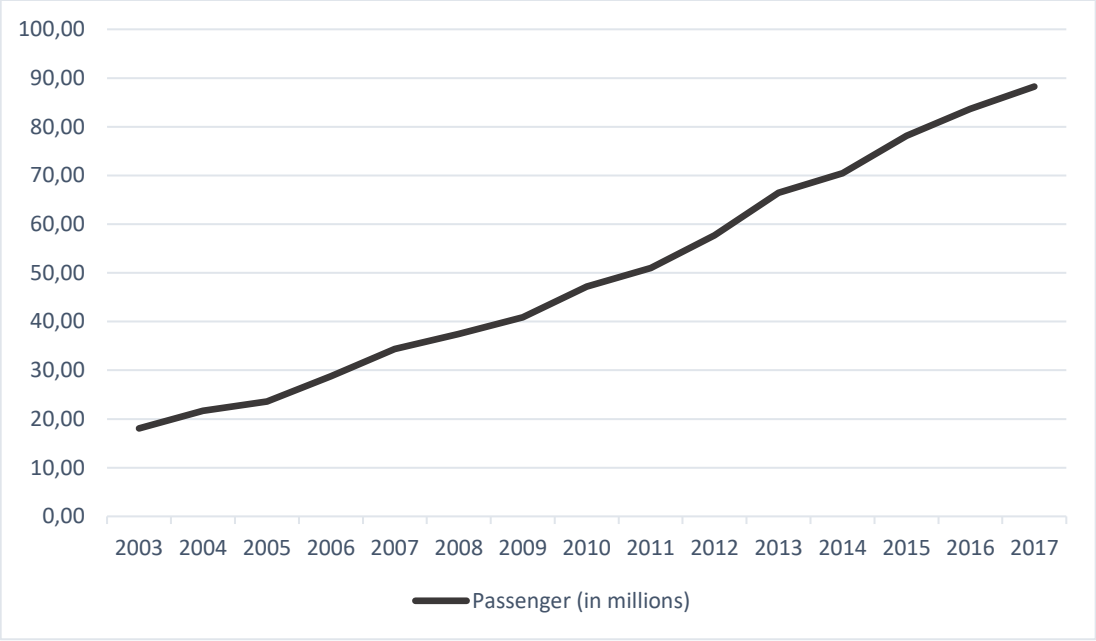

Figure 3.9. Passenger Traffic at Dubai International Airport (2003-2017) (ACI, 2018a)

As mentioned in the previous section, the most important advantage of Dubai International Airport is being the most eastern point of Europe and the most western point of Asia. United Arab Emirates, which is a very important trading point between Europe and Asia, plays a key role in the new silk road of aviation. Dubai has become a perfect airport with an 8-hour flight distance to two-thirds of the world and not being affected by bad weather conditions such as mist, snow etc. According to the report prepared by ACI, Dubai International Airport is ranked 11th in the world with 29.096 index points in terms of the airport hub connectivity (ACI, 2018b).

In recent years, Dubai has made a new airport investment in line with its significant growth in aviation. Opened in 2010, Al Maktoum International Airport is planned as the world's largest airport. Although the future investments are delayed due to the

regional economic crisis, it currently serves with one runway and a passenger terminal with a capacity of 5 million passenger annually. When the investments are completed, it is expected to serve 160-220 million passengers per year with 5 runways(Dubai World Central, n.d.). Once completed, it could be assumed that the airport will have a very important role in the global aviation system. In addition to the high amount of passengers, it is estimated that the airport will have an annual capacity of 12 million tons of cargo(Dubai World Central, n.d.). The completion date of the airport, which is planned to start working with full capacity in 2017, is spoken as 2027(Cha, 2013).

3.1.6. Doha Hamad International Airport

Although not as much as Dubai, one of the major rivals of Istanbul from the Middle-East region can be considered as the airport of Doha Hamad. In recent years, one of the other airport has made use of the geographical location and characteristics of region, could be assumed as Doha Hamad International Airport. Qatar, which is one of the leading countries in the world in terms of economic and cultural well-being, has achieved significant growth in the aviation sector in recent years. The airport, which has two runways and a passenger terminal, is 5 kilometers away from the city center. The airport started to operate in 2013 and passenger operations in 2014. The airport is the main transit hub of Qatar Airlines and can be accessed by private cars, taxis and buses.

Since 2014 Doha Airport was used and then Doha Hamad International Airport has been started to operate. The number of passengers arriving to Doha between 2006-2017 is shown in the graph below(HVS, 2017). With the use of Doha Hamad International Airport, the air traffic has grown considerably and in 2017, it experienced a decrease of 5.4%. In ACI Industry Connectivity Report 2018, this decline is explained due to the political tensions between Qatar and UAE, Saudi Arabia, Bahrain and Egypt. According to the report, Doha Hamad International Airport is ranked 18th in the world with 18.180 index points in terms of the airport hub connectivity. However, Doha's hub connectivity has declined significantly (-20,5%)

due to these tensions (ACI, 2018b). In terms of air cargo, in 2017, airport handled more than 2 million tons of cargo and was ranked 16th in the world(ACI, 2017).

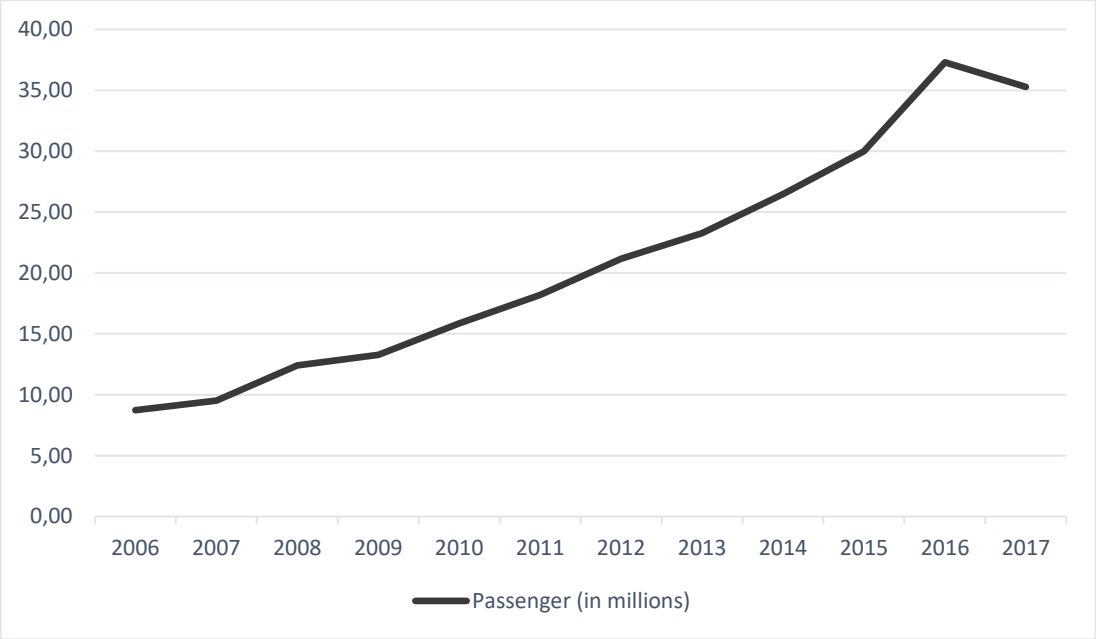

Figure 3.10. Passenger Traffic at Doha and Hamad Airports (2006-2017) (ACI, 2018a)

Qatar is working on an airport city concept that integrates the Doha city and Hamad International Airport. A 4-zone master plan study including zones of Business District, Aviation Campus, Logistics District and Residential District has been carried out and the first two regions are planned to be implemented by 2022. Besides, a second terminal building for Doha Hamad Airport is on the agenda. Such a planning decision has been taken in order to host the tourist expected to come in 2022 for FIFA World Cup. After the construction of the second terminal, the first terminal is expected to be reserved for the use of Qatar Airlines only(John, 2013).

3.2. Competitiveness of Global HUB Airports

Due to their geographical location, global transfer centers in Europe and the Middle East are competing with each other. In order to be a bridge to the passenger traffic between east and west, the airports competing fiercely and the countries have different advantages and disadvantages. In order to better understand how these advantages and disadvantages have contributed to the airports in a holistic approach, a competitiveness index study was conducted. Within the scope of this study, the "Airport Competitiveness Index" study conducted by Martin Grancay in 2009 was admitted as a great guiding light. The research conducted by Grancay has developed a competitiveness index for different types of airports, on the contrary in this study, an index has been tried to develop only for the airports showing the global hub airport characteristics. Therefore, according to the model made by Grancay, different variables have been used and the model has been revised(Grancay, 2009).

According to Grancay, there are two main factors that researchers are dealt in the process of developing an index. The first of these is what variables are included in the model and which should be excluded. The second one is the weighting of the variables used in the model (Grancay, 2009). Within the scope of the Hub Competitiveness Index study, the model has been constructed from 3 main components. These are market potential, infrastructure and past air traffic data. Each index is calculated based on various variables. HCl was obtained by multiplying the average of the sub-components by a safety index.

$$HCI = 0{,}25 * (I_{MP} + I_I + I_{TR} + SAF)$$

The Table 3.5 shows the components used in the model and their indicators.

Table 3.5. *Composition of the HUB Competitiveness Index (HCI)*

INDICATOR	**ABBREVIATION**	**LOW VALUE**	**HIGH VALUE**
Market Potential			
Metropolitan Area Population	POP	0	14.540.000
GDP per capita, PPP	GDP	0 USD	128.374 USD
Destination Popularity	DSP	Neutral	Popular
Global Power City Index	GPC	0	1.692
Political Stability Index	PS	-1,8	0,92
Infrastructure			
Public Transportation	PT	Poor	Developed
Congestion	CONG	Congested	Sufficient
Airport Capacity	CAP	0	90.000.000
Capacity Expansion	EXP	0	% 144
Air Traffic Results			
Air Passenger Amount (2017)	APA	0	88.240.000
Air passenger growth in the last 10 years (CAGR)	APG	0	% 14
Hub Connectivity	HUB	0	78.914
Hub Connectivity Growth 2004-2018 (CAGR)	HUBG	0	% 26,30
Safety	SAF	0	86,89

Market Potential

One of the most important factors in the competition of airports in the world market is the market potential of the region where the airport located. Within the scope of the study, the first indicator of market potential index is assumed as population. The metropolitan population in the cities where the airports are located can be considered as one of the factors that directly affect the air passenger quantity. There are 32 urban agglomeration with more than 10 million inhabitants, which are identified as mega-cities. In addition, there are 534 metropolitan areas where more than 1 million people live(United Nations, 2018). Within the scope of the index study, the population of

Istanbul (14.5 million), which is the city with the highest population among the cities where the competing airports are located, has acquired the highest value (1) and other cities acquired a value between 0 and 1 proportionally according to their population.

To determine the potential of the market, it would be erroneous to accept the population as the only variable. Areas with a similar population may have different potentials due to the difference in income. For this reason, GDP per capita based on purchasing power parity (PPP) has included in the study as a variable. Qatar's GDP per capita based on PPP (128,374 dollars) was accepted as the value of 1, and a value between 0 and 1 was determined proportionally to the other countries accoriding to their GDP per capita PPP(The World Bank, 2017c).

As another indicator, the potential of the city in terms of tourism has been evaluated. The fact that the city where the airport is located has an important place in the world tourism market can be considered as a factor that will directly affect the hub potential of the airport possitively. As part of the study, the research of "The most visited cities in the world" prepared by Mastercard was taken as the basis. Within the scope of project, the cities which are in the list of most visited 20 cities in the world by international visitors has acquired the score of 1. On the other hand, the cities that were not on the list has taken 0 points. Dubai, Paris, London and Istanbul have been included in the list from the compared airports(Talty, 2018).

In fact, not only airports, but also major cities in the world are in intense competition. In many different areas, the competition between cities with various advantages has been tried to be measured by the global power city index prepared by Institute for Urban Strategies of The Mori Memorial Foundation. Within the scope of this index study, cities have been evaluated in terms of economy, research and development, cultural interaction, livability, environment and accessibility of cities and attributed a certain score. In this direction, these points were taken into consideration within the scope of HCI and the highest score of London which is 1692 was accepted as the value of 1, and the other cities received a value between 0 and 1 accordingly to their global

power city index points. This value is not included in the Market potential index for Doha, as Doha was not awarded a score within the GPCI study(Institute for Urban Strategies, 2018).

Finally, the political stability indicator is included in the market potential index. One of the important factors that directly affect the performance of airports can be considered as the countries' political stability. Flights crisis between Russia and Turkey, tensions between Ukraine and Russia are examples of this situation. The tension between Russia and Turkey which was in November 2015, has affected the amount of Russian tourist visits Turkey in summer of 2016 negatively and this reflected on the performance of Turkish airports. Within the scope of the study, the political stability index prepared by The Global Economy was used. This index is defined as follows: "The index of Political Stability and Absence of Violence/Terrorism measures perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism. The index is an average of several other indexes from the Economist Intelligence Unit, the World Economic Forum, and the Political Risk Services, among others."(The Global Economy, 2017)

Accordingly, the market potential index is calculated as follows:

$$I_{MP} = 0{,}20 \ * \ (POP + GDP + DSP + GPC + PS)$$

Infrastructure

Another important factor that increases the competitiveness of airports can be considered as infrastructure. In terms of infrastructure; airports can be examined in two different components. One of them is the infrastructure of the airport and the other is the infrastructure that provides access to the airport. The infrastructure of the airport consists of passenger terminal, runway, tower and ramp. The infrastructure that provides access to the airport can be considered as public transport and road. In this context, the airports we compare have strong highway networks and are integrated because all the airports are over a certain level. For this reason, roadway features do

not seem to be a discriminating factor. However, the public transport modes provided by all airports differ. In this direction, as in the study conducted by Martin Grancay, according to the public transportation modes they have, airports have acquired values between 0 and 1(Grancay, 2009). If there is a high speed train arriving at the airport, airport gets the score of 1, if there is a normal train the score is 0,75, 0,5 for the metro and 0,25 for the bus. Only the highest value is used in this part of the study. To clarify, if there is both high speed train and public bus, the airport gets the value of 1 instead of 1,25.

Congestion is considered as another factor affecting the performance of airports. The occupancy in terminal capacity causes delays in the airports, delays in operations and thus high costs. One of the major obstacles in front of the airports that want to increase the amount of passenger is the lack of capacity. For this reason, values are given according to the congestion levels of the competing airports. While determining the values, the Airport Capacity Map prepared by IATA was used(IATA, n.d.). IATA assigned three different characteristics to the airport in terms of their occupancy rates which are; “Sufficient Capacity”, “Capacity issue in next 10 years” and “current congestion of runway or passenger terminal”. In this way, a score of 0,25 has given for congested airports and 0,5 points for those who are expected to have a congestion problem within 10 years. None of the airports that are competing has sufficient capacity.

The main reason for the congestion at the airports is insufficient runway, apron or terminal capacity. For this reason, in order to increase the competitiveness of the airports, airports make various investments to increase their annual passenger capacity. The capacities of the airports are included in the index study since it is factor that directly affects the competitiveness. The airport, which have the highest capacity from the airports in competition, have a value of 1 and the others gets a value between 0 and 1 according to their capacities. In addition to the existing passenger capacities of the airports, there are investments to increase capacity at almost all airports. It is expected that runway and terminal investments, which are expected to be realized in

different years, will increase airport capacity. It is deemed appropriate to include this expected expansions in the future in the index study. The expected capacity increase rates at all airports were calculated and the airport which has the highest increase rate get the score of 1. Other airports had a proportional score of 0 and 1 according to the expected increase rates. Information on the investments of the airports has been obtained as a result of various researches.

In this respect, the infrastructure index is calculated as follows:

$$I_I = 0{,}25 \ * \ (PT + CONG + CAP + EXP)$$

Traffic Results

In any analysis conducted to measure the rivalry between airports, it would not be correct to not include the amount of passengers. One of the most important indicators showing the success of an airport can be accepted as the amount of passengers transported from the airport. Not only should the passenger movement that took place in the last year, but also the performance of the past years be taken into account. In this respect, 4 different indicators were included in the traffic results index, which is the last essential component of the HCl analysis. The first of these is the number of air passengers used the airport in 2017. The airport that had the highest number of passengers received 1 point and the others were proportionally between 0 and 1.

In addition, the amount of passengers hosted by the airports in the last 10 years has been determined and the annual average growth rate is calculated using CAGR method. In general, European airports have low growth rates in the last 10 years; on the other hand Dubai, Doha and Istanbul has grown significantly. Excluding these growth rates in the index study would be to ignore the performance of airports in the past. In this respect, the airport with the highest CAGR rate have 1 point and the others get a score between 0 and 1 proportionally.

Finally, the connectivity index, which is one of the most important indicators for airports operating as transfer hubs in the world, is included in the analysis. The Hub

connectivity index calculated by the ACI annually gives a point on the number of connections and flights provided by the airports. In the ACI report, this index is summarized as follows: “It measures the number of connecting flights that can be facilitated by the hub airport in question – taking into account a minimum and maximum connecting times, and weighting the quality of the connections by the detour involved and connecting times”(ACI, 2018b). These points calculated for 2018 are included in the index study. In addition, the airport connection index growth rates are also included in the analysis. Throughout the history, how much the airports increased their connectivity index can be considered as an indicator of how much they can be involved in competition. In this context, the annual growth rate was calculated for the connectivity index of the airports between the years 2004-2018 and this calculation was included in the index study. As in all analyzes, the airports having the highest growth rate received 1 point and the other airports had a ratio between 0 and 1 in proportion.

By this means, the traffic result index is calculated as follows:

$$I_{TR} = 0{,}25 \ * \ (APA + APG + HUB + HUBG)$$

Safety

Finally, the safety factor is included in the index study. The study prepared by CEOWORLD was used. 338 cities from the world have a value between 0 and 100. Doha, which has the highest security score within the scope of the study, has been accepted as 1, and the other cities are given a value between 0 and 1 proportionally in the scope of the index study. The safety of cities where the airports are located is very important in terms of the passengers who use the airport in recent years. Terrorist attacks at airports have a direct impact on passenger demand. For this reason, the security issue has been included in the index studies.

To summarize the index study, the following formula is used:

$$HCI = 0{,}25 * [\frac{POP+GDP+DSP+GPC+PS}{5} + \frac{PT+CONG+CAP+EXP}{4} + \frac{APA+APG+HUB+HUBG}{4} + SAF\ ]$$

Data

The data and sources used within the scope of HCI study are shown in the Table 3.6. The most up-to-date data has been tried to use for the study.

Table 3.6. *Data and Source for HCI*

Abbreviation	**Indicator**	**Source**
POP	Population	UN World Urbanization Prospects, 2018
GDP	GDP per capita , PPP	The World Bank, 2017
DSP	Destination Popularity	Mastercard - Most Visited Cities, 2018
GPC	Global Power City Index	Institute for Urban Strategies, The Mori Memorial Foundation, 2018
PS	Political Stability	TheGlobalEconomy.com - The World Bank, 2017
PT	Public Transportation	Own research, official websites of the airports
CONG	Congestion	IATA – Airport Capacity Map
CAP	Capacity	Own research, official websites of the airports
EXP	Capacity Expansion	Own research, official websites of the airports
APA	Air Passenger Amount	ACI
APG	Air Passenger Growth	ACI – 10 years annual growth rate (CAGR)
HUB	Hub Connectivity	ACI – Airport Industry Connectivity Report, 2018
HUBG	Hub Connectivity Growth	ACI – Airport Industry Connectivity Report, 2018
SAF	Safety	CEOWORLD – The World's Safest Cities Ranking, 2018

3.3. HUB Competitiveness Index

HCI is calculated for airports which are expected to be in competition with Istanbul airport in the upcoming period. Today, these airports play a role in the global aviation system as the most important transfer centers in the world. HCI has been developed in order to understand which aspects of the Istanbul airport are strong in terms of which aspects are weak and to get a general idea. As mentioned earlier, the ACI study conducted by Martin Grancay in 2009 during the development of this index has benefited a lot (Grancay, 2009). Atatürk airport was also included in the calculations due to the fact that Istanbul Atatürk Airport will be closed and all operations will be transferred to Istanbul's new airport in the coming period, and past passenger and connection data have been accepted as the same for both airports. Besides, it can be considered that the new airport investment will be useful in understanding how it will affect Istanbul's competitiveness. The main component indices and HCI obtained in the study are shown in the Table 3.7. Airports are ranked according to their HCI score.

Table 3.7. *HUB Competitiveness Index*

Rank	**Airport**	**HCI**	**I_{MP}**	**I_{I}**	**I_{TR}**	**SAF**
1.	Dubai International Airport	**0,757**	0,653	0,750	0,684	0,941
2.	Istanbul Airport	**0,664**	0,554	0,837	0,688	0,577
3.	Doha Hamad Airport	**0,591**	0,381	0,324	0,658	1,000
4.	London Heathrow Airport	**0,585**	0,742	0,643	0,372	0,585
5.	Paris Charles de Gaulle Airport	**0,567**	0,728	0,600	0,388	0,552
6.	Amsterdam Schiphol Airport	**0,562**	0,447	0,544	0,489	0,766
7.	Istanbul Atatürk Airport	**0,543**	0,554	0,354	0,688	0,577
8.	Frankfurt Airport	**0,532**	0,399	0,609	0,490	0,630

Not surprisingly, the airport, which has the highest competitive power, is now Dubai. With its strong infrastructure, rapidly evolving air traffic and growing number of connections, being one of the safest cities in the world and the transition to Al Maktoum airport, which is the world's largest airport when completed, Dubai can be considered as a strong competitor for Istanbul. Istanbul Airport took the second place after Dubai. According to the results, Istanbul airport investment can be thought to increase the competitive power of the existing airport considerably. When past air traffic results are accepted as the same and the market potential of the city is accepted as the same, the most significant increase will be in the infrastructure index. In addition, it can be assumed that the increasing capacity will also increase the ACI connectivity index in the future. After Dubai and Istanbul, Doha is considered the safest city in the world. Although it ranks high in terms of its growth performance in recent years, it has the lowest score among the airports in the infrastructure index. The main reason for this is that it cannot be reached with different modes of public transportation.

European airports with strong market potential have lagged behind in terms of competitiveness in the Middle East and Istanbul airport due to the low growth rates they have shown in recent years and the lack of chance to increase their capacity in the future. This issue was mentioned in the report published by ACI in 2016. The airports of Europe's developed countries already have the most competitive global transfer centers; however, these airports, which provide services to the rest of the world in terms of geographic location and connections they provide, are now stated to be part of a very serious competition. It is thought that some of the airports will lose their position as a global transfer center even though these airports will pass the challenging exams in the future and they have the location features within this challenging test(ACI, 2016a). John Leahy, Airbus Business Officer, talks about the expansion problems at European airports: “Does Charles de Gaulle grow twice? London or Frankfurt will double the airports? Will you build a new Heathrow? A new Frankfurt? A new Kennedy? Of course no. Then the only way to meet the need will

be larger passenger aircraft. That's why we now produce the world's largest passenger aircraft, the A380 (Euronews, 2017)". In other words, it is possible to say that the airports of the countries that have renewed their infrastructure, built the airport or increased the existing airports have higher chances. For this reason, Dubai, Istanbul and Doha may be considered to have a higher competitiveness index.

In summary, the two most important rivals of the Istanbul airport will be Doha and Dubai. In terms of Dubai, it is still possible for Al Maktoum International to be Dubai's main airport in the future. It is even possible that this situation will negatively affect the number out-to-out passengers traveling through Istanbul if the expected number of passengers will be reached. Qatar has to be considered as a competing global transfer hub. Qatar, located to the east of the Arabian Peninsula, is considered to be the richest country in the world with its per capita income (The World Bank, 2017c). With a population of just over 2 million, the country has become an important business and tourism center in recent years. During 2015/2016, Hamad Airport increased its passenger traffic by 20.5% and aircraft traffic by 15.8 and reached a significant success by reaching 248.800 aircraft and 37.3 million passengers in 2016(ACI, 2018a). The fact that Qatar Airways, which is already in a fast growth, ordered about 300 passenger planes is also a sign of a much faster growth strategy(John, 2018). This will certainly affect the development of Hamad Airport. Against Dubai and Istanbul, although Hamad Airport does not seem to be a strong competitor as a global transfer center with its current activities, as it can be understood when the number of passengers hosted in the airports in 2017 compared, Qatar Airways is in a very rapid development trend and the airport capacity is estimated to be 90 million in the future. Thus, Doha Hamad Airport would be a tough competitor for Istanbul in upcoming period.

CHAPTER 4

ISTANBUL AS A POINT OF ATTRACTION

In this chapter, it is discussed whether Istanbul Airport will only act as a transfer center or whether it can take place in the world as a point of attraction. Firstly, Istanbul and Turkey evaluated in terms of tourism potential and their global importance has been examined. Secondly, the business potential of Istanbul has been evaluated and the analysis made by the leading institutions have been examined.

4.1. Istanbul as a Tourism Center

Since the earliest eras of the history of humanity, concept of travel have always been a crucial thing in communities. While the basic reasons behind the travelling were the vital activities, such as commercial, religious, military etc., in ancient eras; through the industrial revolution and changing economic and political perspectives in Europe in 18th and 19th centuries, the foundations of modern tourism has been laid. The industrial revolution has led to economic expansion and increased the accumulation of capital. By this means, participation to the tourism activities has increased. Moreover, with the improving railway infrastructure in Europe and North America, travel times has become shorter and more comfortable and correspondingly tourism travels has increased rapidly.

Revolutions in the field of transport, have always been the leading element of modern tourism. Although the world wars in the 20th century has deal a major blow on world economy and social welfare, accordingly the worlds tourism, after the recovery period international tourism has grown very fast. After the Second World War, highway, automobiles and innovations in air transportation have increased, and these novelties have provided quicker, easier and cozier travels.

With the expansion of air transportation and becoming affordable for people, international tourism has gained a new dimension. Thanks to innovations in aircraft industries, information technologies and marketing strategies, air transportation has become more affordable and these helped to expand the international tourism.

The graphic below shows the number of international tourist arrivals worldwide from 1950 to 2017. Despite some small falls in some years, it can be seen that international tourist arrivals have increased drastically since 1950s. As stated in Statista; *"As international travel has become more accessible, the number of international tourist arrivals has greatly increased. The availability of air travel to the public has been one factor in increasing the number of international tourist. The first commercial jet debuted in 1950, when there were around 25 million international tourist arrivals worldwide. Since then the commercial aviation industry has grown greatly, with an estimated 7,141 commercial air carriers in the U.S. alone, as of 2017. Tourism has grown alongside the aviation industry, reaching with about 1.32 billion international tourist arrivals worldwide in 2017. In the same year, the region with the largest number of international tourist arrivals was Europe, with 670.6 million tourists arriving from abroad, followed by Asia Pacific with 323.1 million."*(Statista, 2015)

Figure 4.1. Number of international tourist arrivals worldwide from 1950 to 2017 (in millions) (UNWTO, 2018)

The Figure 4.2 shows the mode of transport rates of global international tourists for the year 2017. As it can be seen, nearly %60 of international tourist arrivals in 2017 have been realized by air transportation. So it can be assumed that in the modern world, the strongest way of transportation is airplanes and air travel is of vital importance for global tourism.

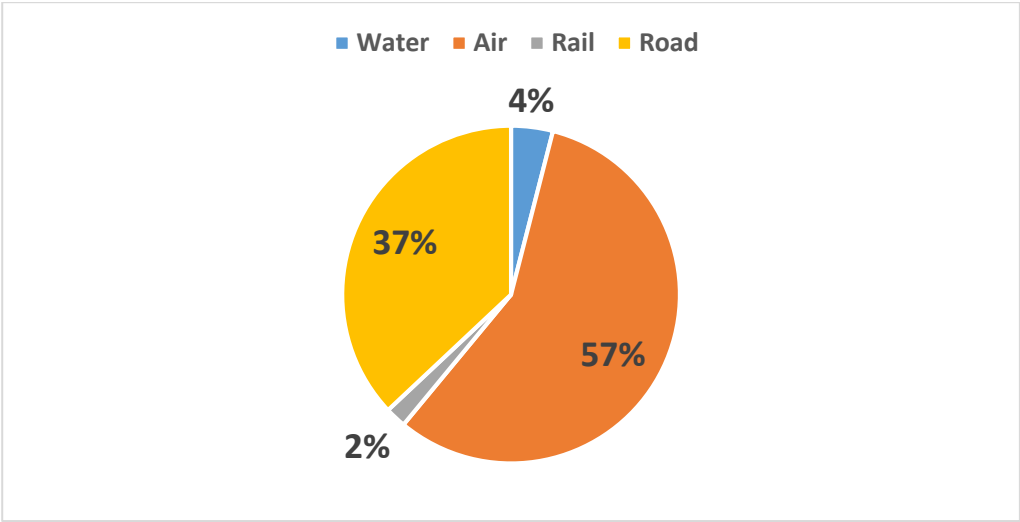

Figure 4.2. Mode of Transport (2017) (UNWTO, 2018)

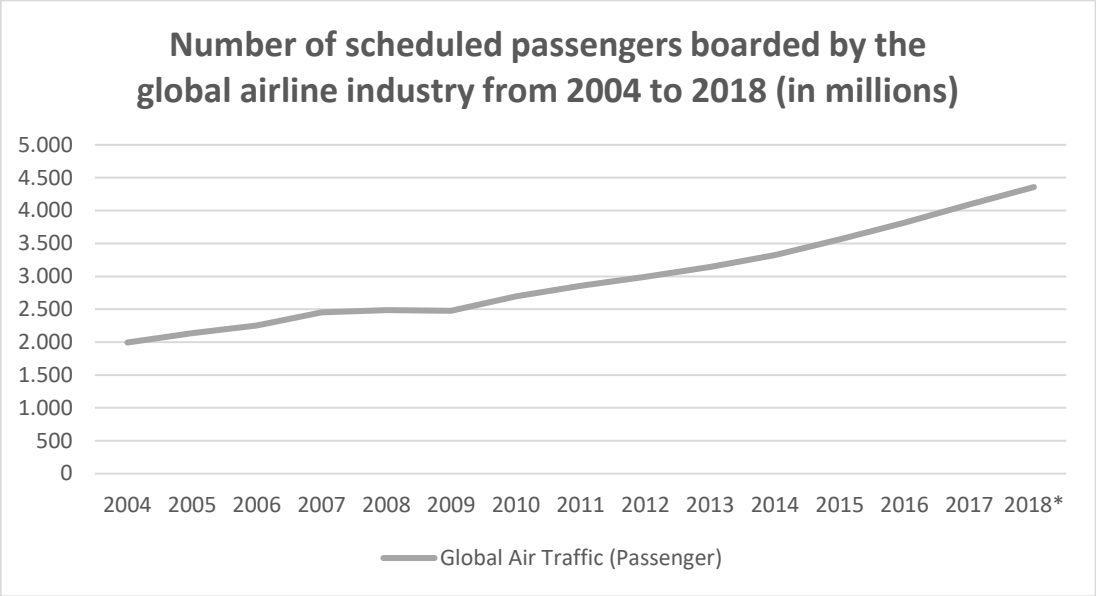

Figure 4.3. Number of scheduled passengers boarded by the global airline industry from 2004 to 2018 (in millions) (Statistica, 2015)

As can be seen in the Figure 4.3, global air transportation is also increasing rapidly. In 2017 total number of scheduled passengers in the world is more than 4 billion. While nearly the %60 of the number of international tourist arrivals in 2017 realized by air transportation which is more than 750 million, for the year of 2017 nearly %20 of global airline passengers are consist of international tourists. When considered that remaining %80 is also includes the local tourist arrivals, this percentage could be assumed as an important indicator to comprehend why tourism and air transportation are crucially important for each other.

Şengür & Hemdil states in their research that; *"The symbiotic nature of air transport and tourism provide the common grounds of interactions between two industries. Various changes in air transport industry such as route developments, number of aircrafts in operation, flight frequencies and airport expansions are prone to be in interaction with tourism industry via affecting and/or being affected by the various*

changes as the number of touristic attractions, touristic accommodation capacity and its utilization as well as tourist profiles and tourist-nights."(Şengür & Hemdil, 2014)

In the view of such information, existing and future tourism potential of both Turkey and Istanbul are essential for the future success of Istanbul Airport. Istanbul Airport, which was invested with the aim of being one of the most important hub airports in the world, should be considered not only as a transfer center but also a tourism attraction center in order to expand the contribution to both regional and national economy. On the other hand, due to mutual affinity between tourism and airports, not just tourism is important for Istanbul Airport but success of the airport is also essential for both regional, national and global tourism.

Before examining the present and future tourism potential of Istanbul, comprehending the role of Turkey in the stage of world tourism could be assumed as a significant point. Both airports in Istanbul are not only using by the tourist came to visit the city but also transferring passengers to go another touristic destinations in Turkey. Since there is not a wide range of international flights at all airports in Turkey, the majority of foreign tourists coming to visit Turkey is making transfers from the airports in Istanbul, especially from Istanbul Ataturk. Because of this reason, the number of international tourist arrivals to Turkey is an important factor for the performance of Istanbul Airport. For year 2017, according to the report of UNWTO(UNWTO, 2018) Turkey is one of the World's top tourism destinations with the ranking of eight. Moreover, as can be seen in the graphic below; with the growth rate of %24,1 according to previous year, Turkey has become the most growing country in terms of international tourist arrivals when compared to top ten tourism destinations in the world in 2017.

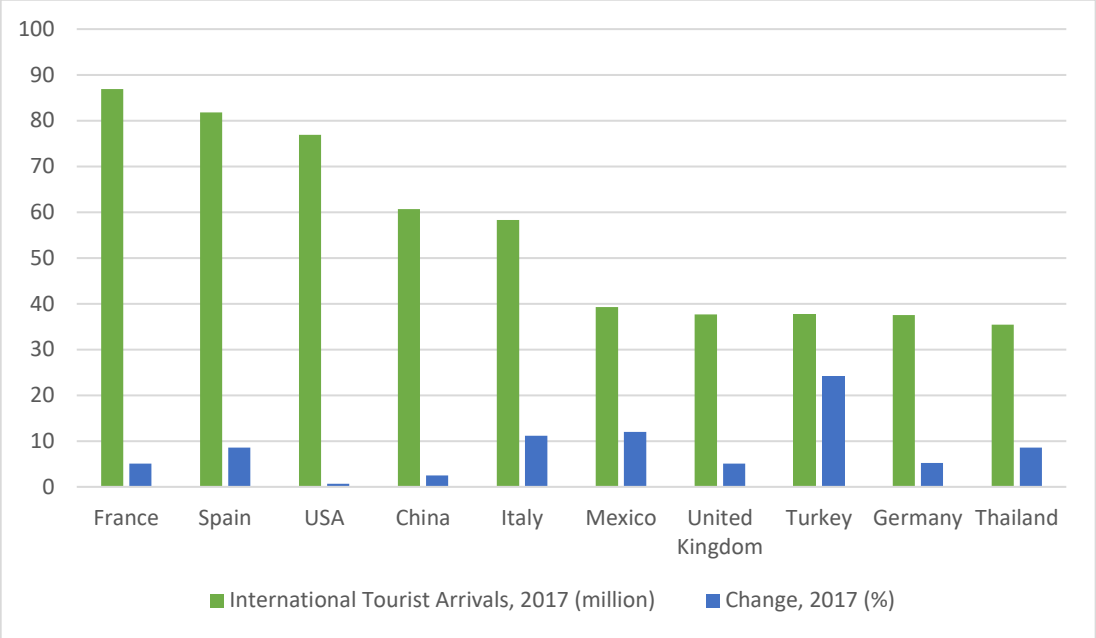

Figure 4.4. International Tourist Arrivals and Annual Change, 2017 (UNWTO, 2018)

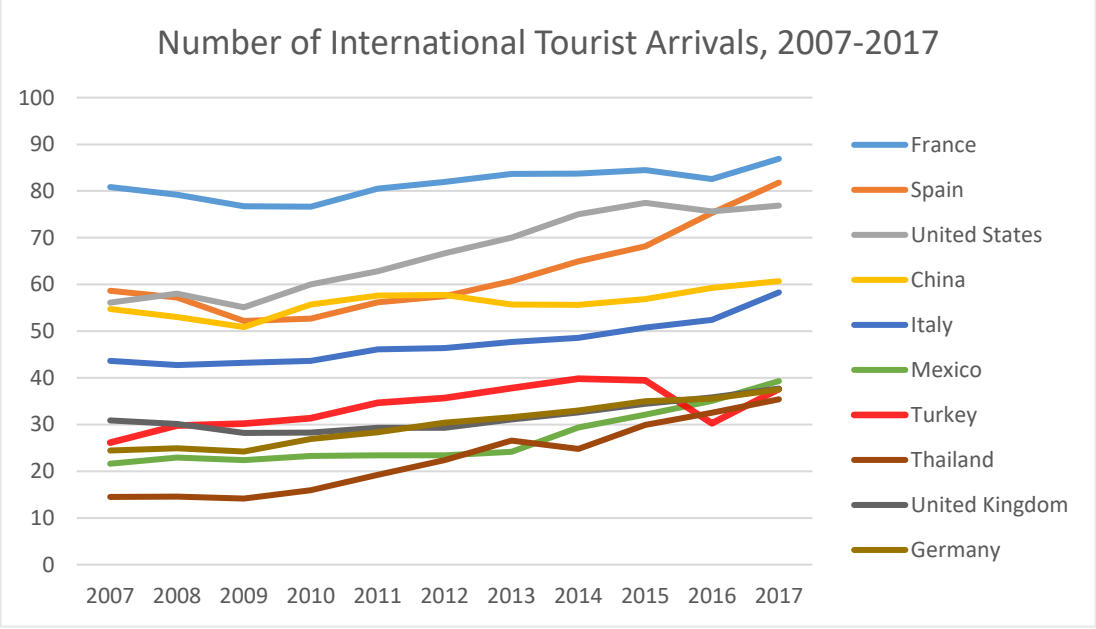

Figure 4.5. Number of International Tourist Arrivals, 2007-2017 (Statistica, 2015)

Recent tourist arrival history of the top ten tourism destinations of 2017 are shown in the Figure 4.5. In year 2016 the number of international tourist arrival to Turkey has

experienced a significant decline as a result of the terrorist attack on Istanbul Ataturk Airport and treacherous coup attempt occurred in same year. However, Turkey has threw out the effects of these terrible experiences and rebound quickly. Probably, with the increasing number of international tourist arrivals, Turkey will achieve again the 6th rank of top tourism destinations in the world at the end of 2018.

Like across Turkey, Istanbul has also influenced pretty bad by the terrible cases experienced in 2016 in terms of foreign tourist numbers. The amount of foreign tourists which had increased continuously since 2008, experienced a significant decline after these events. However, like the country, Istanbul has also gave a quick response and started to recover rapidly. As can be seen from the following chart, İstanbul has drawn close to the 2015 numbers of tourists in 2017 and at the end of the 2018 amount of international tourist arrivals had become the highest level of its history with almost 13,5 million tourists. The number of international tourist arrivals in 2018 have already exceeded the numbers of 2017 even though it only includes the months between January and October. It could be assumed that Istanbul has overcame the effects of the bad cases experienced in 2016 due to its strong tourism potential. Although many intuitions around the world such as Telegraph(Morris, 2016) declared that tourism sector of Turkey received a blow from the terrible events experienced in 2016, Turkey and Istanbul has entered a recovery phase quickly. This could be assumed as a fact that indicates how strong is the tourism potential of Turkey and Istanbul.

Figure 4.6. International Tourist Arrivals to Istanbul, 2008-2018 Source: TUIK and MoCT

All around the world with its diverse tourism potential Istanbul is one of the most visited cities by international tourists. According to the research done by Mastercard(Erenhouse, 2017) Istanbul is the 10th city in the world in terms of being visited by international tourists. Moreover, in Europe Istanbul is the third most visited city. Şengür & Hemdil states that; *"Thanks to her unique geographical position located at the cross-roads Istanbul is a natural bridge between East and West divided by the Bosphorus. This geo-strategic position enabled her to flourish as one of the main and oldest commercial and cultural capitals of the world throughout the ages as the capital city of Roman, Byzantine and Ottoman Empires. Istanbul today is both a trip generator on its own by her various attractions and an air transport hub between Europe and Asia, Africa and Middle East."*(Şengür & Hemdil, 2014)

Table 4.1. *Most Visited Cities by International Tourists*(Erenhouse, 2017)

City	Number of International Visitors, 2017
Bangkok, Thailand	20,2 Million
London, UK	20 Million
Paris, France	16,1 Million
Dubai, UAE	16 Million
Singapore	13,45 Million
Tokyo, Japan	12,5 Million
Seoul, South Korea	12,44 Million
New York, USA	12,4 Million
Kuala Lumpur, Malaysia	12,1 Million
Istanbul, Turkey	10,7 Million

As mentioned before, tourism and aviation sectors are in mutualistic affinity. The potential of Istanbul and its region as a global tourism attraction center is one of the most important factors that can help Istanbul Airport to reach its goals in the future. Istanbul, which offers the opportunity of seeing traces of different periods of history in itself, with the Bosporus, historical and cultural tourism heritage of the peninsula shines out as the most important tourism destination of the country. With cultural/historical, congress, health, cruise and nature tourism potentials, the city is increasing its diversity of tourism each passing day and also hosting many domestic tourists from anywhere in Turkey, not just international tourists. In addition to that, in the "Tourism Strategy of Turkey- 2023(Ministry of Culture and Tourism of Turkey, 2007)" prepared by Ministry of Culture & Tourism, Istanbul has been supported by many themes.

In order to protect and use historical and cultural values where tourism potentials is high, and also provide sectorial development, in accordance with the Tourism Promotion Law No. 2634, 267 "Tourism Centers" and "Cultural and Tourism Conservation and Development Zones" have been declared in 81 provinces with the decision of the Council of Ministers("KTKGB ve Turizm Merkezleri," n.d.). In this

study, Istanbul is the second province with the most tourism center after Antalya. Istanbul has 20 of these centers which are;

1. Akaretler Tourism Center
2. Ataköy Tourism Center Tevsii
3. Baltalimanı Tourism Center
4. Barbaros Evleri Tourism Center
5. Beşiktaş Atik Alipaşa Yalısı Tourism Center
6. Beykoz Hünkar Kasrı Tourism Center
7. Beyoğlu Tophane Salıpazarı Tourism Center
8. Boğaziçi Okullar Bölgesi Tourism Center
9. Çırağan Sarayı Tourism Center
10. Galata Kulesi Ve Çevresi Tourism Center
11. İstinye Koyu Tourism Center
12. İstinye Tourism Center Tevsii
13. Sarıyer İstinye Tourism Center
14. Park Otel Tourism Center
15. Sultanahmet Meydanı Tourism Center
16. Şişli Bomonti Tourism Center
17. Taşkışla Tourism Center
18. Taşkışla Tourism Center #2
19. Tuzla Akfırat Tepeören Tourism Center
20. Yeşilyurt Tourism Center.

When the developments and new trends in tourism sector considered, it could be assumed that interest in not only mass tourism but also alternative tourism is increasing every day. Arguably, these kind of circumstances can be considered as a factor that will increase the number of tourist coming to Istanbul in the future. Furthermore, developments in marketing and business strategies such as low-cost carriers, air travelling is becoming more affordable for people and this is leading to an increase in demand for travelling with airplanes. Since air transportation is the most important mode of travel as mentioned before, it would not be wrong to expect more foreign and domestic tourists will come to Istanbul in the future. Besides taking advantages of being a tourism attraction point, Istanbul airport will also be nourished from tourists who will visit the catchment area of the airport which can be assumed as the cities of Edirne, Yalova, Kocaeli and Kırklareli. In this context, Edirne is an important city in terms of tourism with its cultural and historical potential and also

being in the UNESCO Heritage List(“Spain - UNESCO World Heritage Centre,” n.d.). Thus, it could be assumed as, the developments in Edirne tourism will increase the domestic and international air passenger demand for Istanbul airport. In addition to the contribution of Edirne in the tourism infrastructure development in the provinces of Tekirdag, Yalova, Kocaeli and Kırklareli, the demand for tourism will also be reflected in domestic and international flights at Istanbul Airport.

The tourism sector, which is one of the fastest growing sectors in the world, might have a significant impact in the development of international flights in Istanbul Airport. In addition to its domestic tourism potential, Istanbul has a great potential for being one of the most important cultural and tourism centers in the world. The wide variety of tourism and the strong infrastructure of the city can be an important sign that tourism activities will develop rapidly. Istanbul, which is visited by tourists from all nationalities, from all over the world, has been accepted as a cultural and tourism capital in the world. Thanks to possessing many touristic regions which are in the UNESCO Heritage List, Istanbul is an advantageous city with its reputation in the world in terms of tourism.

As it has been stated many times, the aviation sector and tourism have a strong and mutual relationship, and therefore, tourism regarded as a very important input for the aviation sector. The existence of tourism is very important for the sustainability of the aviation sector. Since accessibility is one of the most important factors for increasing the potential of a tourism center, having strong transportation links and a strong air transportation infrastructure is highly effective for both the tourism and aviation industry's competitiveness.

Accessibility provided by air transportation in developing regions is indispensable for the continuation of tourist flows and development of the region. In addition to the employment created by the aviation sector, through making tourism possible aviation sector is also providing; accommodation, entertainment, local transportation etc. opportunities and it allows for the development of many other sectors, increasing local

employment and accelerating regional development. According to a research done by Airbus, it is foreseen that in 2035, 39% of total air traffic will be between developing countries and 33% will be among the developing countries and today's developed countries. In other words, in the near future, approximately 72% of the world's airway traffic will be carried out to cover these emerging economies(Airbus S.A.S., 2016).

One of the most important characteristics that distinguishes developing countries from the developed countries is the middle-class population, which has increased significantly in these countries. As stated in the "Global Market Forecast" prepared by Airbus, *"The evolution of the middle classes is an excellent proxy for this relationship. In 2002, about a quarter of the world's population could be described as "middle class", today it's around 40% and by 2037, is forecast to be well over 50% or some five billion people, all in the pool of regular or potential new flyers in the future."*(Airbus S.A.S., 2018) As can be seen in the Figure 4.7, middle class is to almost double over the next 20 years.

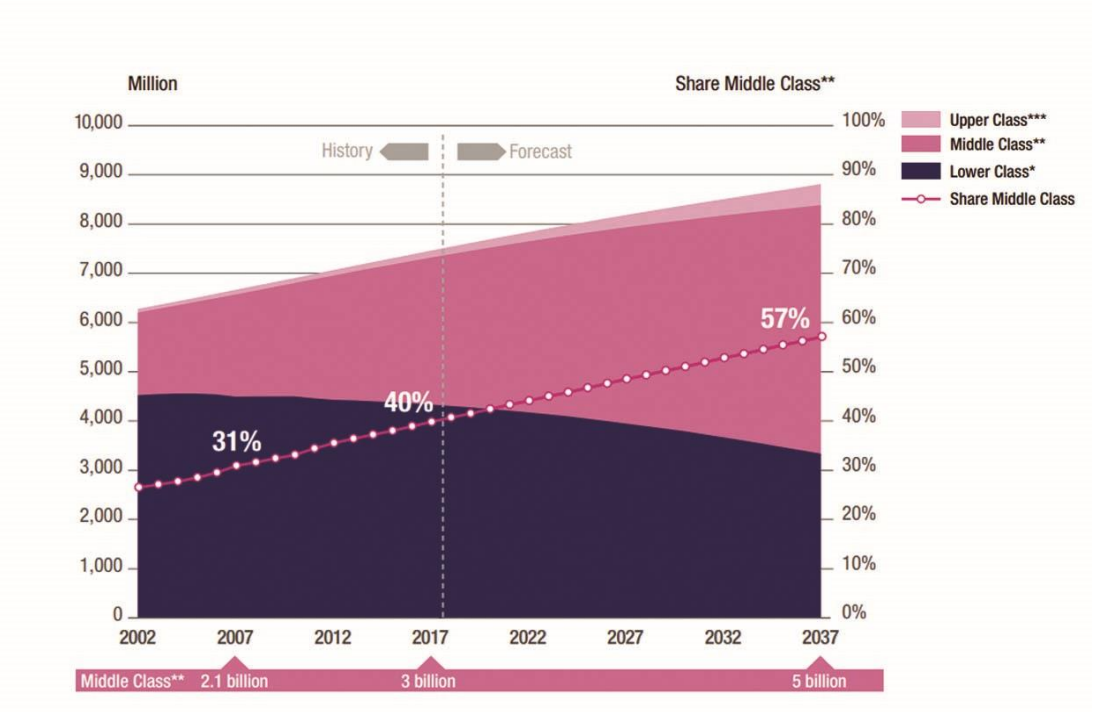

Figure 4.7. Middle Class Population 2002-2037 (Airbus S.A.S., 2018)

In the near future, it may be argued that there will be a significant increase in the proportion of international tourists. As it mentioned before, the main reason behind this expected increase is the growing number of middle class especially in developing countries. Most probably not all of the regions in the world will not benefit from this growing global tourism potential equally. According to World Travel & Tourism Council's Global Travel & Tourism Economic Impact Report(Turner, 2017), it is expected that the global GDP sourced by tourism and travel will increase by 3.9%. For the regions, it is estimated that Asia will be the region that will increase tourism revenues the most. Europe (2.8%), Middle East and Africa (2.8%), which are expected to show growth below the world average, are expected to receive less shares from this emerging tourism market. On a country basis, according to the same report growth rates, with 3.8% of Turkey's tourism and travel revenues are expected to grow by 3,8% which is close to the world average.

Above all, it would be appropriate to state that Istanbul and Turkey has a very important place in the global tourism. With its tourism potential, Istanbul is not only one of the most important tourism destinations in the world, but also has a tendency to recover quickly in the face of bad events in both domestic and foreign policies. The city, which has come to grip with terrible problems such as coup attempt, terrorist attacks and the plane crisis with Russia, can be regarded as very robust in terms of tourism. Istanbul will continue to be one of the most important tourism centers in the world with its tourism diversity and strong transportation infrastructure. In this context, Istanbul Airport can be considered not only as a transfer center in the global aviation system, but also as an airport which will be nourished by the tourism potential of the city, by this means intense air traffic.

On the contrary, the tourism sector for a country is undoubtedly related to being politically stable. Despite Istanbul and Turkey could be assumed as resilient against these kind of events, negative effects of decrease in international tourists visits the city are undeniable. Due to its geopolitical location, it would not be reasonable to expect an increase in the amount of international tourist visits every year in a country which is always up to such events. However, the general trend in the future may be accepted as the increase of passenger traffic in Istanbul airport thanks to tourism. If the tourism potential of Istanbul will be used well and the country will politically stable in the future, there are not any major obstacle to be one of the most important airports in the world in the future in terms of tourism. After all, even now Istanbul is the 10^{th} most visited city and Turkey is the 8^{th} most visited country in the world.

4.2. Istanbul as a Financial Center

In addition to tourism, the contribution of business trips to the aviation sector is significant. Although most of the aviation activities are tourism travels, the number of airline passengers is increasing with the increasing business travels. With the increasing and continuing globalization of the world labor market in recent years, business travels have increased greatly compared to the past, with more regions

becoming more closely connected. As the number of international companies and the middle class population increases, the number of travels increases and countries and cities develop various strategies to attract employees from all over the world. Strategies such as organizing various congresses and conferences, establishing convention centers and organizing fairs can be given as examples.

In this context, Turkey is developing various strategies over Istanbul and one of the world's largest megacity Istanbul aims to become a center of business and finance. With its geographical location, 3-hour flight distance to 120 countries and hosting many international companies, it will not be wrong to think that Istanbul will benefit from this advantage in the aviation field.

In this respect, whether or not Istanbul will play a role as a financial center on the world stage in the future can be considered as one of the important factors that will directly affect the aviation sector and Istanbul airport. In line with the Istanbul Finance Center project, which was included in the ninth development plan and put into practice in 2009, it was aimed to establish a financial center in Ataşehir region. Although the steps taken for this purpose are seen as relatively useful, the desired point has not been reached yet. Berat Albayrak, treasury and finance minister of the Republic of Turkey, Istanbul Finance stated that the center will be opened before 2023(Tabak, 2019). With the completion of the project, it is foreseen that it will provide employment opportunities to nearly 30,000 people. The financial center built on an area of 2.5 million square meters is expected to have 560,000 square meters of office, 90,000 square meters of shopping, 70,000 square meters of hotel and 60,000 square meters of residential area(Daily Sabah, 2019).

Today, although there are many financial centers in the world, some cities are considered as international financial centers. New York, London, Hong Kong and Singapore are recognized as the most important international financial centers in the world. International financial centers are considered to be very important for the countries where they are located. Basically, international financial centers make

significant contributions to the branding of countries, their global transformation and the development and deepening of the financial sector throughout the country. Given the great importance of a strong financial sector for countries today, the existence of an international financial center within the borders of the country can undoubtedly take the country one step further. In addition, these financial centers positively affect the quality and quantity of the workforce and enable domestic firms to attract the investments they need.

4.2.1. GFCI Index

The financial centers of the world have been evaluated twice a year by Long Finance and China Development Institute since 2007. This assessment is considered to be one of the most comprehensive evaluations of financial centers. This assessment made the financial centers in the world; business environment, infrastructure, reputation, financial sector development and human capital. Financial centers with a general GFCI score over the mentioned indicators are shown in the Table 4.2 (China Development Institute, 2019).

Table 4.2. *GFCI Index Scores and Rankings(Source: Long Finance)*

Finance Centers	GFCI 6 - 2009		GFCI 12 - 2012		GFCI 18 - 2015		GFCI 24 - 2018		GFCI 25 - 2019	
	Ranking	**Score**	**Ranking**	**Score**	**Ranking**	**Score**	**Ranking**	**Score**	**Ranking**	**Score**
London	1	790	1	785	1	796	1	788	1	794
New York	2	774	2	765	2	788	2	786	2	787
Hong Kong	3	729	3	733	3	755	3	783	3	783
Singapore	4	719	4	725	4	750	4	769	4	772
Shenzhen	5	695	32	637	23	694	12	726	14	730
Zurich	6	676	5	691	7	715	9	732	8	739
Tokyo	7	674	7	684	5	725	6	746	6	756
Chicago	8	661	8	683	11	710	17	717	20	717
Geneva	9	660	9	682	13	707	27	685	28	698
Shanghai	10	655	19	656	21	698	5	766	5	770
Sydney	11	651	15	670	15	705	7	734	11	736
Frankfurt	12	649	13	677	14	706	10	730	10	737
Toronto	13	647	10	681	8	714	11	728	7	755
Jersey	14	640	20	654	53	633	47	628	47	635
Guernsey	15	638	28	641	54	632	60	603	75	598
Luxembourg	16	637	24	646	19	700	21	694	30	691
San Francisco	17	634	12	678	9	712	14	724	16	727
Boston	18	634	11	680	12	709	13	725	13	732
Paris	19	630	29	640	37	664	23	691	27	699
Washington D.C.	20	630	14	672	10	711	36	655	32	689
Dubai	21	613	22	648	16	704	15	722	12	733
Istanbul	72	442	56	601	47	653	68	590	59	620

GFCI data in the above table is taken from the GFCI 6(Yeandle, Horne, Danev, & Morris, 2009) reports published in 2009, GFCI 12(Yeandle, Danev, & Mainelli, 2012) published in 2012, GFCI 24(Yeandle, Wardle, & Mainelli, 2018) published in 2015 and GFCI 25(Yeandle & Wardle, 2019) published in 2019. While observing the changes in financial centers, it is observed that the first four rows have remained the same for many years. For this reason, London, New York, Hong Kong and Singapore can be considered as the world's top four international financial centers. In addition, Shanghai and Dubai have shown significant increases in recent years. Istanbul is

shown in the Table 4.3 as all years for GFCI by Long Finance. Since Istanbul was included in the GFCI reports with the opening of the financial center in 2009, values have been shown since the GFCI 6 report.

Table 4.3. *GFCI Index Scores and Rankings of Istanbul between 2009 and 2019 (Source: Long Finance)*

ISTANBUL			
GFCI Report	Year	Score	Rank
6	2009/2	442	72
7	2010/1	470	74
8	2010/2	496	70
9	2011/1	494	71
10	2011/2	580	62
11	2012/1	590	61
12	2012/2	601	56
13	2013/1	626	57
14	2013/2	633	44
15	2014/1	651	47
16	2014/2	655	42
17	2015/1	643	44
18	2015/2	653	47
19	2016/1	636	45
20	2016/2	620	57
21	2017/1	609	66
22	2017/2	617	78
23	2018/1	562	76
24	2018/2	590	68
25	2019/1	620	59

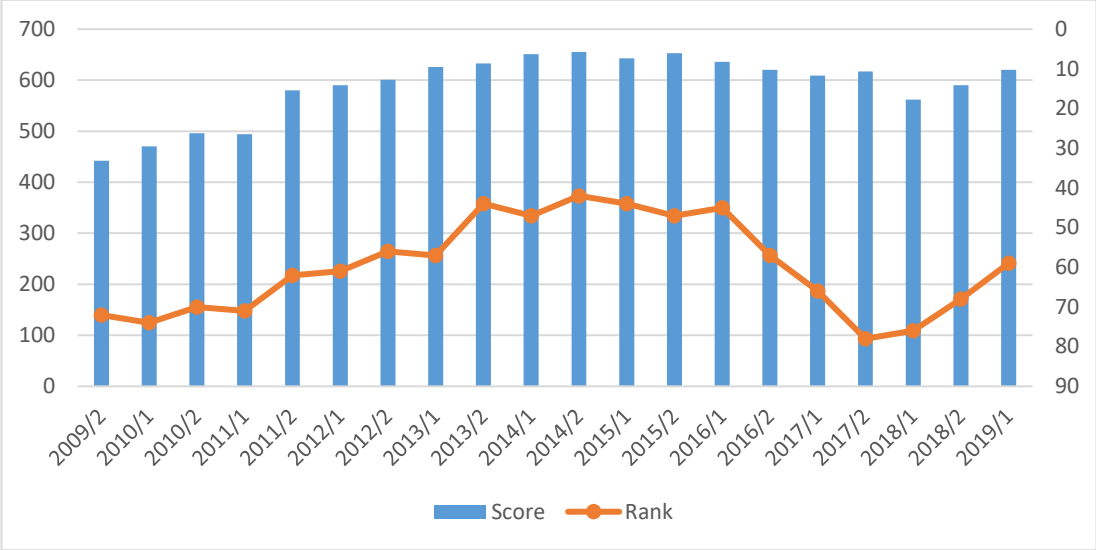

Figure 4.8. Istanbul Global Finance Centres Index, 2009-2019 (Source: Long Finance)

As can be seen from the Figure 4.8, when the Financial Center was launched in 2009, Istanbul was included in the 72nd place in the global financial center index by taking 442 points. Istanbul, which performed well between 2009 and 2014, rose to 42nd place in the list in 2014. GFCI 16 is mentioned as the leading financial center of Eastern Europe and Central Asia for Istanbul(Yeandle & Mainelli, 2014). Istanbul, which exhibited a stable appearance between the years of 2014 and 2016, started to decline with 2016. The coup attempt, political unrests, tensions due to the aircraft crisis faced with Russia and terrorist attacks realized between 2015 and 2016 undoubtedly affected Istanbul quite negatively. In GFCI 19, 20 and 21 reports it is stated that Turkey experienced drop in the rankings due to the continuing political unrest and trouble in Istanbul. Since the beginning of 2018, Istanbul has developed rapidly and compared to the end of 2017, GFCI has increased by 58 points and increased by 17 places.

4.2.2. GCI Index

The global cities index prepared by AT Kearney, one of the leading consulting firms in the world, can be considered as another parameter that can be useful in understanding the importance of Istanbul in terms of finance and business world. When preparing the index, cities are evaluated under five main headings which are;

business activity (30%), human capital (30%), information exchange (15%), cultural experience (15%) and political engagement (10%) (AT Kearney, 2019). Based on the developed index, cities are ranked in a certain order in the report every year. The rankings of the top 10 cities of 2019 and Istanbul between 2014 and 2019 is shown in the Table 4.4..

Table 4.4. *GCI Index Ranks of Cities 2014-2019* (AT Kearney, 2019)

City/Year	2019 Rank	2018 Rank	2017 Rank	2016 Rank	2015 Rank	2014 Rank
New York	1	1	1	2	1	1
London	2	2	2	1	2	2
Paris	3	3	3	3	3	3
Tokyo	4	4	4	4	4	4
Hong Kong	5	5	5	5	5	5
Singapore	6	7	6	8	8	9
Los Angeles	7	6	8	6	6	6
Chicago	8	8	7	7	7	7
Beijing	9	9	9	9	9	8
Washington	10	11	10	10	10	10
Istanbul	26	26	25	25	29	28

As can be seen from the table, New York, London, Paris, Tokyo and Hong Kong have been in the top 5 since 2014. Like in GFCI, Singapore is at the top of this ranking. Istanbul, which ranked 37th in 2012, has managed to climb up 11 steps in 7 years, but Istanbul cannot be assumed in a position to compete with the worlds largest.

CHAPTER 5

TIME SERIES FORECASTING

In this section, it is tried to predict how much passengers Istanbul Airport will serve in the next 10 years. Firstly, the data to be used in the estimation process were collected and appropriate estimation models were determined. Then, ARIMA and Exponential Smoothing models are used to estimate the air passenger amount for 10 years.

5.1. Istanbul Airport Air Traffic Forecast

As mentioned in the previous section, one of the main factors that show the success of an airport can be considered as passenger amount served by airport and aircraft movement realized. The purpose of all airports competing with the role of being a hub in the global air transportation system is to serve more passengers and thus increase their earnings. For this purpose, all airports and airline companies adopt and implement various strategies. The role of Istanbul in the aviation market, which served as a natural bridge between the East and the West, was mentioned in the earlier chapters. In order to sustain the development of the rapidly growing aerospace sector in recent years, Istanbul Airport, which is one of the biggest infrastructure investments of the country, has been constructed in order to sustain the development of the rapidly growing aviation sector. One of the most important questions to be answered within the scope of the thesis study is how many passengers will use the airport in the future.

In this respect, air traffic forecast for Istanbul airport was tried to be made in this part of the thesis study. In the context of the forecast study, the data to be used and the most appropriate estimation method was tried to be determined. Until now, various estimation methods have been developed in many different areas and for many different purposes. Estimation methods vary according to the forecast period as well as the desired information. Different forecast methods are used for short, medium and long term estimations. It can be said that statistical methods are generally used for

short-term predictions, econometric models for medium-term forecasts, and scenario modeling for long-term estimations. In this part of the thesis, with the help of statistical models, the predictions about the passenger traffic of Istanbul airport were tried to be obtained in the short term. In the following section, it is tried to predict the role of Istanbul airport in global aviation system by using scenario based estimation model.

5.1.1. Data

As it stated before, forecasting methods are both vary according to data type and estimation period. Today, forecasting methods are frequently used in many areas such as weather, supply and demand balances, finance, planning and organization. While some parameters are easier to forecast such as weather conditions of tomorrow, on the other hand predicting the lottery results is almost impossible. To clarify, predictability of a case is mostly depends on how much data are there that related to the possibility of the realization of that case. Therefore, adopting the appropriate forecast method is one of the most essential factors for reaching satisfying results. Rather than qualitative methods, in this part of the thesis quantitative forecast methods are more appropriate to use. Rob Hyndman and George Athanasopoulos states in their book that: "Quantitative forecasting can be applied when two conditions are satisfied; numerical information about the past is available and it is reasonable to assume that some aspects of the past patterns will continue into the future(Hyndman & Athanasoppulos, 2013)". As it is seen, quantitative forecasting methods would be more appropriate to use because past air traffic data perfectly fits the requirements of using quantitative methods. In other words, about air passenger visited Istanbul there are numerical information for past years and it would not be wrong to assume that the passenger growth pattern will continue in the near future.

Quantitative estimation methods usually work with two different data types. First of these is cross sectional data which includes samples of specific time points for units such as industries, cities, countries, people or families. The second one can be assumed as time series data which contains the values observed at equal time intervals of the

variables such as annual inflation rates, monthly interest rates or quarterly profits of a company. Since the data planned to be used for Istanbul airport are monthly passenger statistics, it is planned to use appropriate estimation methods for time series. Since Istanbul airport does not have any historical data and Istanbul Atatürk airport will carry all of its operations to the new airport, historical data of Atatürk airport has been used. In the book of "Forecasting: Principles and Practice", Rob J Hyndman and George Athanasopoulos states that for time series data most suitable models are exponential smoothing and ARIMA(Hyndman & Athanasoppulos, 2013). In a study conducted by Alberto Andreoni and Maria Nadia Postorino in 2006, ARIMA model was used to forecast air transport demand for Reggio Calabria airport in the South of Italy(Andreoni & Postorino, 2006). Moreover, Howard Grubb and Alexina Mason has used Holt-Winters methods (exponential smoothing method) in order to forecast UK air passenger demand in their study conducted in 2001(Grubb & Mason, 2001). In this direction, both ARIMA and exponential smoothing models has been used to forecast air traffic demand of Istanbul Airport for next 10 years.

5.1.2. Exponential Smoothing Model

Developed towards the end of the 1950's with contributions of Robert Brown, Charles C. Holt and Peter Winters(Hyndman & Athanasoppulos, 2013), Exponential smoothing technique is one of the most widely used statistical forecast methods in the estimation of time series data. The method is mainly based on the exponential weighting of the data observed in the past from the most current to the oldest. In other words, the oldest data is of the least importance, while the most recent data is considered to be more relevant and more important. The model, which is generally considered to be more reliable for short-term estimates, has three basic types as the basis for different purposes. These three different methods are:

1. Simple Exponential Smoothing: As the name implies, this method is the most basic version of the exponential smoothing method and is suitable for data types that do not include any trend or seasonality.
2. Holt Method (Double Exponential Smoothing): This method was created in 1957 by Charles C. Holt, with the development of the simple exponential

smoothing method, and basically included the concept of trend in the prediction method.(Hyndman & Athanasoppulos, 2013)

3. Holt-Winters' Seasonal Method (Triple Exponential Smoothing): Charles Holt and Peter Winters further developed the trend method developed by Holt in 1960 and included seasonality in the prediction model(Hyndman & Athanasoppulos, 2013).

As the historical data of the Istanbul Atatürk Airport will be used within the scope of the thesis and this data includes seasonality, the third and most complicated method is chosen as the most suitable method of exponential smoothing. As can be seen from the graph below, the seasonality has emerged as the data will be used on the basis of the month. Since the amount of airline passengers has peaked in the summer months and decreases towards winter, it is more appropriate to make estimates on monthly data.

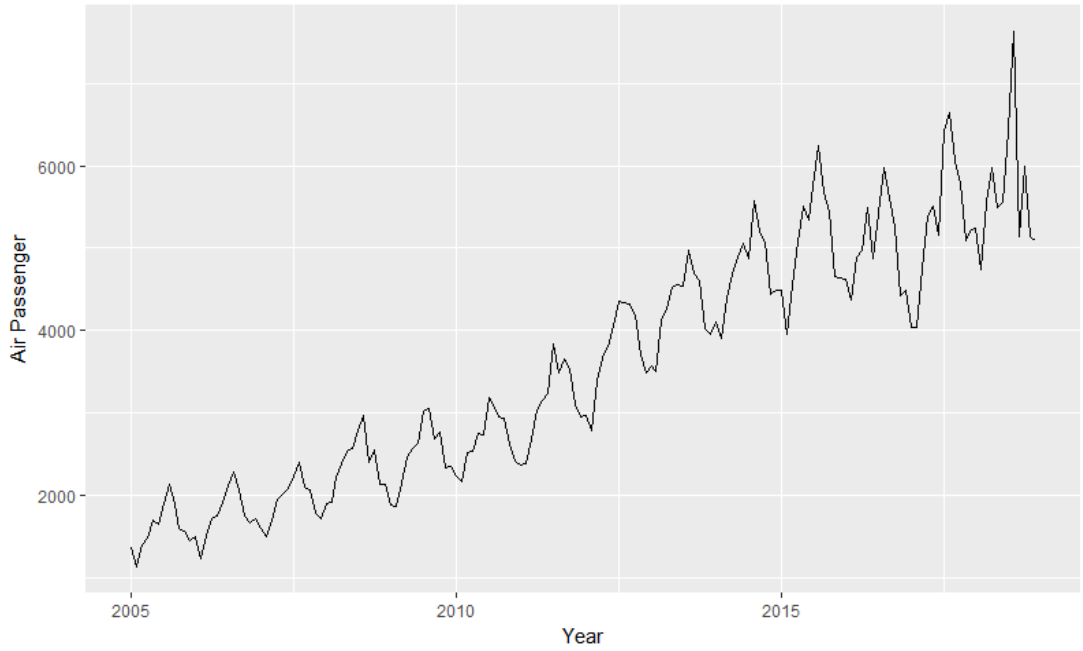

Figure 5.1. Istanbul Atatürk Airport Passenger Amount 2005-2018, in thousands (This figure is created by the author in reference to data of General Directorate of State Airports Authority, 2018)

The Figure 5.1 shows the decomposition of passenger traffic data at the Istanbul Atatürk Airport between years of 2005 and 2018. In Figure 5.2 the observed data on

the first chart, the trend in the second chart and the seasonality in the third chart are shown.

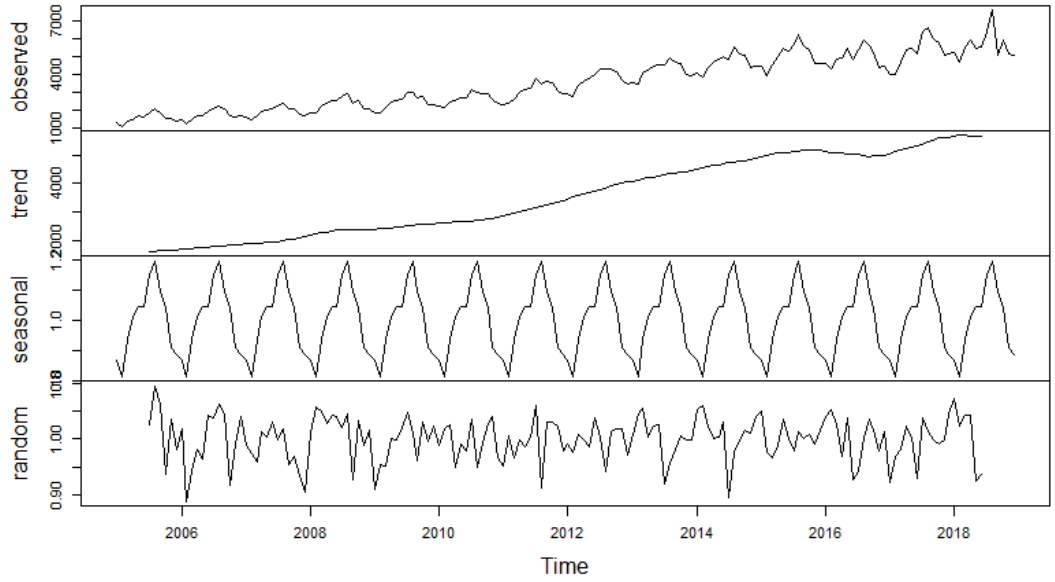

Figure 5.2. Decomposition of Multiplicative Time Series (This figure is created by the author in reference to data of General Directorate of State Airports Authority, 2018)

Basically, the formula for the exponential smoothing method, which does not include a trend or seasonality, was developed as follows:

$$S_i = \alpha X_i + (1-\alpha) S_{i-1}, with\ 0 \leq \alpha \leq 1$$

The variable descriptions in the formula are as follows(Hyndman & Athanasoppulos, 2013):

- X_i is the actual value at time i.
- α is the mixing parameter. How much new vs. old information is used.
- S_i is the smoothed value at time i.
- $S_i = \alpha \sum_{j=0}^{i} (1-\alpha)^j X_{i-j}$
- The last value to be estimated within the scope of the model is determined by the formula of $Xi_{+h} = S_i$.

However, as shown in the chart above, Istanbul Atatürk Airport has an increasing trend in passenger data between 2005 and 2018 and has a seasonality. There is no doubt that

the decreasing graphic, which increases every year to the summer months, is due to the increase in tourism in the summer months. In this respect, it is more appropriate to use the triple exponential smoothing model, which takes into account the trend and seasonality for forecasting. The formula of this model is as follows(Hyndman & Athanasoppulos, 2013):

$$S_i = \alpha(X_i - P_{i-k}) + (1-\alpha)(S_{i-1} + t_{i-1})$$

$$t_i = \beta(s_i - s_{i-1}) + (1-\beta)t_{i-1}$$

$$P_i = \gamma(X_i - S_i) + (1-\gamma)P_{i-k}$$

- k is the length of the period.
- γ is a mixing parameter for the seasonality.
- S_i and t_i are to be thought of as "double-smoothed" values, without taking seasonality into account.
- P_i is the seasonal part.
- The last value to be estimated within the scope of the model is determined by the formula of $X_{i+h} = S_i + ht_i + P_{i+h-k}$.

Holt-Winters or the triple exponential smoothing method is also divided into two types. These are the additive and multiplicative methods. As stated in the book of Forecasting: Principles and Practice, *"The additive method is preferred when the seasonal variations are roughly constant through the series, while the multiplicative method is preferred when the seasonal variations are changing proportional to the level of the series. With the additive method, the seasonal component is expressed in absolute terms in the scale of the observed series, and in the level equation the series is seasonally adjusted by subtracting the seasonal component. Within each year, the seasonal component will add up to approximately zero. With the multiplicative method, the seasonal component is expressed in relative terms (percentages), and the series is seasonally adjusted by dividing through by the seasonal component."*(Hyndman & Athanasoppulos, 2013).

The formula for the Holt-Winters' additive method is as follows(Hyndman & Athanasoppulos, 2013):

$$Y_{t+h|t} = l_t + hb_t + S_{t+h-m(k+1)}$$

$$l_t = \alpha(y_t - S_{t-m}) + (1-\alpha)(l_{t-1} + b_{t-1})$$

$$b_t = \beta(l_t - l_{t-1}) + (1-\beta)(b_{t-1})$$

$$S_t = \gamma(y_t - l_{t-1} - b_{t-1}) + (1-\gamma)s_{t-m}$$

In addition, the formula for the Holt-Winters' multiplicative method is as follows(Hyndman & Athanasoppulos, 2013):

$$Y_{t+h|t} = (l_t + hb_t)S_{t+h-m(k+1)}$$

$$l_t = \alpha\frac{y_t}{s_{t-m}} + (1-\alpha)(l_{t-1} + b_{t-1})$$

$$b_t = \beta(l_t - l_{t-1}) + (1-\beta)(b_{t-1})$$

$$S_t = \gamma\frac{y_t}{l_{t-1} + b_{t-1}} + (1-\gamma)s_{t-m}$$

In the scope of the forecast study, in order to be more comprehensive, both additive and multiplicative methods has been implemented to the observed data. The estimation study was carried out by a software called RStudio and α, β and γ values were determined within the scope of the least error margin thanks to the program algorithm. In this direction, Istanbul airport passenger forecast for a period of 10 years is shown in the Figure 5.3 in 95 confidence intervals. The estimation results on the month basis are indicated in the Table 5.1 and 5.2.

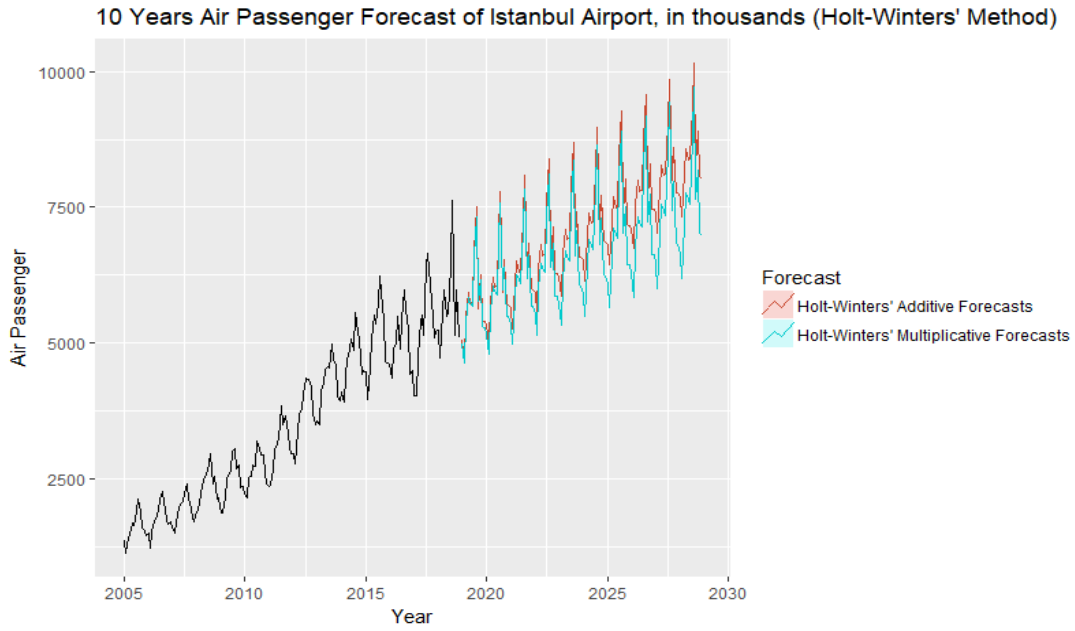

Figure 5.3. 10 Years Air Passenger Forecast of Istanbul Airport, in thousands (Holt-Winters' Methods)

Table 5.1. *Results of the Holt-Winters' Additive Forecast Method*

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Jan	5,056.16	5,350.56	5,644.97	5,939.38	6,233.79	6,528.20	6,822.61	7,117.02	7,411.43	7,705.84
Feb	4,677.74	4,972.15	5,266.56	5,560.97	5,855.38	6,149.79	6,444.20	6,738.61	7,033.02	7,327.43
Mar	5,482.41	5,776.82	6,071.23	6,365.63	6,660.04	6,954.45	7,248.86	7,543.27	7,837.68	8,132.09
Apr	5,926.09	6,220.50	6,514.91	6,809.32	7,103.73	7,398.14	7,692.55	7,986.96	8,281.37	8,575.78
May	5,726.84	6,021.25	6,315.66	6,610.07	6,904.48	7,198.89	7,493.30	7,787.71	8,082.12	8,376.53
Jun	5,748.88	6,043.29	6,337.70	6,632.11	6,926.52	7,220.93	7,515.34	7,809.75	8,104.16	8,398.57
Jul	6,675.04	6,969.45	7,263.86	7,558.27	7,852.68	8,147.09	8,441.50	8,735.91	9,030.32	9,324.73
Aug	7,504.18	7,798.59	8,093.00	8,387.41	8,681.82	8,976.23	9,270.64	9,565.05	9,859.46	10,153.87
Sep	5,640.77	5,935.18	6,229.59	6,524.00	6,818.41	7,112.82	7,407.23	7,701.64	7,996.04	8,290.45
Oct	6,249.52	6,543.93	6,838.34	7,132.75	7,427.16	7,721.57	8,015.98	8,310.39	8,604.80	8,899.21
Nov	5,410.19	5,704.60	5,999.01	6,293.42	6,587.83	6,882.24	7,176.65	7,471.06	7,765.47	8,059.88
Dec	5,400.77	5,695.18	5,989.59	6,284.00	6,578.41	6,872.82	7,167.23	7,461.64	7,756.05	8,050.46
Total	71,517.60	75,051.51	78,585.42	82,119.34	85,653.26	89,187.17	92,721.09	96,255.00	99,788.92	103,322.83

Table 5.2. *Results of the Holt-Winters' Multiplicative Forecast Method*

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Jan	4,987.57	5,172.65	5,357.83	5,543.11	5,728.49	5,913.97	6,099.55	6,285.23	6,471.01	6,656.89
Feb	4,633.49	4,804.91	4,976.43	5,148.04	5,319.74	5,491.53	5,663.42	5,835.40	6,007.47	6,179.65
Mar	5,400.22	5,599.42	5,798.71	5,998.12	6,197.63	6,397.26	6,596.99	6,796.83	6,996.78	7,196.84
Apr	5,830.14	6,044.55	6,259.07	6,473.71	6,688.46	6,903.34	7,118.33	7,333.43	7,548.66	7,764.00
May	5,755.94	5,966.99	6,178.15	6,389.43	6,600.82	6,812.33	7,023.95	7,235.68	7,447.54	7,659.51
Jun	5,690.09	5,898.11	6,106.23	6,314.47	6,522.83	6,731.29	6,939.87	7,148.57	7,357.38	7,566.30
Jul	6,605.05	6,845.80	7,086.68	7,327.69	7,568.83	7,810.10	8,051.51	8,293.04	8,534.71	8,776.51
Aug	7,314.69	7,580.53	7,846.50	8,112.62	8,378.88	8,645.29	8,911.84	9,178.54	9,445.39	9,712.38
Sep	5,771.72	5,980.86	6,190.11	6,399.48	6,608.96	6,818.55	7,028.26	7,238.08	7,448.02	7,658.07
Oct	6,176.66	6,399.82	6,623.09	6,846.49	7,070.01	7,293.65	7,517.42	7,741.30	7,965.31	8,189.44
Nov	5,301.62	5,492.61	5,683.70	5,874.89	6,066.18	6,257.58	6,449.08	6,640.69	6,832.40	7,024.22
Dec	5,293.80	5,483.95	5,674.19	5,864.55	6,055.00	6,245.56	6,436.22	6,626.99	6,817.86	7,008.84
Total	70,780.00	73,290.17	75,801.70	78,314.58	80,828.82	83,344.43	85,861.42	88,379.78	90,899.52	93,420.65

In the light of the data on the month basis as a result of the estimation models, passenger forecast for Istanbul Airport by 2028 is shown in the Figure 5.4 as two methods and average:

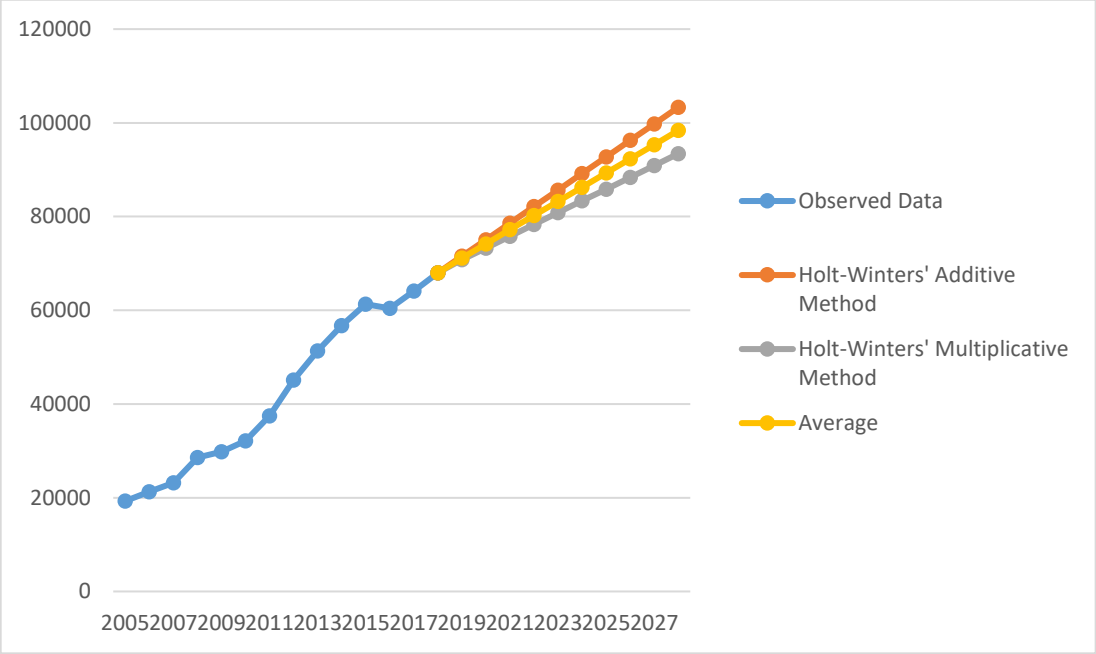

Figure 5.4. 10 Years Air Passenger Forecast of Istanbul Airport, in thousands (Holt-Winters' Method)

5.1.3. ARIMA Model

In addition to the exponential smoothing method, the ARIMA model is another method that is frequently used in time series estimation methods. These two models in a sense are considered complementary to each other. While the exponential smoothing model is basically based on trend and seasonality, as mentioned earlier, ARIMA models, which is an acronym for Auto-Regressive Integrated Moving Average, work on the autocorrelations in the data(Hyndman & Athanasoppulos, 2013).

There are two types of ARIMA models which are non-seasonal and seasonal. The formula for non-seasonal ARIMA model is:

$$y'_t = c + \emptyset_1 y'_{t-1} + \cdots + \emptyset_p y'_{t-p} + \theta_1 \varepsilon_{t-1} + \cdots + \theta_q \varepsilon_{t-q} + \varepsilon_t$$

This model is called as an ARIMA (p,d,q) model where p means order of the autoregressive part, d means the degree of first differencing involved and q means the order of the moving average part.

Unlike exponential smoothing methods, ARIMA models work on the assumption of stationary. While exponential smoothing methods basically depends on trend and seasonality, in order to work these factors should be removed and data should become stationary. This process is carried out by RStudio within the scope of the estimation study. As can be seen from the image below, the trend and seasonality feature of the data has been removed and become stationary.

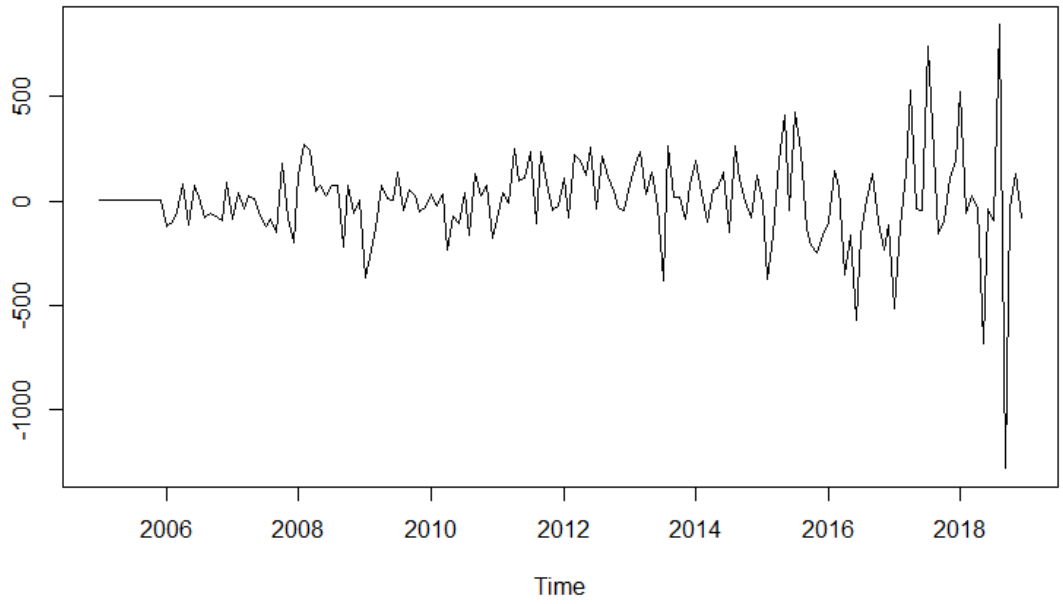

Figure 5.5. Stationary Data

While ARIMA model is being established, p, d and q variables can take different values according to the type of data and autocorrelation patterns. The most optimal values are available by RStudio at every probability. The following image shows the analysis done by RStudio and the most optimal model that has chosen. As can be seen in the Figure 5.6, the best ARIMA model for data has been determined as ARIMA (1,0,2)(0,1,1). The most appropriate ARIMA model selected in this direction was applied to the data and 10-year forecast results were obtained.

```
 ARIMA(2,0,2)(1,1,1)[12] with drift         : 2011.872
 ARIMA(0,0,0)(0,1,0)[12] with drift         : 2086.988
 ARIMA(1,0,0)(1,1,0)[12] with drift         : 2040.899
 ARIMA(0,0,1)(0,1,1)[12] with drift         : 2058.599
 ARIMA(0,0,0)(0,1,0)[12]                    : 2195.994
 ARIMA(2,0,2)(0,1,1)[12] with drift         : 1998.744
 ARIMA(2,0,2)(0,1,0)[12] with drift         : 2001.737
 ARIMA(2,0,2)(0,1,2)[12] with drift         : 2000.639
 ARIMA(2,0,2)(1,1,2)[12] with drift         : 2013.87
 ARIMA(1,0,2)(0,1,1)[12] with drift         : 1995.777
 ARIMA(1,0,1)(0,1,1)[12] with drift         : 2000.442
 ARIMA(1,0,3)(0,1,1)[12] with drift         : 1997.737
 ARIMA(2,0,3)(0,1,1)[12] with drift         : 2000.733
 ARIMA(1,0,2)(0,1,1)[12]                    : 1999.254
 ARIMA(1,0,2)(1,1,1)[12] with drift         : 2008.924
 ARIMA(1,0,2)(0,1,0)[12] with drift         : 1998.999
 ARIMA(1,0,2)(0,1,2)[12] with drift         : 1997.674
 ARIMA(1,0,2)(1,1,2)[12] with drift         : 2010.532
 ARIMA(0,0,2)(0,1,1)[12] with drift         : 2030.815

 Now re-fitting the best model(s) without approximations...

 ARIMA(1,0,2)(0,1,1)[12] with drift         : 2142.879

 Best model: ARIMA(1,0,2)(0,1,1)[12] with drift

Series: btsdata
ARIMA(1,0,2)(0,1,1)[12] with drift

Coefficients:
         ar1      ma1     ma2     sma1    drift
      0.8831  -0.6483  0.2157  -0.2287  24.7840
s.e.  0.0557   0.0979  0.0803   0.1066   5.4873

sigma^2 estimated as 51273:  log likelihood=-1065.44
AIC=2142.88   AICc=2143.44   BIC=2161.18
```

Figure 5.6. Possible ARIMA Models for Data

Istanbul airport passenger forecast done by ARIMA model for a period of 10 years is shown in the Figure 5.7. The estimation results on the month basis are indicated in the Table 5.3.

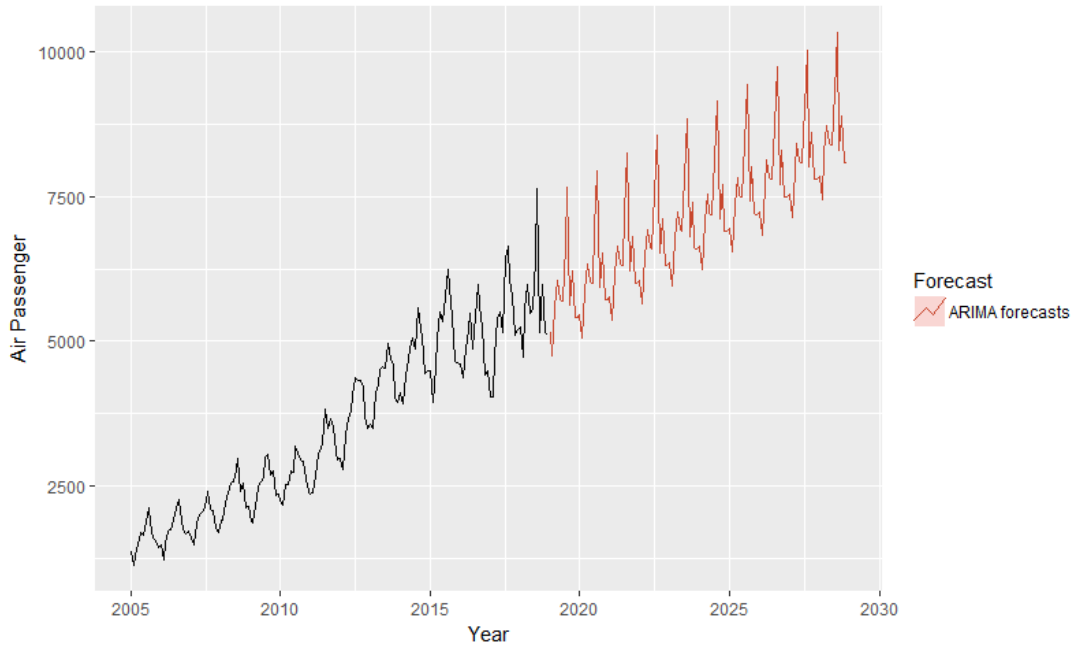

Figure 5.7. 10 Years Air Passenger Forecast of Istanbul Airport, in thousands (ARIMA Method)

Table 5.3. *Results of the ARIMA Method*

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Jan	5,165.31	5,459.10	5,756.70	6,054.15	6,351.57	6,648.98	6,946.39	7,243.79	7,541.20	7,838.61
Feb	4,760.74	5,058.90	5,356.47	5,653.92	5,951.33	6,248.74	6,546.15	6,843.56	7,140.97	7,438.37
Mar	5,574.09	5,872.16	6,169.72	6,467.16	6,764.58	7,061.99	7,359.39	7,656.80	7,954.21	8,251.62
Apr	6,043.12	6,341.12	6,638.66	6,936.09	7,233.51	7,530.92	7,828.33	8,125.73	8,423.14	8,720.55
May	5,732.06	6,029.98	6,327.50	6,624.94	6,922.35	7,219.76	7,517.17	7,814.58	8,111.98	8,409.39
Jun	5,707.88	6,005.75	6,303.26	6,600.69	6,898.10	7,195.51	7,492.92	7,790.33	8,087.73	8,385.14
Jul	6,643.21	6,941.02	7,238.52	7,535.95	7,833.36	8,130.77	8,428.18	8,725.59	9,022.99	9,320.40
Aug	7,654.51	7,952.27	8,249.76	8,547.18	8,844.59	9,142.00	9,439.41	9,736.82	10,034.23	10,331.63
Sep	5,627.22	5,924.94	6,222.42	6,519.84	6,817.25	7,114.66	7,412.07	7,709.48	8,006.88	8,304.29
Oct	6,221.72	6,519.40	6,816.87	7,114.29	7,411.70	7,709.11	8,006.52	8,303.93	8,601.34	8,898.74
Nov	5,419.01	5,716.66	6,014.12	6,311.54	6,608.95	6,906.36	7,203.77	7,501.18	7,798.59	8,095.99
Dec	5,411.59	5,709.21	6,006.67	6,304.08	6,601.49	6,898.90	7,196.31	7,493.72	7,791.13	8,088.53
Total	71,979.44	75,550.50	79,121.66	82,691.84	86,261.80	89,831.71	93,401.60	96,971.49	100,541.39	104,111.28

5.1.4. Results of the Forecast Models

As it was mentioned many times before, one of the most important indicators of success for airports was the amount of passengers. For this reason, an important way to understand what role Istanbul airport will play in the future is the amount of passengers. In this direction, the air traffic demand of Istanbul Atatürk Airport between the years of 2005 and 2018 was used to estimate the demand for air transportation for the next 10 years. Exponential smoothing and ARIMA model, which are one of the most frequently used estimation methods for time series, have been used in the study and all results are shown in the Figure 5.8 and 5.9 on month and year basis.

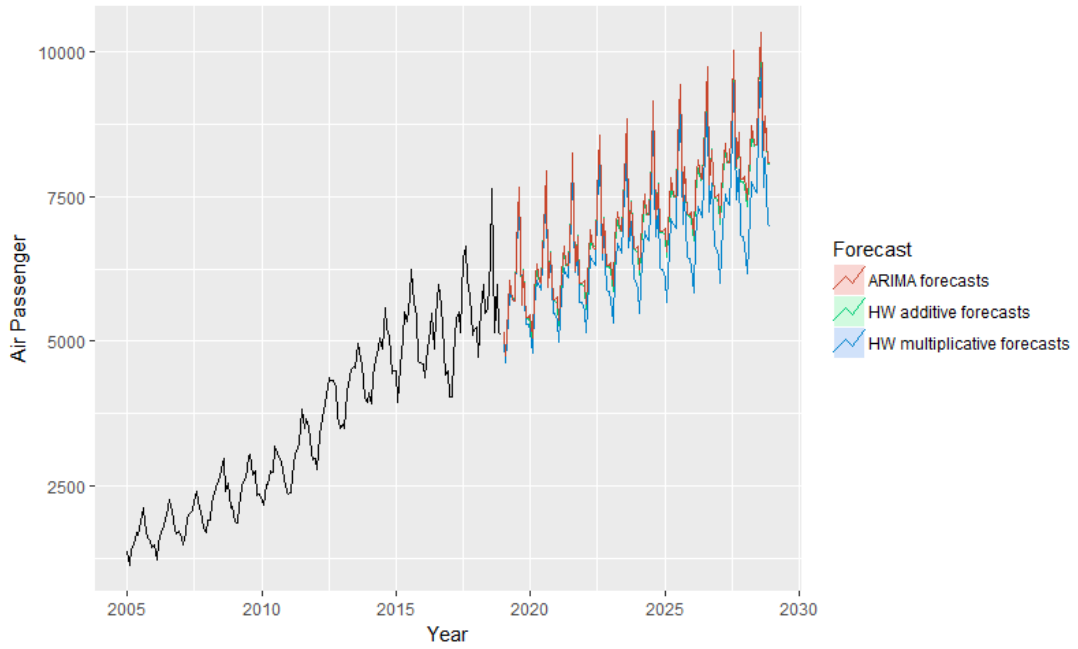

Figure 5.8. Air Passenger Forecast of Istanbul Airport

Estimation data on a year-by-year basis to be more understandable is shown in the graph below. According to this, it can be thought that Istanbul airport will serve about 100 million passengers after 10 years. Although the prediction models are based only on historical data and ignore other indicators that will affect the amount of passengers, forecast results can be considered as a clue to what the future will look like. In addition, as the capacity increase resulting from airport transition is not included in the forecasting model, it is expected that the air traffic forecasts will be slightly higher. It can be expected that Istanbul airport will serve more passengers with the other runways to be completed in the following phases. Finally, because the future has too much uncertainty, the estimation model is limited to 10 years. A qualitative forecast study for a longer period which is covering the other indicators are expected to affect air transportation were developed in the next section.

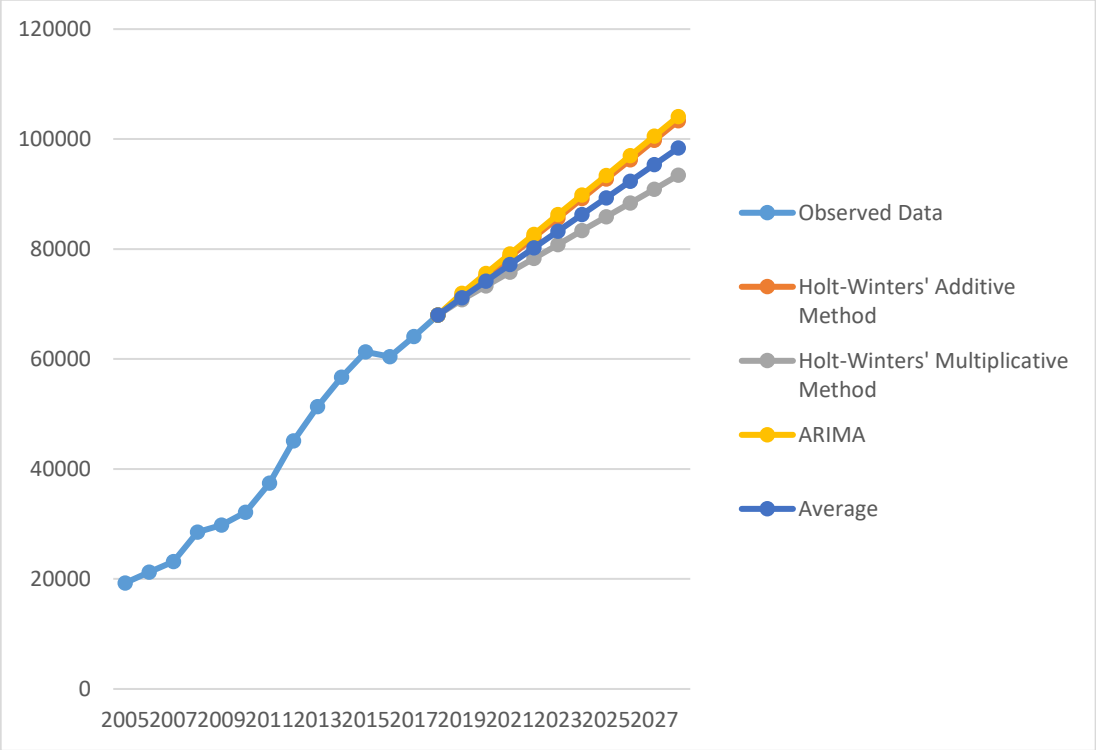

Figure 5.9. 10 Years Air Passenger Forecast of Istanbul Airport, in thousands (ARIMA and Holt-Winters' Methods)

Table 5.4. *Istanbul Airport Forecast Results, in millions*

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Holt-Winters' Additive Method	72	75	79	82	86	89	93	96	100	103
Holt-Winters' Multiplicative Method	71	73	76	78	81	83	86	88	91	93
ARIMA Model	72	76	79	83	86	90	93	97	101	104
Average	71	74	77	80	83	86	89	92	95	98

CHAPTER 6

SCENARIO ANALYSIS

In this chapter, a scenario analysis has been developed in order to predict what kind of a future is waiting for Istanbul airport. In this context, the outputs of two workshops organized within the scope of "Air Transportation General Study" project carried out by YTM-MATPUM were used and scenarios were developed by using in-depth interviews and multi-criteria decision-making method. Finally, the most probable scenario determined by the stakeholders of the sector.

6.1. Long Term Forecasting

The forecast of the future becomes more difficult as the targeted time interval increases. While predicting the next day’s weather condition may be quite accurate in today's conditions, guessing an event 15 years is considered to be difficult. Today's world is based on the very fast circulation of many resources such as money, people and information and makes it very difficult to predict the future due to the excess of the variables involved. Various uncertainties and risks in every aspect of life lead to rapid change of concepts. In addition, the technology that develops with each passing day affects people's lifestyles either positively or negatively. According to the old world, the theories that are assumed as absolute true are collapsing, huge institutions are being demolished and countries are altering. In this respect, trying to predict the future only basing on quantitative methods increases the margin of error and compels the world to ignore many variables that may affect the world.

By this means, estimating the future position of Istanbul Airport, its importance in the global aviation system and the possible spatial reflections would not be possible by only predicting the air traffic handled by the airport in next 20 years and more. At this point, it might be the most important thing to foresee how the future and global aviation system will be shaped where Istanbul Airport will take place.

In light of these ideas, a long-term estimation study was conducted, recognizing that the world would be filled with unexpected processes and uncertainties in the distant future. This estimation study can be considered as a qualitative research method which includes the results of a quantitative analysis done in the previous section. As mentioned earlier, it is thought that it would be more appropriate to use a method where both quantitative and qualitative data and analyzes are harmonized, since only a quantitative method based estimation model would increase the likelihood of fallibility.

The most commonly used long-term quantitative estimation methods are scenario based forecast models. As used by IATA and EUROCONTROL which have been summarized in the second section, various scenarios have been developed and the most likely scenario has been tried to be estimated. In the scenario development process political, economic, technological, ecological and social factors expected to affect the future of air transportation have taken into account, moreover, goals and priorities targeted by Turkish government in the field of transportation and aviation have also been addressed. Besides, the opinions of the experts closely related to the sector have been got, which is an important part of the scenario development process, in order to adopt a comprehensive and participatory way.

6.2. Scenario and Scenario Development Methods

The scenarios used in long-term forecasting models can be regarded as basically a description of a possible future and the way of developments towards achieving that. The scenarios include how possible future key issues will be shaped, and likely to be predicted, rather than in every sense of the future. Scenarios are generally regarded as hypothetical definitions by experts, and it is not asserted that the future will be shaped as described in the same way(Kosow & Gassner, 2008).

The scenarios that are intended to be developed generally arise from the possible relationships between the variables related to the subject matter, how the variables will change and how they will affect each other. Kosow and Gassner describe this as a

scenario funnel in his books and conceptualizes them through the visual shown below(Kosow & Gassner, 2008). Accordingly, variables a, b and c come together in different concepts according to their expected future and reveal different scenarios.

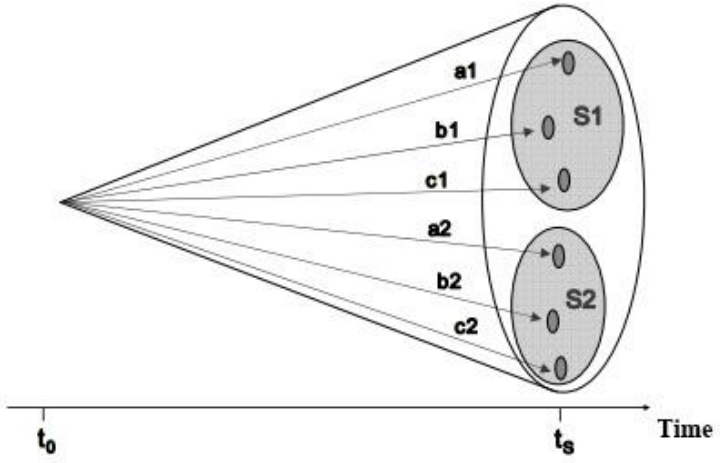

Figure 6.1. Scenario Funnel (Kosow & Gassner, 2008)

Although the scenario development process can be explained in this way basically, as in every field, there are various scenario development methods. The scenario development techniques vary in accordance with different times periods, different needs of fields such as business, urban planning, entrepreneurship, research and consulting etc., and of course, in the light of various ideas and paradigm approaches. In other words, there are various methods such as; trend analysis, actor analysis, cross impact analysis, Delphi-Methods, multi-criteria evaluation, analytical hierarchy process and road-mapping techniques etc.(Sarpong & Amoah, 2016).

Kosow and Gassner discuss the scenario development process in 4 phases. These are; definition of the scenario field, determination of key factors, analysis of key factors and scenario generation.(Kosow & Gassner, 2008).

In the first phase; the scope of the scenario is determined by answering questions such as “what purpose the scenarios will be developed”, “what is the subject” and “what

problems should be dealt with". In the second phase, the variables, parameters, trends and developments expected to shape the future related to the subject of interest are determined. In the third phase, the effects of the key factors determined in the previous period, their relations with each other and their uncertainty are evaluated. In the fourth phase, various scenarios are developed as can be seen from the previous visualization by grouping the key factors evaluated(Kosow & Gassner, 2008).

There are two different types of scenarios in the literature which are accepted as the outputs of the scenario development process. These are explorative and normative scenarios. The exploratory scenarios are basically opinions about how the future can be without a desire for the future. On the other hand, normative scenarios include some targeted values and interests. The example questions involved in normative scenarios can be given as "What kind of a future do we want?", "How we can achieve it?" etc. Kosow and Gassner summarized these two types of scenarios as follows(Kosow & Gassner, 2008):

	Explorative	**Normative**
Procedure	Explores possible future developments with the present as point of departure	Identifies desirable futures or investigates how to arrive at future conditions
Function	Explorative and/or knowledge function	Target-building function and/or strategy development function
Implementation	Study of factors and unpredictabilities, test of possible actions to be taken and/or decision-making processes	Definition and concretization of goals and/or, if appropriate, identification of possible ways to reach a goal
Central question	What? – What if?	How? – How is it to come about? – How do we get there?
Inclusion of probabilities	Possible	Indirect, part of plausible shaping and planning

Figure 6.2. Schematic comparison of explorative and normative scenarios (Kosow & Gassner, 2008)

In this respect, it is considered that developing explorative scenarios within the scope of the long term forecast study more appropriate.

6.3. Scenario Analysis

Unlike the time series forecasting work it has been recognized that not only past the air traffic results realized during the past but also the expected variables that may affect the global air transportation and the air transportation priorities determined by the Republic of Turkey should be taken into account in the long term forecasting study. In this respect, a prediction model is needed which will consider these criteria and develop scenarios in line with these. The analytical hierarchy process, which is one of the multi criteria decision making methods, has been used in the study. The analytic hierarchy process can be considered as one of the most suitable models that can be used in this context, since it is important that the estimation study has a methodology that adopts a participatory approach as it mentioned before. AHP, which is a multi-criteria decision making method developed by Thomas Saaty in 1970s, is a multi-criteria measurement theory that uses descriptive, quantitative and qualitative criteria that derive scale values from pair comparisons and scoring(Ünal, 2012). It is a very beneficial method for evaluating various variables for decision makers, determining their importance and seeing their interactions with each other.

AHP allows decision-makers to decide on the importance of several variables for each other through a matrix. Participants give points about the importance that they have in a range determined by the variables and as a result of this process, hierarchical variables can be sorted or grouped according to their importance. Within the scope of the scenario study, it is aimed to evaluate the variables that are likely to affect air transportation in terms of air transportation targets that are prioritized by the country. In other words, it is aimed to evaluate the country's air transportation targets and the developments that are expected to affect the world air transportation together. Within the scope of the model, firstly, it is aimed to determine the priorities of air transportation, to determine an importance value to these priorities and then to compare these priorities with the variables that may affect air transportation.

In this context, first of all, the targets determined by Turkish Republic in terms of aviation sector has tried to be detected. These objectives have detected through investigating; The Ministry of Transport, Maritime Affairs and Communications 2013 Council and the 2017-2021 Strategic Plan, the Tenth Development Plan and the National Transportation Master Plan. By this means 20 objectives determined by government has been detected. These are;

2. Ensuring a competitive environment
3. Development of regional air transport
4. Development of domestic air transportation
5. Development of international air transportation
6. Ensuring Istanbul new airport being an important global hub in world aviation
7. Increasing international flights from Anatolian airports
8. Increasing tourism transport by airline
9. Increasing cargo transportation
10. Becoming a regional base in maintenance, repair and renovation services
11. Development of transport by sea aircraft
12. Development of air taxi activities
13. Increasing general aviation activities
14. Compensation of the needs of Turkey in the field of aviation training
15. Becoming a World Center for Aviation Trainings
16. Focusing on public-private cooperation projects
17. Increasing environmentally sensitive design and applications
18. Ensuring energy efficiency (sustainability)
19. Integration with other modes of transport (especially rail)
20. New aircraft technologies
21. New air navigation systems

After the determination of Turkey air transport priorities, within the scope of the "Systems and Development Planning of Turkish Airports" project which was tendered by The State Authority of Turkish Airports and conducted by YTM-MATPUM, on 15 January 2018 a workshop held at the Ankara Esenboga Airport. In this workshop identified air transport priorities were scored by the sector stakeholders. In line with the voting results of 84 participants from different institutions such as The State Authority of Turkish Airports, Directorate General of Civil Aviation, Ministry of

Transport and Infrastructure, Universities and Airline companies, the five priorities that were considered as the most important were reviewed and weighted according to the votes of the participants. The five most important priorities and their weights as a result of the voting are shown in the Table 6.1.

Table 6.1. *Top 5 Scores and Weights of Air Transportation Priorities of Turkey*

	Objectives	**Scores**	**Weights**
1	Integration with other modes of transport (especially rail)	56	%27,72
2	Development of regional air transport	47	%23,27
3	Increasing general aviation activities	36	%17,82
4	Ensuring Istanbul new airport being an important global hub in world aviation	32	%15,84
5	Increasing international flights from Anatolian airports	31	%15,35

As previously mentioned before, within the long-term forecast study not only the priorities of the air transportation of Turkey but also different trends that might affect the global air transportation in future has taken into consideration. As a result of literature reviews and interviews, 41 trends were identified. These are:

2. Growth of global trade and service sector
3. Development of free trade agreements
4. Increased flexibility in global production
5. Increase in GDP per capita
6. Increase in business travels
7. Emergence of aviation mega cities
8. Development of e-commerce (for air-cargo)
9. Development of comfortable and cheap alternative transportation technologies such as high speed train
10. Establishment of new airline alliances
11. Rapid development of market shares of low-cost airlines (LCC)
12. Starting low-cost airlines (LCC) to make long-range flights
13. New developments affecting aerospace technology
14. Development of long-distance aircraft technologies
15. Increased migration rates
16. The rapid growth of the African population
17. Increase in the middle class population

18. Development of 3D printer technologies (for air-cargo)
19. Reduction of operational time via robotics and automation technologies
20. Reduction of flight safety problems
21. Increase in fuel prices
22. Increased global political tensions
23. Increased political tensions in nearby geography and image problems
24. Increased security threats and extended processing times accordingly
25. Increased security costs
26. Emergence of new tourism regions and areas
27. Becoming widespread of the travelling oriented lifestyle
28. Increased new restrictions to reduce emission levels
29. Adoption of lifestyle towards environmental awareness
30. Development of environmentally friendly alternative transportation technologies
31. Reduction in aircraft noise limits
32. Natural disasters
33. Increased epidemic diseases
34. Aging population
35. Use of alternative fuels
36. Shift of global economic center to Southeast Asia
37. Increase in air transportation liberalization
38. Emergence of new airport business models
39. New developments in EU-Turkey relations
40. Development of information technologies
41. Becoming widespread of video-conferencing
42. Decrease in global resources

At this stage, the importance of the future trends have tried to be determined according to the top five air transportation priorities which were identified in the first session of the workshop held on January 15, 2018, by using "Analytic Hierarchy Process" which is a multi-criteria decision making method. In the second session of the workshop, participants scored importance levels of future trends compared to the air transportation priorities on a scale between 1 and 5. Thanks to matrices with air transportation priorities in columns and future trends in rows, participants scored each future trend by comparing them with every priority. As a result of the evaluation of the participants, a significance index was calculated for each trend. When calculating this index, the following formula is used.

$$m_j = \sum_i w_i k_{ij}$$

In this formula; w_i Indicates the weight of the criterion i, k_{ij} indicates the significance of trend j in terms of criterion i and m_j indicates the weighted significance level of trend j. Calculated significance indices are shown in the Table 6.2, sorted from top to bottom:

Table 6.2. *Average Significance Indices of Global Trends*

	Trends	Significance Index
1.	Becoming widespread of the travelling oriented lifestyle	**4,05**
2.	Emergence of new tourism regions and areas	**3,87**
3.	Increase in business travels	**3,77**
4.	Growth of global trade and service sector	**3,76**
5.	Increase in GDP per capita	**3,73**
6.	Increase in fuel prices	**3,72**
7.	Rapid development of market shares of low-cost airlines (LCC)	**3,59**
8.	Development of information technologies	**3,56**
9.	Development of comfortable and cheap alternative transportation technologies such as high speed train	**3,46**
10.	Increase in air transportation liberalization	**3,44**
11.	New developments in EU-Turkey relations	**3,43**
12.	Emergence of aviation mega cities	**3,42**
13.	Increased security threats and extended processing times accordingly	**3,37**
14.	Development of free trade agreements	**3,34**
15.	Increase in middle class population	**3,33**
16.	Increased political tensions in nearby geography and image problems	**3,32**
17.	Development of e-commerce (for air-cargo)	**3,31**
18.	Increased global political tensions	**3,30**
19.	Emergence of new airport business models	**3,30**
20.	Reduction of flight safety problems	**3,24**
21.	New developments affecting aerospace technology	**3,21**
22.	Increased security costs	**3,21**
23.	Establishment of new airline alliances	**3,21**
24.	Use of alternative fuels	**3,21**

Table 6.2 (continued)		
25.	Starting low-cost airlines (LCC) to make long-haul flights	**3,20**
26.	Development of environmentally friendly alternative transportation technologies	**3,14**
27.	Natural disasters	**3,11**
28.	Aging population	**3,08**
29.	Decrease in global resources	**3,03**
30.	Increased migration rates	**2,95**
31.	Increased new restrictions to reduce emission levels	**2,94**
32.	Increased flexibility in global production	**2,92**
33.	Shift of global economic center to Southeast Asia	**2,87**
34.	Development of long-haul aircraft technologies	**2,83**
35.	Reduction of operational time via robotics and automation technologies	**2,81**
36.	Increased epidemic diseases	**2,81**
37.	Adoption of lifestyle towards environmental awareness	**2,80**
38.	Reduction in aircraft noise limits	**2,66**
39.	Becoming widespread of video-conferencing	**2,55**
40.	Development of 3D printer technologies (for air-cargo)	**2,32**
41.	The rapid growth of the African population	**2,22**
Average		**3,2**

In line with the data obtained as a result of the workshop, scenario development process has started within the scope of the thesis study. Basically, the scenario development process is based on trends with high index of significance and uncertain future realization.

Considering the realization probability of all variables, thousands of scenarios will emerge as a result of the combinations. Therefore, firstly the future trends whose significance index are above the average integrated into scenario development process. Secondly, the variables with high uncertainty in the future were selected among these variables. Finally, the trends that will be used in the scenario development process are grouped among themselves according to their relevance.

6.3.1. Trends and Uncertainties

As mentioned before, the future trends which are above the average in terms of significance index and whose future realization is uncertain are included in to the scenario development process. The uncertainty levels of the variables were scored between 1 and 5 (1: Most Certain - 5: Most Uncertain) as a result of the studies and literature reviews. Following this, the uncertainty level of the future trends that get 1 or 2 points are assumed as certain; and trends that received 3,4 or 5 points are assumed as uncertain. Brief evaluations of the variables in terms of uncertainties and air transportation are given below.

Becoming widespread of the travelling oriented lifestyle – Uncertainty Score: 2

Consumer spending in the services sector (travel and tourism) of the global economy continues to increase. According to the World Tourism Organization, in 2016 international tourist arrivals grew faster than the global GDP growth of 3.9%. Just like airline passenger traffic, general tourism has grown sustainably in 2016 with 300 million more tourists since the financial crisis compared to the pre-2008 crisis(UNWTO, 2017). According to the World Tourism and Travel Council, this trend is expected to grow by 4% in real terms over the next 10 years(World Travel & Tourism Council, 2017). Regional trends in the air travel market reflect broader travel and tourism developments. In 2016, the strongest regional growth was recorded in Asia-Pacific, while positive growth was achieved despite strong growth in North America and a tough geopolitical year in Europe. The outlook for a strong airline travel demand is consistent with external consumer demand trends and the tourism and travel outlook(Boeing, 2017).

Emergence of new tourism regions and areas – Uncertainty Score: 3

Tourism maintains impressive growth and significantly contributes in many national economies. The role played by airlines and airports in uncovering new destinations is enormous. It is very difficult to reach some continents, countries and regions without using airlines. It will be difficult for these regions to use their potential as a tourist

attraction without using air transportation. The United Nations World Tourism Organization demonstrates how travel for tourism is expanding globally. According to the report; in the 1950s, at most 15 countries attracted 98% of all international tourist arrivals; It is said that it constitutes 75% in the 70s and in the new millennium this rate has fallen below 60% and will continue to decline further(UNWTO, 2012). This indicates that new travel destinations will emerge in many developing countries. However, although the potential of new tourism areas to be formed, it remains unclear where, when and when they will occur.

Increase in business travels – Uncertainty Score: 2

Business travelers of the new generation is becoming an important issue to consider. The millennials - born between 1980 and 2000 - has unique tastes and habits. By 2020, the millennium generation will begin to form half of the global workforce. This tech-savvy and social-minded generation is more likely to want to travel for business than the previous generation, according to the 2015 GBTA Business Travel Sensitivity Index(GBTA, 2015). It is foreseen that the millennium belt will constitute almost half of the labor force by 2020 and will have much different travel habits and expectations than previous generations. Boston Consulting Group predicts that by 2020, the Millennium generation will account for 50% of all business travel expenses(Barton, Haywood, Jhunjhunwala, & Bhatia, 2013). According to a new study published by Expedia, professionals between the ages of 18 and 30 (millennials) make 5 business trips a year, while those aged 35 and over are limited to two per year(Forest, 2014). By this means it could be assumed that business travels will probably continue to increase in the future. Today, one of the fastest developing sectors is accepted as software sector and it is almost certain that information systems will develop further in the future.

Growth of global trade and service sector – Uncertainty Score: 3

According to the World Trade Organization (WTO), world trade, which has been declining due to restrictions restricting trade between countries, is expected to capture

a new growth trend through free trade agreements between countries(IATA, 2018b). On the other hand, trade wars between the US and China in the world raise doubts about the future of global trade. Although global trade, which has grown rapidly since the beginning of globalization, does not continue to grow as fast as before, new free trade agreements are still being made. Accordingly, the global trade and service sector is linked to the decisions of the major actors in the market, and it is unclear how it will be shaped in the future.

Increase in GDP per capita – Uncertainty Score: 3

PricewaterhouseCoopers' 2050 'World Economic Order Forecast' report prepared in 2017 made a comparison in terms of purchasing power parity. According to the estimation; in the period of 2017-2050 GDP of the E7 countries (China, India, Brazil, Russia, Indonesia, Mexico, Turkey) will increase more than 40.000 billion dollars and reach 140.000 billion dollars. On the other hand, the GDP figures of the G7 countries (USA, Japan, Germany, England, France, Italy, Canada) are projected to grow much slower and reach $ 60,000 billion dollars from $ 40,000 billion. In this context, about 3% of GDP growth is projected in Turkey. However, the model on which these predictions are based ignores short-term cyclical changes, global disasters and political changes that will prevent technological and economic developments. Therefore, the increase in GDP per capita remains uncertain(PwC, 2017).

Increase in fuel prices – Uncertainty Score: 3

The crisis in the world economy since 2008 and consequently the increase in oil prices posed a significant threat to the aviation industry. In the report of "Challenges of Growth" prepared by EUROCONTROL, in the scope of most probable scenario it is estimated that oil prices will reach around $ 145 per barrel by 2035(EUROCONTROL, 2013). Although the peak of oil prices and the crisis situation are not expected in this process, the change in prices is still considered as a risk factor. The fuel component, which constitutes 25-35% of the airline's expenses, will have an impact on ticket prices and passenger travel expenses. In the same report, it is stated

that there is a risk that oil prices may show sudden changes in the next 20 years due to the increasing speculation and investment of oil and this risk should be taken into consideration(EUROCONTROL, 2013).

Rapid development of market shares of low-cost airlines (LCC) – Uncertainty Score: 2

One of the most important changes that significantly affect the air transport sector and significantly increase the place of air transport in human life can be considered as the formation of low-cost airlines. With the introduction of low-cost airlines, air transport has become a more affordable transportation mode for people. According to the Airbus 2017-2036 report, when it is considered as an airline business model, it is stated that hybrid airlines are also pursuing a development strategy especially in the medium and long range market and are looking for new market opportunities to benefit from differentiation. The increase in cabin capacity of full-service carriers and the efforts of low-cost carriers to expand into the longer-range market can be cited as examples of this opportunity(Airbus, 2017). These companies, which are developing new strategies every day and want to increase their market share, can be predicted to be an important part of our lives in the future.

Development of information technologies – Uncertainty Score: 1

Air transport system is modeled as some interactive subsystems such as aircraft, airline and air traffic management. The impact of information technologies in each of these subsystems is assessed by the performance of these control loops. It appears that information technologies, air transport systems and components have a significant impact on security, efficiency, capacity, environmental impact and financial performance(Hansman, 2013). In addition, technological advances enable the aviation industry to develop day by day, and digital technologies continue to become an factor that increases the operational efficiency of airlines. Developing custom software applications contributes greatly to the competitive advantage of a company. The development of information technologies helps the industry to utilize its potential and

services in the most efficient way. It also facilitates the implementation and development of global standards and adds value to airlines(iFour Technolab Pvt. Ltd., 2017).

Development of comfortable and cheap alternative transportation technologies such as high speed train – Uncertainty Score: 2

In the report of "Challenges of Growth" published by EUROCONTROL in 2013, it has stated that in the European Union countries, between 2019 and 2035, new and more developed high speed train lines will be established among more than 50 cities. In addition, the report states that high speed train connections in the European Union countries will have a negative impact of 0.5% annually on short-haul flights for ranges up to 800 km(EUROCONTROL, 2013). In the future, the competitiveness of the aviation sector will be limited against the high speed trains that provide greener, more secure and more comfortable transportation. In other words, in the future high-speed train connections tend to develop continuously and new high-speed train connections will probably be made between cities.

New developments in EU-Turkey relations – Uncertainty Score: 4

Turkey-EU relations is a 56 years ongoing process, starting from 1963. Customs Union is an option for Turkey enter the European Union's common market. It has forseen that Turkey can join EU by completing a three step process in accordance with Customs Union(Delegation of the European Union to Turkey, n.d.) and Turkey is reported to be ready to update the Customs Union in this process(NTV, 2017). However, the fact that the EU does not take a positive step in this regard, makes the process difficult and increases the uncertainty of the developments. It is often raised that alternative models for full membership to the European Union can be sought for different models. Aviation and travel are global industries affected by international trade and politics. Significant changes in regulation, trade or politics affect the dynamics of these sectors globally. The result of the British referendum (Brexit) has created uncertainty about how the UK and EU aviation sectors will operate and

continue to cooperate in a mutually beneficial way. United Kingdom aviation industry may be faced with a renewal may require significant operational changes, and these developments may also affect Turkey together with EU Member States(Pickett, 2016).

Emergence of aviation mega cities – Uncertainty Score: 1

Airbus reports in recent years reveal a significant expectation about the future air industry and city relationship(Airbus S.A.S., 2016)(Airbus, 2017). Accordingly, a large proportion of future air transport will take place over mega-cities, the number of which will increase in the world. In the Airbus "Global Market Forecast" report in 2011, the number of mega aviation mega-cities with at least 10,000 long flight passengers per day in the world by 2030 is estimated to increase from 39 to 87(Airbus, 2011). In 2016, Airbus stated that the number of mega-cities has reached 55 and more than 90% of the long-range traffic is realized through these cities(Airbus S.A.S., 2016). In 2035, it is predicted that there will be 93 aviation mega-cities. Accordingly, it could be assumed that presumably in the future there will be many aviation mega cities around the world.

Increased security threats and extended processing times accordingly – Uncertainty Score: 3

The duration and intensity of passenger safety checks at airports has increased in the context of strengthening security measures since the terrorist attacks of September 11 and onwards. This has a significant impact on flight delays at airports(Centre for Strategy and Evaluation Services, 2011). It is observed that new and expensive security technologies prolong the processing time while it is expected to increase the control point efficiency at the airports(Shallow, 2018). As an example of new technologies, the body scanner introduced at Changi Airport uses millimeter wave technology to detect metallic and non-metallic substances secreted in the person's body and warns the staff if a hidden element is detected(Kaur, 2019). In other words, the length or shortening of processing times will be evident with the direction of developing technology.

Increase in middle class population – Uncertainty Score: 1

According to Airbus "Global Market Forecast" report; the population of the middle class, which is expected to double globally, is expected to quadruple in Asia-Pacific within 20 years(Airbus, 2017). The globally increasing middle class population is considered to be one of the important factors that will create new potential airline users and positively affect demand in aviation. Similarly, according to the same report, the ever-increasing middle class in Asia is seen as one of the factors that create demand for aviation(Airbus, 2017). The middle class population, which constitutes 38% of the total world population by 2.8 billion in 2015, is expected to reach 46% in 2025 and 55% in 2035 and reach 4.8 billion(Airbus S.A.S., 2016).

Increased political tensions in nearby geography and image problems – Uncertainty Score: 4

As is known, Turkey is geographically located in a region where political stability could not be achieved for many years. The political turmoil in the Middle East for many years, wars, riots and administrative changes are constantly affecting Turkey. Experienced and currently ongoing instability of Arab world is expected to continue over the next ten years and Turkey is concerned about this negative situation in the geography. It is likely that these kind of developments will affect Turkey in a positive or a negative way. Although it could be assumed that the political instability will be permanent in the region in future, it is still uncertain that how and when the possible events will effect Turkey.

Development of e-commerce (for air-cargo) – Uncertainty Score: 1

One of the events directly affecting the air transport sector in recent years is the increase in e-commerce. In line with this increase, products are now transported all over the world by airfreight and air cargo is considered to be one of the most preferred transportation methods due to fast shipments. According to the estimation made by Goldman Sachs investment bank, the global retail e-commerce volume, which reached USD 1.6 trillion as of 2016, is expected to approach the $ 3 trillion in 2020(Kantarcı,

Özalp, Sezginsoy, Özaşkınlı, & Cavlak, 2017). By 2020, China's e-commerce market is expected to be larger than the combination of the US, UK, Japan, Germany, United States and Germany markets. In addition, it is stated that the development in e-commerce is an important potential for supporting the growth of air cargo(Boeing, 2016). In this respect, it can be considered that e-commerce will grow further in the future and its input to the air cargo sector will increase further.

Increased global political tensions – Uncertainty Score: 3

International relations are one of the most important issues that has the potential to affect market dynamics of the sector. The most recent example of this effect is that the US President (Donald J. Trump) forbids citizens of 7 countries to enter the United States on grounds of security measures shortly after taking office(Diamond, 2017). This was closely related to the airlines that transport passengers between the countries in question and the United States, and citizens of seven countries were unable to use the airline. Despite increasing political tensions due to economic interdependence between major powers, relations between powers may well remain for now, but may not be sufficient to prevent future conflict. These forces may seek to reduce the forms of dependence that make them vulnerable to economic coercion and financial sanctions, and potentially offer them more freedom of action to aggressively pursue their own interests(Global Trends, 2017).

Reduction of flight safety problems – Uncertainty Score: 2

According to IATA Vision 2050 Report; although it is expected that flight safety will continue to be one of the most important priorities for passengers in 2050, the rapid development of aircraft technology and the fact that flight safety related incidents will occur less frequently indicate that this priority may be less on the agenda. Automation and other new technologies make significant improvements in flight safety and continue to reduce the risk factor(Bisignani, 2011).

New developments affecting aerospace technology – Uncertainty Score: 4

International organizations like ICAO, European Union, IATA etc. are developing a set of targets and restrictions to reduce aviation environmental pollution (air, water and noise), emissions cause global warming and natural resource consumption. While some of these targets could be reached by more efficient air traffic management and ground services, another way is the reduction of the fuel consumption of aircrafts and making them more efficient. Automation technologies are expected to have significant impacts on transportation and logistics. It is also stated that there will be risks of the combination of pilot and non-pilot flights in the same airspace(IATA, 2018a). In other words, it remains unclear how future technology will be shaped and how new technologies will affect air transport.

Increased security costs – Uncertainty Score: 2

The events of September 11 made the most impacts in the aviation sector and many attacks against the airports in the following period required compulsory security arrangements. The aviation sector is much safer today than in 2001. However, these security measures and restrictions imposed many costs(Tyler, 2011). While operating costs constitute 2/3 of the costs at the airport, the security costs constitute 20% of this cost on average(ACI, 2018c). Costs of aviation security systems will continue to increase as the number of airline passengers and cargo continues to increase in the future.

Establishment of new airline alliances – Uncertainty Score: 3

Airline companies are struggling with differentiation, competition for access to large flight networks, and pricing and service quality. The profile and behavior of airline companies is undergoing a certain change, and increasing alliances between companies prevent fragmentation in the market. In OECD countries, although most of the international agreements limiting cross-border mergers are still in force, alliances still occur between large carriers. Some small airlines become feeder networks for large companies. Although it is not known which model will be the perfect one, it is

seen that there is a trend in the market for more differentiated, segregated business models.

Use of alternative fuels – Uncertainty Score: 4

The most important factor determining the prices of air transportation in the world stands out as fuel. Accordingly, changes in fuel prices or the use of alternative fuels are one of the major factors that directly affect demand. There are still many issues that need to be resolved regarding sustainable alternative fuel. To illustrate, since the animal or vegetable based sustainable fuels are not exclusively produced as an alternative to jet fuel, they compete with use in other modes of transport and the market price is rising due to this competition. In addition, in this period when food security is occupying the agenda of the countries and food inflation is constantly increasing, using agricultural lands for fuel production as an alternative to food is a subject that may attract a lot of reaction. The "Challenges of Growth 2035" report published by EUROCONTROL states that low-carbon alternative fuels are expected to contribute to the reduction of total emissions, but the uncertainty regarding the rate and scale of this development continues. On the other hand, although some raw materials like agricultural waste or municipal waste and production techniques offer the possibility to reduce the cost of biofuels to the level of conventional jet fuels; the production capacity for biofuels are limited and the commercial costs of biofuels are still high(EUROCONTROL, 2013).

Starting low-cost airlines (LCC) to make long-haul flights

90% of the current low cost airline (LCC) flights are short-haul flights. However, with the change in market structure and consumer behavior, new "hybrid low-cost longhaul" business models have begun to emerge(Stoenescu & Gheorghe, 2017). Low-cost airlines meet passenger demands by offering a more affordable travel option to long-range markets; network carriers respond to this with their own low cost options. Although long-range flights have disadvantages, such as operational difficulties (the need to establish a feeder network and the need for additional

regulatory compliance), many low-cost airlines foresee long-range flights. However, there is uncertainty about long-term success due to the difficulties mentioned(Boeing, 2017).

6.3.2. Scenarios

The trends with higher significance levels and uncertainty points are grouped according to their relevance and 4 scenarios have been developed in which every possibility is evaluated. The variables grouped for the scenario development process were accepted as the main axes which are Globalization and Geopolitics. In line with the variables, the technology axis has come to the forefront within the study. However, it is accepted that the technology will develop and progress in the future as well as in the past, although the trends in technology group have different uncertainties. The scenario axis and grouped trends in terms of their field are shown in the Table 6.3.

Table 6.3. *Grouped trends*

Globalization	Geopolitics
Growth of global trade and service sector	Increased global political tensions
Development of free trade agreements	New developments in EU-Turkey relations
Increase in air transportation liberalization	Increased security threats and extended processing times accordingly
Emergence of new tourism regions and areas	Increased political tensions in nearby geography and image problems
Increase in GDP per capita	
Increase in fuel prices	

In the direction of these two axes, 4 scenarios were created by considering all possibilities. These could be assumed as; positive globalization and negative geopolitical issues and vice versa, a scenario which formed through positive globalization and geopolitics and finally a scenario which formed through both

negative globalization and geopolitics issues. To clarify, the four scenarios are shown conceptually in the Figure 6.3.

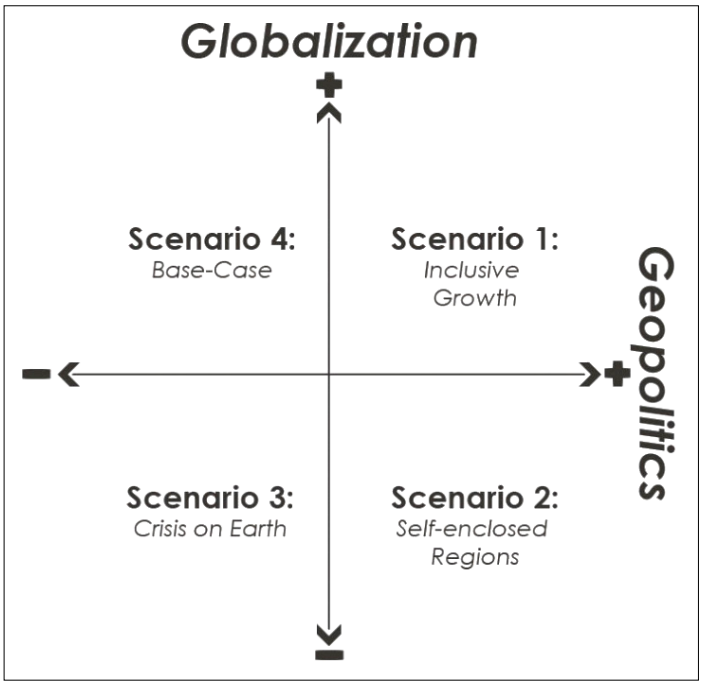

Figure 6.3. Scenario Axis and 4 Scenarios

6.3.2.1. Scenario 1 – Inclusive Growth

This scenario is mainly based on situations where future globalization has increased, geopolitical unrest and tensions are low, and aviation technologies have made a significant progress and have taken the sector far ahead of the current situation. In the future, global political tensions will diminish and security threats will become controllable. Thanks to the developing technologies, the world will increase its ability to fight epidemics and natural disasters and is no longer a factor that can adversely affect the world aviation demand. According to the United Nations population projection, the population of Africa, which was approximately 1.2 billion in 2015, will reach 2.1 billion in 2040; The Asian population, which is 4.4 billion, will increase to

5.1 billion and make up 80% of the total world population(United Nations, 2017b). The rapid growth of the population in Asia and Africa will have a positive impact on world aviation demand and will significantly increase the number of airline passengers worldwide. With the rapid increase in globalization, the expansion of free trade agreements and the growth of world trade and the increase in the amount of GDP per capita(Hawksworth & Chan, 2015), living standards and disposable incomes will increase and thus, both business and travel airlines will increase at a global level. It is estimated that the trend of expansion of the middle class at the global level will continue in the coming years. According to a study by the Brookings Institute, the middle class will be the majority of the global population for the first time in 2020 and 88% of the 1 billion people who will join the middle class in the coming years will be from the Asian region(Kharas, 2017). The rapidly growing population and the expanding middle class in the Asia Pacific region will undoubtedly have a significant impact on the number of world airline passengers and change the number of airline travel between East and West.

As well as global economic developments, new tourism regions and aviation megacities will be formed until 2040 under this scenario. In line with the contributions of globalization and economic developments, the lifestyle to travel will begin to spread throughout the world and new tourism areas will be formed in various regions of the world. These developments will naturally increase the demand for the aviation sector. Aviation mega cities and airport cities will be adopted all over the world as one of the most important tools to increase competitiveness in the world. Business centers and urban developments which were shaped by harbors in the 18th century, by railways in the 19th century and by highways in the 20th century will now begin to develop through airports in the 21st century.

In addition to globalization and geopolitical peace, there will be developments in the field of technology that will significantly affect the aviation sector in the future. With the advancing aircraft technologies, the damages caused by air transport to the environment will no longer be a matter of debate, and air transport will become the

most socially acceptable mode of transport in the new world where the environmental awareness lifestyle is adopted by most of the people. With the development of environmentally friendly aircraft technologies, applications such as the carbon footprint to reduce emission levels will no longer be considered as factors that adversely affect air transport. Advances in aviation technology will contribute not only to reducing environmental impacts, but also to lower operational and safety costs. In line with these developments, security problems and cyber attack risks, which adversely affect the aviation sector, will be reduced to low levels and accelerate the operation and reduce costs. Fuel prices which are the most basic costs for airlines tend to increase by 2025 although they are on the lowest levels of past decade nowadays(Airbus, 2017). Although fuel prices tend to increase in the future, rising fuel prices in line with the important technologies likely to be experienced in this scenario will not come to the fore as a factor that adversely affects airline passenger demand due to lower operational costs.

Increasing globalization and technological advances will significantly improve not only passenger demand but also freight transport in the aviation sector. In addition, the moderate trade environment experienced in a world that is politically peaceful and where security threats are at a minimum level will carry the air freight system between the countries to the next level. The volume of trade in the east and west, especially between the USA and China, which does not include radical restrictions, will make the air cargo and logistics sector one of the most important sectors in the world, and the prominent airports in Istanbul and Dubai will become important parts of the sector. In addition, with the increasing flexibility of production with developing technologies and the development of e-commerce and 3D printer technologies, not only the large-scale trade volume between countries but also the imports and exports of small companies will increase. In this way, the air cargo sector will be indispensable as the best logistics tool in the world.

In the scope this scenario, Turkey, thanks to Istanbul may have a very important role in the future. Istanbul airport is likely to become an important external-outward transit

center in the developing aviation sector around the world. With the significant development of Asia Pacific and sub-Saharan Africa regions and the increasing demand for air transportation, Istanbul can become one of the most important points connecting these two regions to the west and can also play a role as a regional base in the field of logistics between east and west trade. With the Istanbul airport, where intensive activities will take place in both passenger and freight transportation, the region will start to emerge as a worldwide aviation mega city. Europe, on the other hand, will transfer most of its advantages in the aviation sector to Istanbul and the Middle East due to its aging population and slow-growing economies.

6.3.2.2. Scenario 2 – Self-Enclosed Regions

Within the scope of the self-enclosed regions scenario, it is envisaged that globalization is gradually decreasing and localization has started in the countries, yet the world will be geopolitically stable and peaceful balance is maintained and technological developments continue to increase rapidly. Until 2040, a self-enclosed economic structure will develop between the countries. Rather than nationalist geopolitical negativities raising today, globalization process in the world will decrease because of the shift in production from global scale to regional scale. Global trade volume will decrease as technologies such as 3D printers will develop and involve fewer countries and factories in the production process. Due to the diminishing globalization, the trade and services sector will become stagnant and will leave its place to a more closed economic order in which free trade agreements are decreasing. For these reasons, especially due to the decrease in trade at global levels, the exchange of goods will restrict air cargo activities to local scales. Moreover, civil aviation liberalization is not in this scenario since it is determined by global and political developments and the economic order is increasingly distant from globalization. Although liberalization will be declining, the traveling lifestyle among people will continue to spread, especially in countries with high GDP growth. In line with Airbus's forecast, the demand for the middle-class population, which will quadruple globally in Asia-Pacific in 20 years, will further increase the number of potential airline users,

especially in this region(Airbus, 2017). Due to the aging population in developing countries, aviation activities in Turkey will develop in a positive frame considered in this scenario. However, due to pressures on globalization and liberalization, new regions for tourism will not probably emerge. The demand for traveling will mostly concentrated in the existing areas and in the immediate vicinity. Therefore, the aviation mega-cities, which are foreseen to be formed, will also serve the country and the surrounding environment.

Unlike globalization, in the technological context, there will be a major breakthrough in both aviation and information technologies until 2040. Airline demand, which will expected to increase, will be managed easily by developing robotic and automation technologies, and airport waiting times will be reduced gradually. Developing information technologies will also enable the operation of airline services more efficiently and support the process at the airport. In addition to this, although a geopolitically stable process during this period reduced the risk on airports, security will still be an important issue. However, developing security technologies will increase the demand for air flights by minimizing the waiting time and cost for security purposes.

The rapid development in aviation and space technologies will minimize the impact on the environment by developing aircraft technologies. This technology will both reduce restrictions on aviation due to the environment and the reduction in noise levels will make airport expansion and city integration more convenient. In addition, developing technology will also reduce the risk of human-induced flight safety. For these reasons, the preferability of air transportation against alternative modes of transportation will increase and the number of passengers will reach its peak in 2040.

Increased fuel prices, coupled with scarcity of resources and poor globalization, will accelerate the process of using alternative fuels by triggering emerging technology. Both the more effective use of existing fuel technologies and the development of new fuel technologies, alternative fuel technologies will be used effectively in aviation.

This will increase the demand for the aviation sector because of the reduction of fuel costs. With the decline of globalization, developing technology enables long-range flights of low-cost airlines, but the number and demand of these flights will be very low. Nevertheless, the market share of low-cost airlines will increase to a high level in the short-term and therefore more locally. Especially short-range air flights are very popular in this scenario. Therefore, regional air transport will be more prominent in 2040.

In addition to these developments, increase in the real GDP per capita and the peaceful political balance achieved in the local and near geography will support the development of the aviation sector in this scenario. There won't be any political tension in the world, as well as in Turkey-EU relations in general. Turkey will overcome image problems at the political level which has ceased to be an obstacle to the aviation industry. Although this calm political environment and controlled natural disasters cause a decrease in migration rates, this will not cause a decrease in flight demand.

Within the scope of this scenario, the aviation sector serves a demand that is formed within the local geography rather than a global. For this reason, it is not possible for Istanbul to become a global hub airport. However, Turkey can be an important regional aviation training center and air transportation hub in the near geography. In this scenario, the sector may have a rapidly growing structure both regional and local scale due to technological development and geopolitical positive factors.

6.3.2.3. Scenario 3 – Crisis on Earth

This scenario is mainly based on low levels of globalization, higher political tensions both in global scale and in the near geography and technological progress and developments in aviation and defense industry. This scenario can be evaluated as the worst case out of the four scenarios identified. The most important reason for this is that in a world where globalization is rapidly decreasing and geopolitical tensions are at the highest level, technology is developing as the leading sector alone. According

to this scenario, there will be major developments in aviation, space and robotics and automation technologies such as security systems, information and software technologies, geographic information systems and drones which constitute important components of defense industry until 2040. On the other hand, as a result of the negativities in the political processes, there will be a period of cold war in which there are polarizations between certain regions and countries.

With the industry's rapid adaptation to technology, the use of low-carbon alternative fuels such as bio-fuels will become widespread, and as a result of the reduction in CO2 costs and the development of environmentally friendly aircraft technologies, restrictions to reduce emissions and noise limits will no longer be repressive policies and will not adversely affect the sector. However, due to the limited permission to use of biofuels; the fuel component(EUROCONTROL, 2013), which accounts for 25-35% of airline expenses, will continue to have an impact on ticket prices and passenger travel expenses in the future. It is assumed that oil will become a subject of increasing speculation and investment which will lead to sudden changes in oil prices and fuel prices will reach its highest level by 2040(EUROCONTROL, 2013). This increase in fuel prices will increase the costs in the aviation sector and these costs will be reflected in the ticket prices, which will lead to a significant drop in demand on national and international flights. While such an increase in costs is experienced in the aviation sector, alternative transport modes such as fast, comfortable and environmentally friendly alternative transportation methods like high speed trains will take a step forward, especially in short distances.

Although it is known from past experience that epidemics and natural disasters are important events affecting the aviation sector especially at the regional level, the aviation sector will be affected by these events with the least damage by making predictions with developing technology and taking the necessary precautions in a short time and these effects will be compensated in a short time. Another contribution of technological developments will be the formation of new airport business models and low-cost airlines to make long-range flights. However, with the deterioration of

globalization and increasing tensions, the cooperation of certain countries and the exclusion of others will result in limited development of these activities within certain geographies.

Global political tensions and increasing trade restrictions will adversely affect economic growth, leading to a lack of expected growth in the welfare level. The fact that GDP, which is one of the most important factors in choosing whether passengers prefer air transport, will not show the expected increase and this will negatively affect flight demands. On the other hand, the elderly population is expected to double to about 2.1 billion by 2050, and 80% of this population is expected to live in developing regions(United Nations, 2018)(Silver Economy, 2018). This elderly population, which has a tendency to travel less, will cause a decrease in flight demand with all the negative developments in globalization. One of the most important effects of the bad progress in the globalization process will be the lack of widespread civil aviation liberalization and consequently the lack of a competitive environment that supports growth in the aviation sector. Although the middle-class population is expected to increase significantly, especially in the Asia-Pacific region, global tensions increase, indicating that this population will not increase the demand and impact in aviation. Similarly, aviation mega-cities, which have a dependent relationship with globalization, will come to the forefront at national level rather than developing as an international hub. This class, which has the desire to see new places especially in mega cities, will have limited scope of movement and will not cause the expected increase in demand in aviation at the global level.

Although it is predicted that airline business travel will increase in future forecasts, as a result of increasing global political tensions, the obstacles to the global trade and service sector and developing technology will highlight video conferencing technologies in the business world and business travel will increase much less than expected. With the developing technology, in such a world dominated by the global war, there will be a serious economic loss in the tourism sector which has a very strong driving force in the aviation sector. In particular, stopping tourism activities among

certain routes as a result of polarizations will lead to a serious decrease in tourism travel, which has the largest share in aviation, and as a result, the absence of new tourism zone areas will create a vicious circle by reducing demand in aviation. This will of course negatively affect economic growth.

Very limited international trade relations will affect air passenger transport as well as adversely affect airline passenger transport. Therefore, freight transport will be carried out by road to a large extent. Although e-commerce is likely to gain speed with technological developments; international global trade relations and freedom agreements will come to a standstill, which will pose a major obstacle to the development of e-commerce activities that are vital for airport logistics and will result in financial losses. In such a case, it is not possible to mention flexible production models. In addition, while globalization is declining, the rapid development of 3D technologies will also reduce the share of air cargo transport.

In this scenario, it is clear that geopolitical tensions will adversely affect the development of the aviation sector. Today, the ongoing fluctuating relations between Turkey and European Union will be worse and even the accession process of Turkey to EU will be suspended. Moreover, the current political tensions between the US administration and China, Russia and Iran will continue to increase and these tensions will bring Western and Eastern countries to the point of cold war in general. All of these will affect the route of intercontinental and other long-range flights, especially in the aviation sector, and cause certain restrictions.

Although the problems related to flight safety are diminishing with the developing technology, airports will become an increasing target in terms of terrorist acts, especially with the increasing geopolitical unrest in the Middle East, and with the spread of the use of the latest technologies in such attacks, the security risks and their negative consequences will rise to higher levels. As a result, increased security threats, as well as increased costs, will be reflected in ticket prices, resulting in a significant reduction in passenger flight demand.

In the crisis on earth scenario, a cold war situation with east-west polarization will be inevitable while the developments in defense industry, aviation and information technologies continue. Within the scope of the scenario, the most devastating consequences for Turkey would be the failure to reaching the development goals of Istanbul airport which is to be a global hub airport. Regional transport, which is an important resource for large transport companies, will not be as expected. Although Turkey would continue to develop in national level in terms of aviation with technological improvements, expected developments in global scale will not be realized.

6.3.2.4. Scenario 4 – Base-Case

This scenario is mainly based on situations in which globalization is rapidly advancing in the future, technological advances take the aviation sector one step further and geopolitical tensions continue. With the rapid increase in globalization, the expansion of free trade agreements, growth of global trade and the service sector and the increase in the amount of GDP per capita(Hawksworth & Chan, 2015); people's living standards and disposable incomes will rise. Therefore, both global and business airline passengers will increase significantly. It is estimated that the middle class population, which is expected to make up 46% of the world population in 2025, will increase to 55% in 2035 and the total middle class population will reach 4.8 billion(Airbus, 2017). Likewise, considering the increase in the share of the African population in the world which is expected to reach 1.7 billion in 2030(United Nations, 2017b), this increasing population and global economic growth will create new potential airline users. All these developments will positively affect the demand for the aviation sector. Increasing globalization and permeability of the borders will make migration easier as a result of social, political and economic reasons. Due to these migrations, the global population dynamics will change and the people will be more mobile and they will travel more.

Looking at the last decade, e-commerce has grown more than 10 times in the world(Kantarcı et al., 2017). However, new business models are emerging and consumption habits are changing. E-commerce is important for the development of the logistics sector and this development in e-commerce is an important potential for supporting growth in the air cargo sector(Boeing, 2016). Although total trade share in retail e-commerce in Turkey is predicted to be 4.3%, this ratio will increase in the future(Kantarcı et al., 2017). Increasing flexibility in global production will accelerate this development.

With the development of technology and the increasing use of alternative fuels, dependence on petroleum products will be reduced and fuel prices will increase slightly. This situation will increase the flight activities with the spread of civil aviation liberalization. In addition to this, with the rapidly developing technology, information technologies will be developed and new developments that will affect aviation and space technologies will be supported and new environmentally sensitive aircraft technologies. The development of comfortable and inexpensive alternative transportation technologies such as high-speed trains will be integrated with airline transportation and a transportation network will be formed to support each other. With the development of new aircraft technologies produced with the development of technology, aircraft will create less noise pollution and damage to the environment will be reduced.

Two-thirds of the world's elderly population live in developing regions and their population is growing faster than developed regions(United Nations, 2017a). By 2050, it is estimated that 80% of the world's elderly population will live in developing regions(United Nations, 2017a). In this context, with the increasing elderly population in developing countries, travel lifestyle will spread and travels will increase considerably. In recent years, the growth trend of the cities focused on the aviation sector and the urbanization of the cities to be shaped through airports will create new airport megacities and this will lead to the growth of global air traffic. Developing

technology will improve robotics and automation technologies and this will reduce operating times at airports.

Tourism in the globalizing world continues to exhibit impressive growth and contributes significantly to many national economies(OECD, 2016). Considering that the purpose of most of the travels is tourism, the role of airlines and airports in uncovering new destinations is enormous. With the increasing demand for air transportation, the new tourism regions and areas will be formed. In addition, long-distance aircraft technologies will develop with the introduction of new technologies. Market shares of LCCs will expand by being successful in long-range flights. Flight cost for people will be reduced and global aviation volume will increase. This may lead to the development of regional air transport and to make Istanbul airport an important global hub.

One of the problems that may affect the world and the aviation sector in the future is epidemic diseases. The fact that people travel more frequently, the globalization of trade, and the greater interconnectedness of countries makes epidemics inevitable in the international arena(World Health Organization, 2017). However, being prepared for such epidemics and controlling these diseases will become easier with developing technology and will no longer be a problem for the aviation sector. In other words, it is estimated that this scenario will be successful in fighting epidemics and will significantly improve the global aviation sector. Another problem that may affect the aviation sector in the future is natural disasters. The uncertainty of natural disasters stems from both the unpredictability of natural phenomena and the uncertainty of how these events will interact with the environment and people. Thanks to the developing technology, the world will be less vulnerable to natural disasters and thus the aviation sector will be less affected by natural disasters.

All these air transportation activities and developments will take place in a world where political tensions will increase in close geography of Turkey. Some tensions in the environment where Turkey and EU relations progress slowly, may affect

negatively the establishment of a new airline alliance. In addition, the instability in the Arab world is expected to continue for the next decade. Turkey will positively or negatively affected from this situation.

6.3.2.5. Most Probable Scenario

In the light of the studies and the information obtained as a result of the workshop, four possible scenarios have been developed. There is no doubt that the scenarios developed in the future are undoubtedly different, and within the scope of the thesis, it is aimed to investigate which scenario is the most likely and to develop some opinions about the future role of Istanbul airport according to the possible scenario.

The main aim of the "Air Transportation System and Development Planning of Turkey" project which was tendered by General Directorate of State Airports Authority and conducted by YTM-MATPUM research center; was analyzing the current situation of Turkish aviation system and developing system and development plans. In line with these objectives, it was tried to predict how the future will be shaped and plans were developed accordingly. In the process of forecasting the future, scenarios have been developed in the light of the data obtained after two workshops and the most probable scenario has been selected.

Within the scope of the thesis, the results of the interviews held with the stakeholders in the workshops were taken into consideration and the scenarios were developed by using the project outputs as input in a different model prepared for the thesis study. The most probable scenario was selected with the votes of 25 participants from various institutions. In the first session of the workshop, the method and process of the scenario study were explained to the participants and then the scenarios developed were discussed. In the second session, participants were asked to score between 0 and 100 on how the globalization, geopolitics and technology will be shaped in the future. The average of the voting results of 25 people is shown in the Table 6.4.

Table 6.4. *Voting Results of Scenario Axis*

Globalization	Geopolitics	Technology
65,5	**33,8**	**74,2**

According to the results of the voting, it is agreed that the technology will continue to develop in the future, globalization will be positive but geopolitical unrest will continue. Accordingly, the fourth scenario can be considered as the most probable scenario. In this context, in the last part of the thesis, various researches about Istanbul airport will be evaluated in the context of the possible scenario and the discussion will be shaped in this context.

CHAPTER 7

CONCLUSION AND DISCUSSION

Today, the aviation sector is considered as the driving force for the economies of countries, regions and cities and contributes not only to economic developments but also to social development. Every day, new air transport connections are being created all over the world and people's demand for air transport is growing. In a developing and changing world, speed, comfort and time have become the most important parameters for travels. Thus, the aviation industry and air transport are growing day by day. Today, one of the most important catalysts in the development and rapid expansion of globalization is accepted as the aviation sector. Since the 1970s, the aviation industry has doubled every 15 years, with a total of 1.8 billion passengers moving in 2005 and 4.3 billion in 2018. In addition to this, not only passenger transport but also freight transportation has become a place for the aviation sector. We can buy any product from anywhere in the world within seconds and the purchase of the product in the world has decreased considerably. In the past, almost all of the products transported by rail, road and sea can now be realized by air transport in very short periods.

In order to get a share from the development of the aviation sector, which is a very important field in today's economies; countries all over the world are in harsh competition. Within the scope of this competition, countries want to create various advantages by developing various strategies. Some countries are planning airport cities, some are competing through airline companies and others are using their geographical advantages to play a role in the global aviation sector as a passenger or freight transfer center. In line with these strategies developed by countries, the global aviation sector is changing day by day and can move in different directions. In addition, the changing world economy, differentiating country relations and

demographic changes affect the aviation sector and contribute to its development as well as damage it.

Within the framework of all the events and changes in the world, that Turkey also carries out various actions to achieve their goals and develop a variety of strategies for the aviation industry. The aviation industry in the last 20 years Turkey has experienced a quick and advanced growth. 34 million passengers across the whole of Turkey in 2003 moved the climb to 6 times that amount to about 211 million level reached in 2018(General Directorate of State Airports Authority, 2019). Experienced great growth, of course, this may be associated with growth and infrastructure investments in Turkey's economy.

The number of airports in Turkey which was 26 in 2003 has increased to 55 in 12 years and is still generating some airports make investments in Turkey, which is one of the history of the republic has made the largest investment in the aviation industry in the area. A third airport was built in Istanbul, which has grown rapidly in the aviation field and currently hosts two airports. In the tender held on May 3, 2013, it won a bid of EURO 22,152 billion and its foundations were laid on June 7, 2014. The official opening ceremony was held on 29 October 2018 which is the Republic Day and flights started on 1 November 2018. After the transfer of Turkish airlines, the Istanbul Atatürk airport was closed to passenger traffic and all flights started to continue through Istanbul airport.

The thesis mainly focuses on whether this urban investment, which is the largest in the history of the republic, will achieve its goals in the future; in other words, it has been prepared on the curiosity about whether it will be successful or not. In this context, some sub-questions were developed and by searching for answers to these questions, it was tried to predict the future role of Istanbul Airport. In this part of the thesis, the results of the researches for the sub-questions identified are discussed and a general opinion is tried to be reached.

Competition of Global HUBs

One of the most important components of the global aviation sector is the hubs. Having acted as a global transfer center through Istanbul Atatürk Airport in recent years, Istanbul has planned to increase its competitiveness in this area by launching its new airport. For this reason, the most important purpose of Istanbul Airport is to be one of the leading transfer centers in the world. Istanbul has a tough competition with some transfer centers in its region. Istanbul, which connects the east and the west in terms of its geographical location and performs the transfers between these regions, does not compete with the transfer centers in the America and Asia. On the contrary, airports in Europe and the Middle East can be considered as Istanbul's main competitors. When the historical air traffic data and connection indices are examined within the scope of the study, Istanbul's rivals are considered as London Heathrow, Amsterdam Schiphol, Paris Charles de Gaulle, Frankfurt, Dubai and Doha Hamad airports.

A competitiveness index has been developed for Istanbul Airport, Istanbul Ataturk airport and other competing airports. While developing the index, airports were evaluated under market potential, infrastructure, historical air traffic data and security components. In this context, metropolitan populations, GDP per capita, tourism potential, global power city index, political stability index, public transportation facilities, congestion, airport capacity, capacity increase, number of air passengers, air passenger annual growth rate, transfer center connections, connection growth rates and security index were used as indicators.

Within the scope of the study, the competition index was developed both for Istanbul airport and for Istanbul Atatürk airport. In this way, it has been tried to measure how the new airport will affect the competitive power of Istanbul Atatürk airport. The value of airports as a result of the transfer center competitiveness index study is shown in the table 7.1.:

Table 7.1: Hub Competitiveness Index

Rank	Airport	HCI
1.	Dubai International Airport	**0,757**
2.	Istanbul Airport	**0,664**
3.	Doha Hamad Airport	**0,591**
4.	London Heathrow Airport	**0,585**
5.	Paris Charles de Gaulle Airport	**0,567**
6.	Amsterdam Schiphol Airport	**0,562**
7.	Istanbul Atatürk Airport	**0,543**
8.	Frankfurt Airport	**0,532**

As can be seen from the Table 7.1. Istanbul Airport ranks second after Dubai airport. It can be argued that the competitiveness of the new airport will increase considerably compared to the Istanbul Atatürk airport. The main factor in this increase is the increase in airport capacity and a stronger public transport system. The main reason for European airports lagging behind Istanbul, Dubai and Doha airports is the low air traffic growth in the past years and the inability to increase capacity. Despite their strong market potential and their advantageous geographical location, European airports have reached their satisfaction points in terms of capacity and the transition to the new airport is not on their agenda. Although some minor interventions that could increase capacity have been planned and put on the agenda, Dubai, Istanbul and Doha airports do not have as much capacity increase potential as they do.

Just a Transaction Point? Or a Point of Attraction?

The main aim of the Istanbul airport investment is to strengthen its role of being a global hub of and help Istanbul to move one-step ahead of the competition with their rivals. All strategies that could make Istanbul stronger in the competition between global hubs could be regarded as important for region and country in terms of economics. On the other hand, just serving as a transfer center would not be enough

for Istanbul Airport’s future success due to being deprived of other parts of aviation like tourism, business trips or air cargo. In this respect, various studies have been conducted in order to predict the current situation and future of tourism and business potential of Istanbul.

The concept of travel, which has an important place in human life since the early ages of humanity, is mostly realized through tourism. Holidays and trips constitute the majority of the transportation in the world and according to 2017 data, 57% of these travels in the world are made by air transportation. In addition to this, tourism travels around the world is increasing rapidly each year. The number of international tourist arrivals in the world increased from 25 million in 1950 to 1.3 billion in 2017.

For these reasons, the tourism potential of the city where the airport is located is undoubtedly directly related to the success of the airport. The tourism potential of Istanbul can be considered as very strong. According to the data of 2017, it has become the tenth most visited by international tourists in the world and the third city in Europe. Istanbul offers a wide variety of tourism opportunities to its visitors with its richness in many areas such as cultural, historical, health, cruze, congress and nature tourism. Istanbul has 20 tourism centers and is the only city in the world on two continents. In this regard both to Turkey and Istanbul it is also said to have an important place in global tourism. Based on historical data, the number of foreign tourists visiting Istanbul tends to increase rapidly. The number of visitors, which was 7 million in 2008, reached the highest amount of time in 2018 with 13.5 million.

In this respect, Turkey and Istanbul, which are important places in the global tourism, are likely to maintain its importance in the future. In the context of the scenario that is expected to be realized within the scope of the scenario analysis, it can be assumed that globalization will increase and thus Istanbul will attract more tourists in the future. The addition of Turkey's tourism potential is likely to be a positive impact on the amount of passengers the airport in Istanbul.

In addition to tourism potential, as mentioned earlier, the importance of Istanbul in terms of business world is an important factor that will affect the performance of the airport. The current business potential in cities is, of course, directly proportional to business trips to cities. In this context, Istanbul invested in a financial center in order to increase its potential in business world as well as congress and conference tourism. With the launch of the financial center in 2009, it was evaluated by the global financial center index made by Long Finance and made significant progress until 2016. Istanbul, which entered the world's international financial centers ranking 72nd in 2009, rose to 42nd place in the second half of 2014, but declined to 78th place due to political tensions and fluctuations at the end of 2017. On the other hand, Istanbul, which has been on the rise again in recent years, ranks 59th in 2019. When the global financial centers index is analyzed, it is seen that the top four places have been owned by London, New York, Hong Kong and Singapore for a long time and when the airports in these cities are considered, it is in the top ranks of the world's busiest airports. In this respect, it can be said that the financial and business potential is directly related to the performance of the airport in the city.

With its historical richness, important position in the world geography, strong local market and over-young population, Istanbul has significant advantages in becoming a financial center. On the other hand, it may be considered that Istanbul have to wait more to become a global financial center. Looking at the GFCI 25 report published in March 2019, Istanbul; It has surpassed its leading competitors in Eastern Europe and Central Asia, such as Prague, Warsaw, Moscow and Budapest. When it comes to the Middle East and Africa regions, Istanbul has come behind the cities of Dubai, Abu Dhabi, Tel Aviv, Doha, Johannesburg and Cape Town. In the Global Cities Index, another important index prepared by AT Kearny, Istanbul is among the top 30 global centers of the world. According to 2019 data, Istanbul ranks 26th, Dubai ranks 27th and Moscow ranks 18th.

In general, it is seen that Istanbul ranks among the top 50 in the global indices and competes with Moscow and Dubai in the near geography. Accordingly, it can be said

that Istanbul plays a role as a regional financial center. Although it is thought that Istanbul is an important regional financial center, it can be argued that the city has more time to be a global financial center. At this point one of the major problems of Istanbul and Turkey could be assumed as political instability and geopolitical problems. Looking at the historical data, Istanbul has achieved significant increases in some periods, however events such as the coup attempt, terrorist attacks and the plane crisis with Russia prevented the rise of Istanbul and caused it to decline. In other words, the biggest handicap in front of Istanbul, both in terms of tourism and business potential, can be considered as being located in a region where there are many unrest and it is likely to continue in the future. Both money both tourists "safe harbors" loved Given the close environment of Turkey and its relations with the countries best kept as a future Istanbul is very likely to be put forward will act as a major inflection point in the world. Therefore it could be assumed that Istanbul would be an important point of attraction in the future where Turkey have good relations with its near geography and rest of the world.

Time Series Forecasting

As mentioned several times in the thesis, one of the most important indicators of success of an airport is accepted as the amount of passengers it serves. Estimating the number of passengers that Istanbul Airport will serve in the future is one of the most important objectives of the airport. In this direction, it has been tried to make air traffic forecast for Istanbul Airport. Historical data of Istanbul Ataturk Airport is used in the forecasting model due to the lack of historical data due to the newly opened Istanbul airport. Although there are many estimation models that can be made over time series data, ARIMA and ETS statistical models are used in the estimation study for 10 years.

ARIMA, Holt-Winters' Additive and Muliplicative models were used to estimate the future passenger amount of Istanbul Airport until 2028 and the results are shown in the following graph.

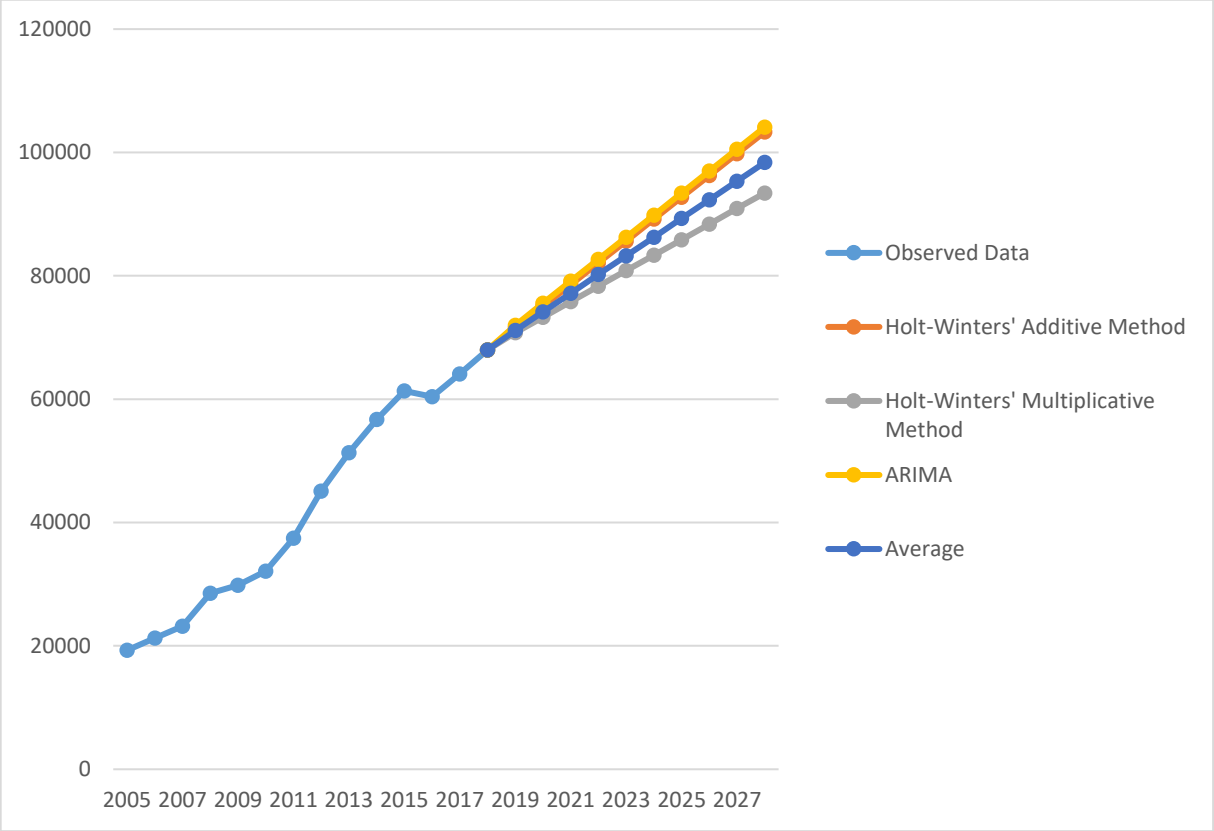

Figure 7.1: Time Series Forecasting Results

Although different results have been obtained according to different estimation models, the results are very close to each other. According to the average results of the models, it can be argued that Istanbul Airport will serve approximately 100 million passengers by 2028. It can be thought that this amount is very important compared to the competitors of Istanbul airport and the airport will develop rapidly. It can be said that it will be able to take the advantage of the airports in Europe faster than its competitors in the Middle East region. As can be seen from the graph below, since 2006 European transfer centers have shown a very slow growth in terms of passenger volume, while Istanbul, Dubai and Doha have shown a rapid growth. As already mentioned in the thesis, it is not possible for airports in Europe to increase their capacity to a great extent and thus to increase the amount of air passengers rapidly. In this respect, Istanbul airport may be able to get ahead of Frankfurt, Amsterdam Schiphol and Paris Charles de Gaulle airports in a short time and London Heathrow

Airport after 2023. On the other hand, it can be said that Istanbul airport will be in a rivalry competition with Dubai airport, which has achieved rapid growth and serves 89 million passengers in 2018. In this context, the most important competitor of Istanbul airport in the future is likely to be Dubai.

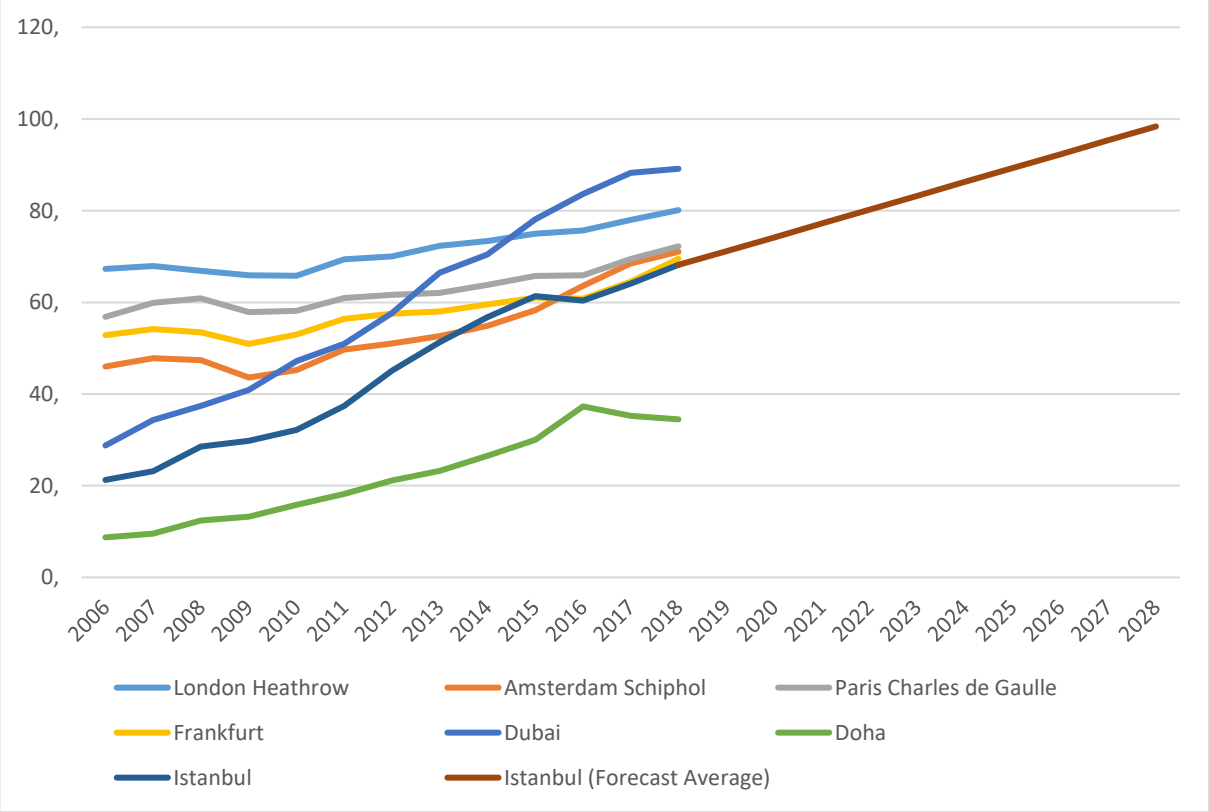

Figure 7.2: The number of passengers carried by Istanbul Airport and its competitors by years

Scenario Analysis

The future passenger traffic of Istanbul Airport was analyzed with forecasting models for a 10-year period. For a more distant future, a qualitative research method was chosen. It is tried to predict how the world will be shaped in 20 years and how Istanbul airport will play a role in this future through scenario analysis. Within the scope of the scenario analysis, the results of the workshops and analyzes organized within the scope of the "Air Transportation General Study" project, which was tendered by the

State Airports Authority and implemented by YTM-MATPUM, were used. In this context, air transportation priorities of Turkish Government has been determined by examining the various reports firstly. The priorities identified were voted by the sector stakeholders in the workshop organized within the scope of the project and the five most important priorities were identified and weighted. In the second stage, via literature reviews, the trends that may affect the global air transport sector in the future are tried to be identified. Again, within the scope of the workshop, participants determined how important these trends were in terms of priorities. Thanks to this voting, it was scored by using analytical hierarchy process which is one of the multi criteria decision making methods. In addition, the uncertainty status of the scored variables in the future was between 1 and 5 according to the uncertainty cases examined. Among these variables, the ones with high index of indeterminacy and the uncertainty in terms of affecting the air transportation sector in the future were selected and grouped in two groups. These groups, defined as globalization and geopolitics, formed the scenario axes and four different scenarios were developed on these two axes. These four scenarios were shared with the participants in the second workshop organized within the scope of the Air Transportation General Study and asked to identify the scenario most likely to occur in the future.

As a result of the workshop, the scenario in which globalization has increased rapidly in the future but geopolitical problems continue has been accepted as the most probable scenario. Within the scope of the scenario, the rapid increase of globalization in the future is expected to contribute to the serious developments in the aviation sector. Air traffic is expected to increase in terms of both passenger and goods with the development of free trade agreements, the growth of global trade, the increase in GDP in the world and the growth of the middle class population in addition to passenger transport. In the globalizing world, the tourism sector will also witness impressive growth and contribute to the country-regional economies. Despite these positive developments, the political tensions in the neighboring region of Turkey and is expected to continue geopolitical issues. Possible tensions and problems in the

Middle East region can have positive or negative consequences for Istanbul airport. Istanbul Airport may have an advantage over Dubai, one of its most important competitors, if it gains a stronger political role by translating the consequences of political tensions in its favor. Turkey's negative image in the eyes of other countries to obtain the status of future performance acceptable Istanbul airport as one of the most important conditions that negatively impacted. With the increasing globalization and strong technology in line with the possible scenario within this scope, the main problem facing Istanbul Airport can be considered as geopolitical problems. If the impact of these problems and tensions on the airport is minimized, it can be argued that Istanbul Airport has the potential to be one of the most important global transfer centers in the world.

An Urban and Regional Planning Perspective

In the last decade, the Turkish government has developed various mega projects for Istanbul in order to increase economic competitiveness. Developed urban projects such as Canal Istanbul, Marmaray, Third Airport and the third bridge are undoubtedly the investments that will directly affect the urbanization of Istanbul. Upon the idea of the two airports located in Istanbul are not able to cover the air traffic demand, Istanbul Airport, perhaps one of the most important mega projects of Istanbul, put into operation. In this context, the impact of the new airport on urbanization and how will it change the urban patterns in the future can be considered as an important issue.

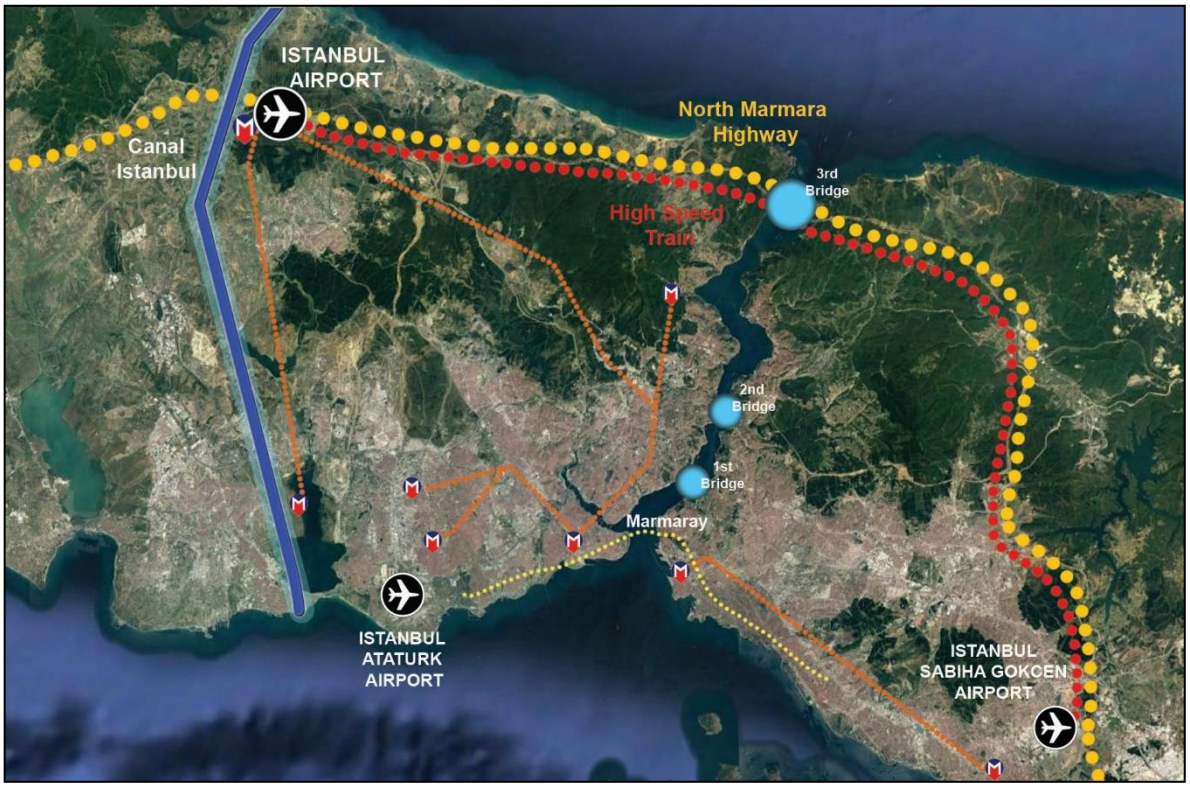

Figure 7.3: Istanbul Airport and Transportation Network

As can be seen from the above image, it can be said that the transportation connections for Istanbul Airport are strong. While it is an advantage to be fed by the North Marmara motorway and to be provided by metro and high speed train, its distance to the city center can be considered as a disadvantage. On the other hand, Istanbul, which has a population of more than 15 million people and is accepted as a mega city, is unlikely to have such a large airport near the city center.

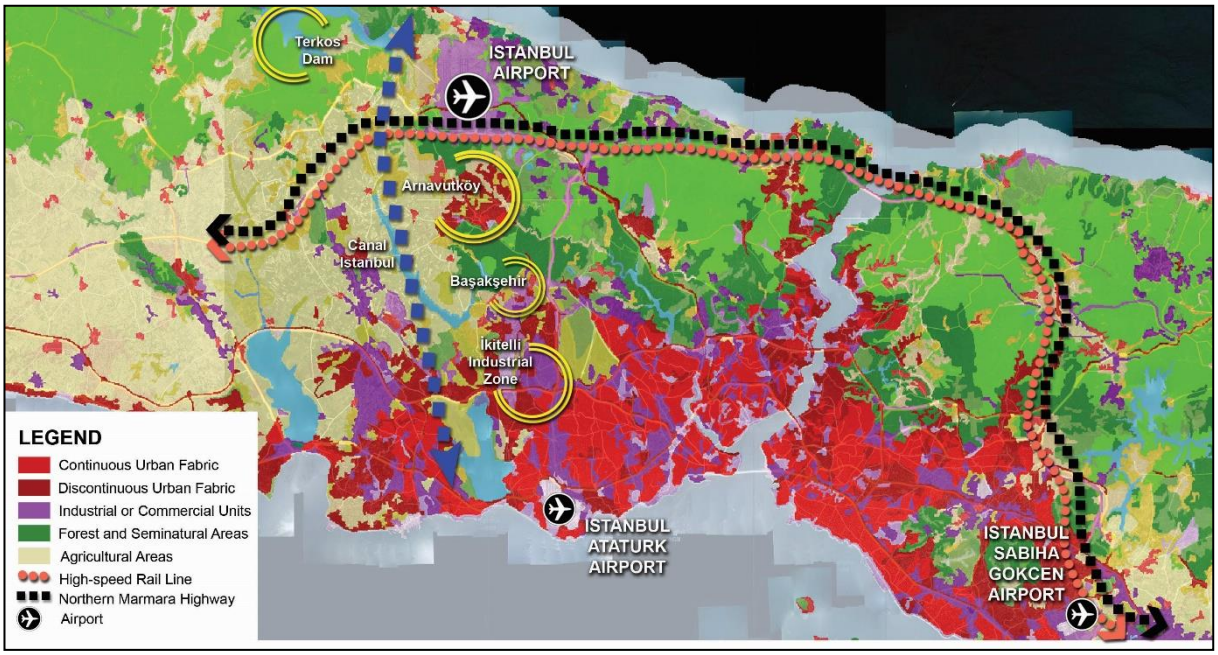

Figure 7.4: Corine 2018 Land Cover – Istanbul

Figure 7.4 is based on 2018 Corine land cover which is retrieved from ATLAS 2019. It can be said that the macroform of the city of Istanbul developed on the east-west line through the map where urban uses can be easily seen. However, it can be said that the urbanization direction of Istanbul may differ in terms of new urban developments and land availability. According to TUIK data, it is not wrong to assume that Istanbul population, which is expected to reach 16.3 million in 2023, will continue to increase in the future. In this context, it can be assumed that there will be new settlements in the future and urbanization will continue. Istanbul Atatürk Airport, where air cargo and general aviation activities will be carried out and will be used as a large recreation area, Başakşehir district, where the urban transformation and new settlements are made, İkitelli industrial zone located in the north-south axis and Arnavutköy can create a new development axis in the north-south direction. In addition, the Canal Istanbul project, which is located close to the Istanbul airport, can be argued as another factor that will accelerate urban development in the north-south axis. If it is completed, urbanization can be expected to be around the canal within the scope of the project, which is expected to address a population of 500,000 people. Finally, it can be thought

that urbanization will increase in the future around Istanbul airport. The airport, which is planned not only as an airport but also with an airport city concept, is expected to have hotels, offices, shopping centers, social living areas, hospitals, mosques, schools and fairgrounds. In this respect, it can be said that the value of the areas available for settlement around the airport will increase considerably and create rent. Although the surrounding area of the airport is considered as a forest and agricultural area in the Istanbul Environmental Plan, it can be thought that these areas will be opened to settlement in the future, just as in the case of Istanbul airport. In summary, it can be expected that the city macroform will develop on the north-south axis especially in the European part of Istanbul. Istanbul Airport, canal Istanbul and the Northern Marmara Highway have created points of attraction for urbanization on this axis. On the other hand, the growth of Istanbul on the European side to the north can be considered as ecologically dangerous. Forests in the north of the city, Terkos dam lake and agricultural lands located very close to the airport may be negatively affected by an urban development that may occur in this direction.

Considering the city of Istanbul only as a metropolitan area and not taking into consideration its relations with its region will be incomplete. It would be more inclusive to consider mega cities like Istanbul as an integrated economic geography not only with the metropolitan areas but also with economic coverage and their hinterlands. In this context; the region which includes the cities of Istanbul, Bursa, Kocaeli, Yalova and Tekirdag can be considered as the most important city-regions in Turkey. It could be argued that the region where the very large portion of imports, exports and GDP of Turkey generated, has an important potential for being a globally competitive region in terms of air cargo and air passenger. Today, a strong transportation network is undoubtedly the most important issue for the mobility of goods, products and people. The airports within the region can significantly increase the economic performance and competitive strength of the region and the country if they are integrated with a strong transport network rather than being trapped in their own spatiality.

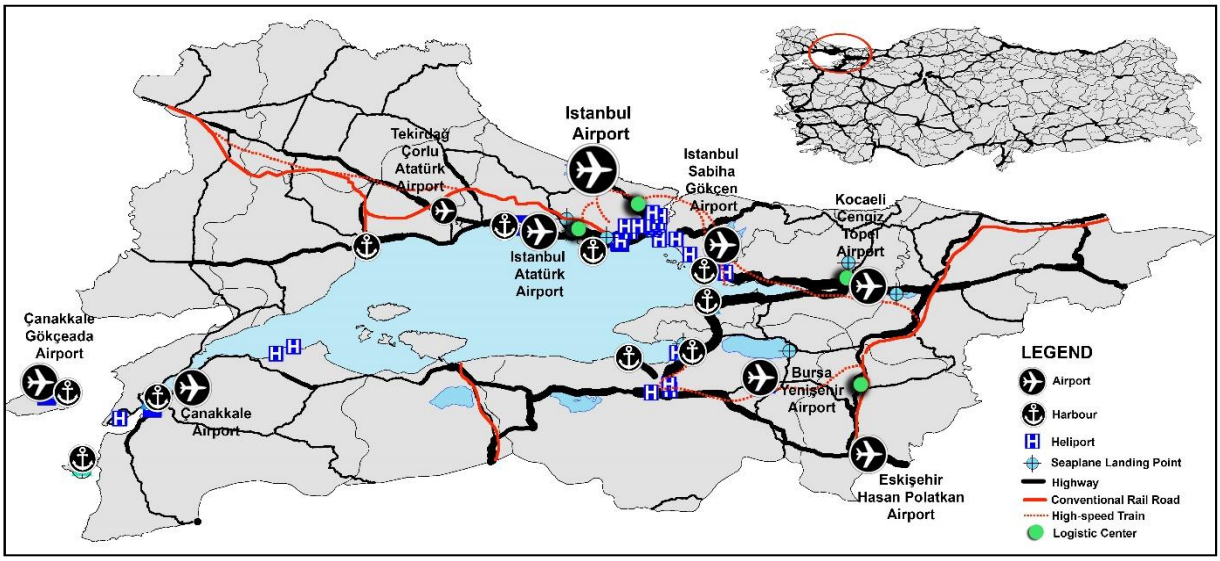

Figure 7.5: Istanbul City-Region

In the figure 7.5, the highways are weighted according to the most intense traffic according to 2015 traffic data. It could be seen that the cities of Istanbul, Yalova, Kocaeli and Tekirdağ composed a region where the most intense road traffic in Turkey has been realized. The traffic density in this region shows the strong relations and integrated structures of the cities. In this respect, it would not be wrong to consider this area as a city-region. 7 airports, heliports, seaplane landing areas and several harbours within the region can be considered as a sign that the region has a strong potential for multi-modal transportation. Moreover the region also hosts for four logistic centers determined by the government. Therefore, the region, which is a very important point not only for passenger transportation but also for the circulation of goods within the global system due to its geographical location, can increase its competitive power if its transportation system is integrated with each other effectively. Regional development can be strongly supported by an integrated transport system to be established within the region that includes all modes of maritime, road, rail and air transport. In this respect, it is possible to say that the region to be led by the Istanbul airport has the potential to play a role, which is one of the few examples in the world. With the rise of Istanbul Airport, this city-region system can evolve into an airport region. Istanbul can access to the airport region concept, which is also aimed by

Germany via Berlin Brandenburg Airport much earlier than Berlin. Due to wrong planning, technical failures and day-by-day increasing costs in Brandenburg Airport, Germany is in a disadvantageous position in terms of airport region. On the contrary, there are significant potentials for the Istanbul city-region. The concept of airport city may evolve towards the concept of airport region with active airports operating in the region, planned transportation connections and logistic potential. With the airport region concept, Istanbul city-region may get a bigger share of the cake not only serving for passenger transportation but also all fields of the sector such as education, production, design, air cargo etc.

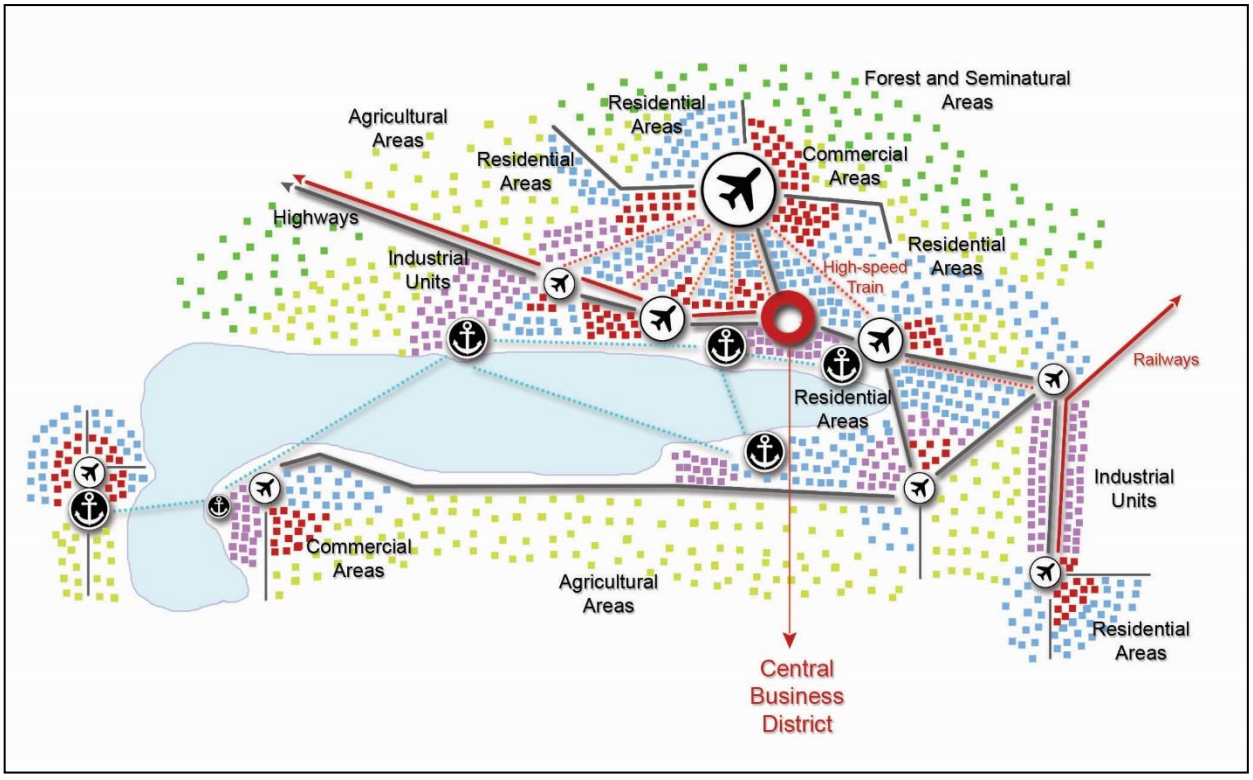

Figure 7.6: Airport Region Conceptual Scheme

The concept of the airport region can be better understood from the Figure 7.6. The airport city-region concept can be considered as an integrated structure around the economic coverage area of the region due to its strong transport links with the different urban areas around it, rather than a new urban area, which is developed around the airport away from the existing city and disconnected. In other words, the airport

region, which is integrated with urban and industrial areas, with strong transportation network and high diversity of transportation modes, supported by logistic centers and hosting many airports and heliports might have a top-tier competitive power among the world in the future thanks to the broad experience and power obtained throughout the history. Accordingly, the concept of airport region, which has the potential to develop under the leadership of Istanbul Airport, can be considered to support regional development by increasing employment, economic contribution, commercial diversity and trade activities.

Conclusion

Throughout the thesis study, the role of Istanbul airport in the future has been examined from different perspectives. In this context, it has been tried to predict whether Istanbul Airport will be successful in the future by means of four main sub-questions and the possible effects are discussed. It can be said that the airport investment made with the aim of increasing the competitiveness of Istanbul with global transfer centers in the world will serve this target in the future. Istanbul, which is currently in competition with London Heathrow, Amsterdam Schiphol, Paris Charles de Gaulle, Frankfurt, Dubai and Doha airports, will strengthen its advantage in this competition thanks to the new airport investment. With the fact that the airports in Europe cannot easily increase their capacity, Istanbul's advantageous geographical position and rapidly growing air traffic, with its more integrated public transportation and high capacity, Istanbul Airport will be one of the most important global transfer centers of the world in the future. In this process, it can be argued that the most severe competition will be experienced with Dubai International Airport in the future. In the time series estimation model made within the scope of the thesis study, it is predicted that Istanbul Airport will reach 100 million passengers in the next 10 years. Thanks to this rapid growth, it can be predicted that within 10 years Istanbul airport will outperform its competitors in the European region and Doha airport and will remain alone with Dubai at the summit within the region.

The strong tourism potential of Istanbul and Turkey has been considered as another factor, which will also guarantee the success of the airport. As a result of the researches conducted within the scope of the thesis, tourism potential of Istanbul has been examined in detail. Istanbul, one of the 10 most visited cities in the world by international tourists, strengthens its tourism potential every year and hosts more tourists. It would not be wrong to say that this trend will continue in the future. In addition to its impressive tourism potential, Istanbul stands out as an important location for business with its strong local market. Although it is not considered as a global financial center in the world market for the time being, Istanbul is considered as an important regional financial center, and it will undoubtedly continue to meet the increasing demand for air transport in the future. In this context, it will not be wrong to argue that Istanbul airport will not only be a transfer center but also an important point of attraction in the world. Within the scope of the study, not only the future of Istanbul Airport, but also what kind of future awaits the world in 20 years is tried to be predicted. A scenario study was conducted with the participation of sector stakeholders using the analytical hierarchy process, which is one of the multi-criteria decision-making methods and a scenario in which technological developments will continue, globalization will increase but geopolitical problems will continue to be considered as the most probable one. This scenario can be considered as a suitable scenario for Istanbul Airport to achieve its goals. It is probable that the increase in globalization and the continuation of technological developments will increase the demand for aviation globally. In addition, it is quite possible that Istanbul airport will be one of the important global transfer centers according to this scenario. Geopolitical problems and political unrest can be considered as the biggest obstacle against the achievement of Istanbul Airport's targets in the future. Although Istanbul airport is very advantageous in a world where globalization will develop, the aviation sector always suffers from political tensions and geopolitical problems, which has experienced before. In this regard, if Turkey will minimize the geopolitical problems and provide the political stability in the future, there would not be a serious obstacle for Istanbul airport against reaching the targets.

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