THE IMPACT OF THE RUSSIAN-UKRAINIAN WAR ON THE GLOBAL AVIATION INDUSTRY

by

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IATA - The International Air Transport Association

ICAO - International Civil Aviation Organisation

SNA – Social Network Analysis

CHAPTER 1. INTRODUCTION

The global aviation industry has experienced major disruptions in their operation for the past two years. The first hit was the pandemic of COVID-19. As the result countries closed their borders, imposed strict restrictions and regulations. Airlines were forced to cancel all their flights and airports were operating at their minimum capacity. All of that followed in the significant drop of all of the companies' revenues and major layout. It was not until the end of the 2021, when countries started opening their borders (IATA Annual Review, 2021).

It seemed as if this long rough patch was finally over when the new challenge emerged. On February 24, 2022 Russia started a full-scale invasion to Ukraine. The outrage of the war in the middle of Europe created great challenges for many countries and spheres, and the aviation industry was one of them. Fearing that Russia could start the invasion and this would possibly affect the safety of the aircrafts and their passengers, many airlines cancelled their flights to Ukraine several days ahead (CNN, February 20, 2022). After the beginning of the full-scale invasion, all European countries, but Serbia, decided to cancel all their flights to Russia as part of the sanctions. The one country that has a very important geographical position right between the Europe and Russia is Turkey. Due to its political position, this country has not cancelled its flights to Russia.

The closed airspace and airports created inconveniences not only for people who were interested in travelling to or from Ukraine and Russia. It also meant that there are less options for those travelers, who used these airports to transfer to other flights to reach further countries. Thus, the passengers were left with the question on how to get to the desired destination and the aviation industry had to come up with the idea on how to satisfy this demand in the short term and under the tight constraints.

As the result, some flights were cancelled, some rerouted and new directions were added. All of that changed the airport network. This means that some airports became more important to the overall network, i.e they became more central as of the result of these changes. However, more central airport (which means that there are more incoming and outcoming flights and it is better connected to other central airports) can face some new challenges. The more popular the airport is, the more passengers choose to travel to or from it, especially during the most heated seasons. Considering the fast and drastic changes in the world, the unpreparedness of some airports to meet new demand can mean that it is at the higher risk to experience significant disruptions to their operations, such as cancelled flights, long ques and not enough personal to support.

To determine which airports have become central and, thus, are at higher risk of the operational disruptions, the Social Network Analysis will be used. It will allow us to model the network and then by calculating the metrics spot the changes.

Thus, the purpose of this paper is to, first, see how the airport network changed after the invasion and then to identify which airports become more central as the result of it. The more central it is, the more important the airport is. Should there any additional challenges happen, e.g any disruptions in the operation of the airports or airlines, it can cause even greater costs not only to the airport itself but to the network as a whole. Thus, it is important to analyze the airport network and see if there is anything that can be considered as a week spot.

CHAPTER 2. INDUSTRY OVERVIEW AND RELATED STUDIES

The year of 1993 can be considered as a starting point of the formation of the modern aviation industry in Europe, when the European Union agreed on the new internal air transport regulations. It is worth mentioning that before this decision entered into force, every aircraft had operated under the bilateral agreements that existed between certain countries (Fu et al., 2010). This means, that a Spanish airline, for example, could only make the flights to other countries, with which Spain had a bilateral agreement. The same aircraft was not allowed to operate in the foreign airport and complete flights between two other foreign states (e.g between France and the UK). Such bilateral agreements often stipulated which carriers were allowed to make the flights and on which routs and could always be adjusted in response to the needs of both sides. These regulations and limitations made the aviation marked very monopolized by the major national companies. Thus, the entrance of new players on the market was very difficult.

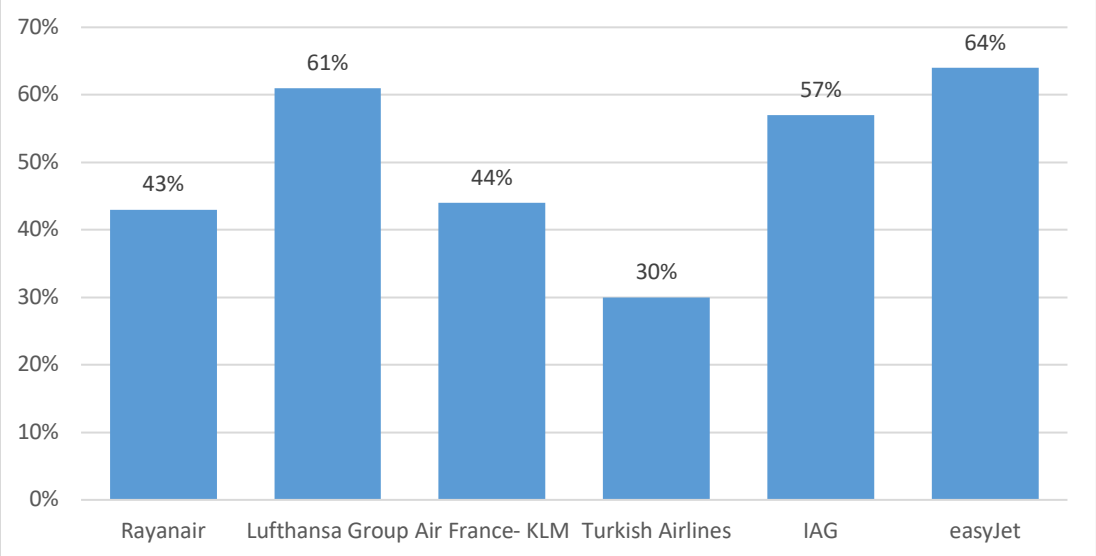
After the liberalization of the market, all EU air carriers received a great freedom in choosing the roots. Since then, they could decide where they operate and what services they want to provide. Additionally, each air carrier now has the right to impose a price in accordance with the market situation. This new reality became the prerequisite to the creation of the new low-cost air carriers that operate on routes beyond their own country.

What is also worth mentioning, is that the liberalization of the market also affected the business model of the modern airports. First of all, it is worth mentioning that such changes resulted in a bigger number of airports in European region, many of them being now privately held. Secondly, the working strategy for airports has changed as well. Before the liberalization it would be the airports that chose the airlines that they wanted to work with. However, nowadays the decision is mostly made by the airlines. Thus, airports are faced with a big competition and

are using different methods to attract new airlines. Such methods could vary starting from the better terminals and lanes and ending up with more shops in the duty free zone and more comfortable waiting zones for the passengers. (Thelle et al., 2015)

Such changes in the airline traffic regulations proved to be very effective and boosted the market growth for many years. However, the situation has changed due to the world's pandemics. Travel restrictions due to the spread of the COVID-19 as well as the long-lasting lockdowns in almost all countries in Europe greatly decreased the air traffic. As the result, in 2020 the market was down by 40-73% comparing to the results in 2019. With the time the situation has improved and the market was recovering. The major prerequisite for this was the creation of the COVID vaccines. That allowed the countries to take the infection rate under control and as the result to lift almost all lockdown restrictions. Nevertheless, the market in 2021 was down by 8%-62%.

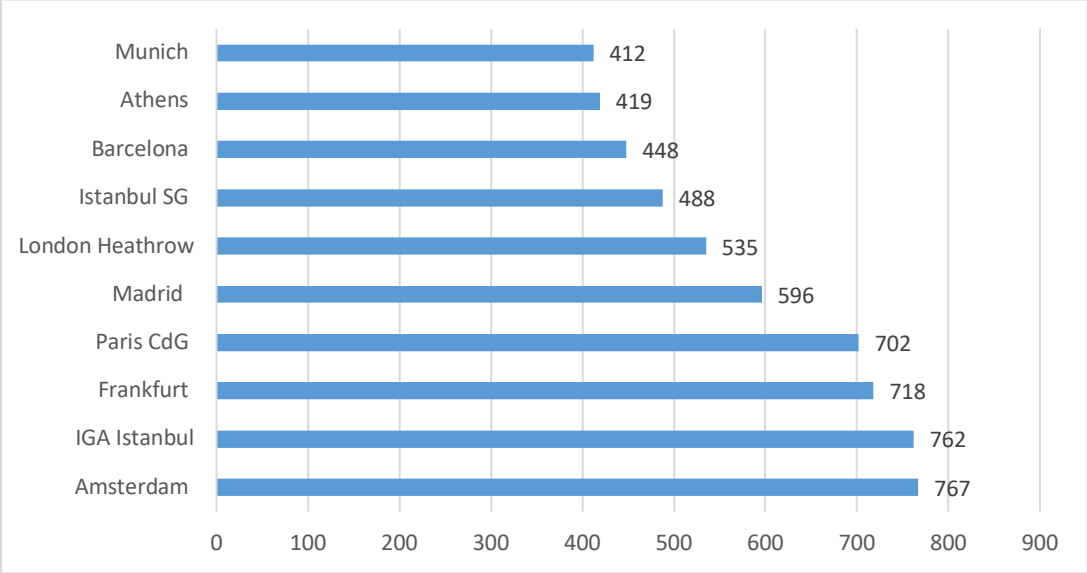
Figure 1. Percentage of flights down in 2021 in the leading aviation groups in comparison with 2019.



Source: Eurocontrol Think Paper #16

When talking about the top 10 airports in Europe by the number of flights, Amsterdam had the largest average number of arrivals and departures in 2021 (767 flights). Amsterdam is also closely followed by the following airports: IGA Istanbul, Frankfurt and Paris CdG. It is also important to point out that the majority of the largest and the busiest airports are located in the Western part of Europe.

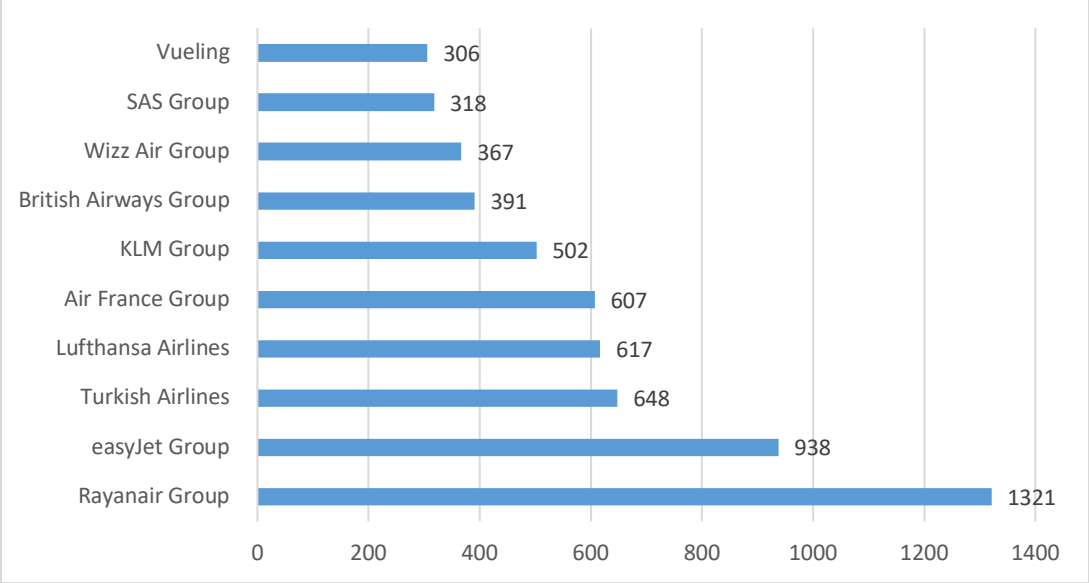
Figure 2. Top European Airports in 2021 by number of flights (average daily movement).



Source: Eurocontrol Think Paper #16

As for the air carriers, the top 3 airlines that had the largest number of flights in Europe, both departures and arrivals are Rayanair, easyJet and Turkish Airlines. It is also worth mentioning, that out of top 10 airlines, 4 are low-cost air carriers (Rayanair, easyJet, WizzAir and Vueling). This is partly due to the fact that low-cost airlines were one of the first to recover the number of flights after the pandemic as comparing to the other national airlines.

Figure 3. Top European Airlines in 2021 by number of flights (average daily movement).



Source: Eurocontrol Think Paper #16

Considering the graduate recovery in the number of flights, the aviation industry had great expectations for 2022. However, the invasion in Ukraine by Russia created a new disruption in the network logistics. The aviation companies had to take into consideration all new restrictions (such as banning of all Russian carriers as well as closed Ukrainian airspace) and reroute their flights in the very short term.

Unfortunately, there is very few research done that would describe the strategy the aviation industry uses when developing new routes in response to the rapid and long-lasting disruptions, such as war in Europe. However, it is worth looking at the route-developing process during the peaceful times.

Nigel Halpern, Anne Graham, 2015 have discovered several similarities when analyzing the airport root development. The first similarity if the airport size. Small airports are usually more focused on the leisure and/or holiday charter

services. As for the bigger airports, most services offered there are foreign flights and cargo shipments. Another similarity is the geographical location. The smaller the country, where the airport is located, is, and the more countries it boarders with, the more international its airport is. For example, most airports in China or US offer domestic flights to other cities, while the airport in any European country is more focused on the international flights.

When trying to discover and analyze how air traffic was rerouted in response to the ongoing military actions, the Social Network Analysis can be used. There are several research papers that analyze the air traffic network using the social network analysis.

In their work, Saleena. P, P.K.Swetha, D.Radha, 2015, created the US transport network and calculated different centrality measures. As the result, it was discovered that Chicago O'hare International airport has the highest degree centrality, namely the Betweenness, Closeness, Eigenvector, reach and information centrality. Such results have shown that Chicago is one of the designated cities in U.S.A and the airport Chicago O'hare Intl is very important to the whole US air network. Such higher importance of one particular airport also creates risks for the network. If Chicago O'hare airport stops working, the whole network is sabotaged.

In another research conducted by Min GeunSong, Gi TaeYeo, 2017 the social network analysis helped to calculate the degree centrality for many airports across the world. This was necessary to discover the major characteristics of these airports. Additionally, the result of such analysis also showed how different countries and regions are interconnected. The more diplomatically friendly the countries are, the more flights there were between their airports.

Considering the last disruptive for the industry events as well as the available literature, this paper can contribute to understanding of the current airport route development process. Additionally, it can show how the rapid changes can affect

the position of the certain airports on the network as well as will show the possible challenges that can arise.

CHAPTER 3. METHODOLOGY

The purpose of this research paper is to build the European air transport network before and after the Russian invasion. For these purposes the Social Network Analysis will be conducted. This will allow us to build the transportation network where each node represents the airport, and each tie will show the connection between the two airports, i.e a flight that is conducted from one airport to another. Additionally, the network is weighted by the number of flights happening from one airport to the other within a selected time period (4 days). This can help to capture the magnitude of the existing connection.

For the purposes of this research the data from the OpenSky Network will be used. OpenSky Network is a non-profit organization that collects different data on the air traffic and weather condition. Having a large data set that tracks all the aircraft movement, it is used by many academic groups. The data is collected and aggregated in such way that it reflects the connections between different airports, i.e all the flights that happened from one particular airport to the other during the certain period of time.

After collecting the data and building the air transport network, the next step will be to calculate different centrality measures. These measures can help to better understand the overall characteristics of each of the node in the network. This is necessary to determine which airport was central before and which airports became more central now. The higher the centrality degree of the airport is, the more important it is to the whole network. Any disruptions that happen to the central airport can sabotage the rest of the network.

To determine which airports are very important to the network, at first, the degree centrality will be calculated. For this purpose, the number of incoming and outcoming edges to each node is calculated. A node with the largest number of incoming and outcoming connections to the other nodes, has the highest degree

centrality. This means that by calculating this measure, it will be determined which airport has more direct flights.

Very often airports are used to transfer to the other flights. The decision to use for these purposes one airport over the other can be based on several reasons. First reason is that the traveler would try to choose the shortest route, which means with the less possible transfers. Another reason can be how well the chosen airport is connected to the other very central and important airports.

The following two measures would help to determine the centrality of the airports based on the number of the shortest paths that go through it and how close one airport in the network from the other. These are the betweenness and the closeness centrality respectfully.

The formula for the betweenness centrality for weighted networks is the following:

$$s_i = \sum_{j=1}^{N} a_{ij} w_{ij} \quad (1)$$

a_{ij} – the adjacency matrix between nodes i and j,

w_{ij} – the adjacency matrix of weights between nodes i and j.

When talking about airports, this measurement will show which airport is often used by the passengers for their transfers. The airports with the highest betweenness centrality are very important to the network, as any failures in this node can damage the whole network.

The formula for the closeness centrality is as follows:

$$C(x) = \frac{1}{\sum_{y}^{N} d(y,x)} \quad (2)$$

$d(y, x)$ – the shortest distance between the two nodes.

Overall, the abovementioned measures are necessary to model a global airport network and also to have a better understanding how important one airport over the other.

CHAPTER 4. DATA

For the purposes of this work, the OpenSky Network data was used. OpenSky Network provides the dataset that reflects all flights that happened around the world starting from 2019 till nowadays. Initially this data was used to track the effect of COVID-19 on the aviation industry itself and on the world generally.

In this research it was decided to cover only specific region, such as all countries on the European continent, Israel, Turkey, Russia, Saudi Arabia, Qatar, and United Arab Emirates. The reason for that is that due to the military actions all flights over and to Ukraine were cancelled. Additionally, many European countries stopped their flights to Russia, except for Serbia. Turkey has also refrained from cancelling its flights to Russian cities and, thus, became a main transfer- hub for travelers from Russia. Such countries as Saudi Arabia, Qatar, and United Arab Emirates were included to the research due to its relatively close location to the European countries and well-developed airports.

Since the goal is to compare the airport network before and after the Russian invasion to Ukraine, it was decided to use the data that covers all the flights within the chosen region that happened on 1-4 December 2021 and on 1-4 June 2022. This four-day period was taken to make sure that as many as possible connections between the airports is captured. Additionally, it is desired to represent not only the existents of the direct connection between the two airports but also the magnitude, which means how often there are flights between two airports. This information will help to create a weighted network of flights between the two airports.

By simply looking at the data we can see that most of the flights occurred withing the country. Right before the war has started the most common airway roots were within Norway, Spain and France (they form the top-9 roots by number of flights during the 1-4 December).

Table 1. Top-9 airway roots that occurred within the period of 1-4 December 2021.

ICAO - From	Country - From	ICAO - To	Country - To	Numb of flights
ENGM	Norway	ENBR	Norway	90
ENBR	Norway	ENGM	Norway	88
LEBL	Spain	LEPA	Spain	80
LEPA	Spain	LEBL	Spain	78
LEMD	Spain	LEPA	Spain	74
LFBO	France	LFPO	France	71
LFPO	France	LFBO	France	71
LEPA	Spain	LEMD	Spain	70
LEBL	Spain	LEMD	Spain	63

When it comes to international flights most common routes were Denmark - Norway, Portugal – Spain, Sweden – Finland, Denmark – Sweden, Sweden – Norway, Finland – Sweden.

Table 2. Top-10 international flight destinations on 1-4 December 2021 by the total number of flights.

ICAO - From	Country - From	ICAO - To	Country - To	Numb of flights
EKCH	Denmark	ENGM	Norway	61
ENGM	Norway	EKCH	Denmark	57
LPPT	Portugal	LEMD	Spain	57
LEMD	Spain	LPPT	Portugal	52
ESSA	Sweden	EFHK	Finland	50
EKCH	Denmark	ESSA	Sweden	47
ESSA	Sweden	EKCH	Denmark	47
ESSA	Sweden	ENGM	Norway	46
EFHK	Finland	ESSA	Sweden	45
ENGM	Norway	ESSA	Sweden	45

Flights to or from Ukraine and Russia did not make the top-10 list, however, they still constituted a great presence. Before the war 451 flight happened from Russia and 494 to Russia. There were 236 flights from Ukraine abroad and 252 flights to Ukraine from the foreign countries. Within this four-days period 709 flights happened within Russia and only two flights within Ukraine.

The post war situation differs from what was happening in December. However, most flights still happened withing one country. For example, from the

Table 2 it can be seen that 106 flights happened from one Norwegian airport to the other. Russia is the third country with the largest number of flights within the mentioned period. Only 98 flights happened between Sheremetyevo International airport and Pulkovo Airport in St. Petersburg.

Table 3. Top-10 flight destinations on 1-4 June 2022 by the total number of flights.

ICAO- From	From	ICAO - To	Country-To	Numb of flights
ENBR	Norway	ENGM	Norway	106
ENGM	Norway	ENBR	Norway	104
UUEE	Russia	ULLI	Russia	98
LFPO	France	LFBO	France	97
LFBO	France	LFPO	France	94
LEBL	Spain	LEPA	Spain	90
LEPA	Spain	LEBL	Spain	90
LFMN	France	LFPO	France	87
ULLI	Russia	UUEE	Russia	86
LFPO	France	LFMN	France	82

As for the international flights, the biggest number of flights occurred between Norway and Denmark (81 flight within 4 days). Other popular routes are Germany – Spain, UK – Ireland, Portugal – Spain, Denmark – Sweden, Norway – Sweden, UK – Germany.

Table 4. Top-10 international flight destinations on 1-4 June 2022 by the total number of flights.

ICAO-From	Country - From	ICAO - To	Country - To	Numb of flights
ENGM	Norway	EKCH	Denmark	81
EKCH	Denmark	ENGM	Norway	76
EDDL	Germany	LEPA	Spain	69
EGLL	United Kingdom	EIDW	Ireland	67
LEPA	Spain	EDDL	Germany	67
EIDW	Ireland	EGLL	United Kingdom	66
LPPT	Portugal	LEMD	Spain	65
EKCH	Denmark	ESSA	Sweden	64
ENGM	Norway	ESSA	Sweden	63
EGLL	United Kingdom	EDDF	Germany	62

Meanwhile, most international flights that happened from Russia were to the following countries: Belarus (total of 51 flights during the 4 day period), Israel (3), Qatar (1), Serbia (7), UAE (33) and Turkey (32). Airports, from which these flights occurred, are Sheremetyevo International airport, Pulkovo Airport in St. Petersburg, Vnukovo International Airport, Moscow Domodedovo Mikhail Lomonosov Airport and Kazan International Airpor. Overall, the number of flights from Russia and to Russia has significantly dropped, being 128 flights and 101 respectfully.

Such differences in flights not only to Russia but also across the whole European countries can also be described by the different seasons: the first one happened during the winter and the second one during the first days of summer, when many people start traveling for holidays and vacations. The increasing activity is also due to the ease of most of the COVID-19 restrictions. All of this leads to the rise of the number of flights abroad for many countries. Russia on the contrary experienced the relative increase of the domestic flights. And this is the result to its the military actions.

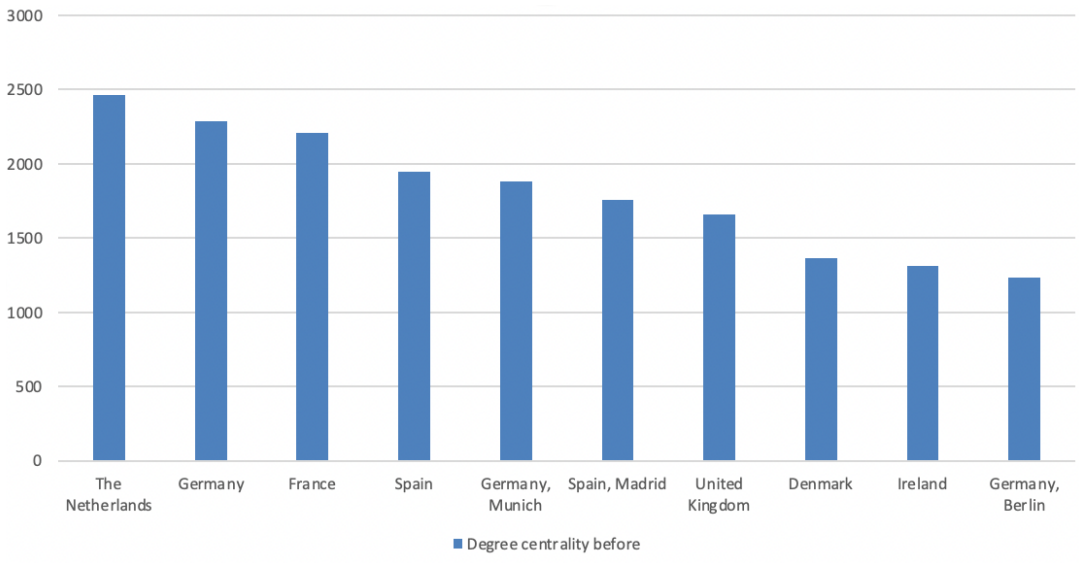
CHAPTER 5. RESULTS

5.1. Degree centrality

Degree centrality shows how central certain nodes are to the network by simply calculating the incoming and outcoming ties. This was done for both before and after war airport network.

Before the war the degree centrality is expectedly high for the majority of the Western-European countries, such as The Netherlands, Germany, Spain, The UK, Denmark etc. Their airports had the biggest number of the incoming and outcoming flights. It meant that to the whole airport network, these airports are generally very important.

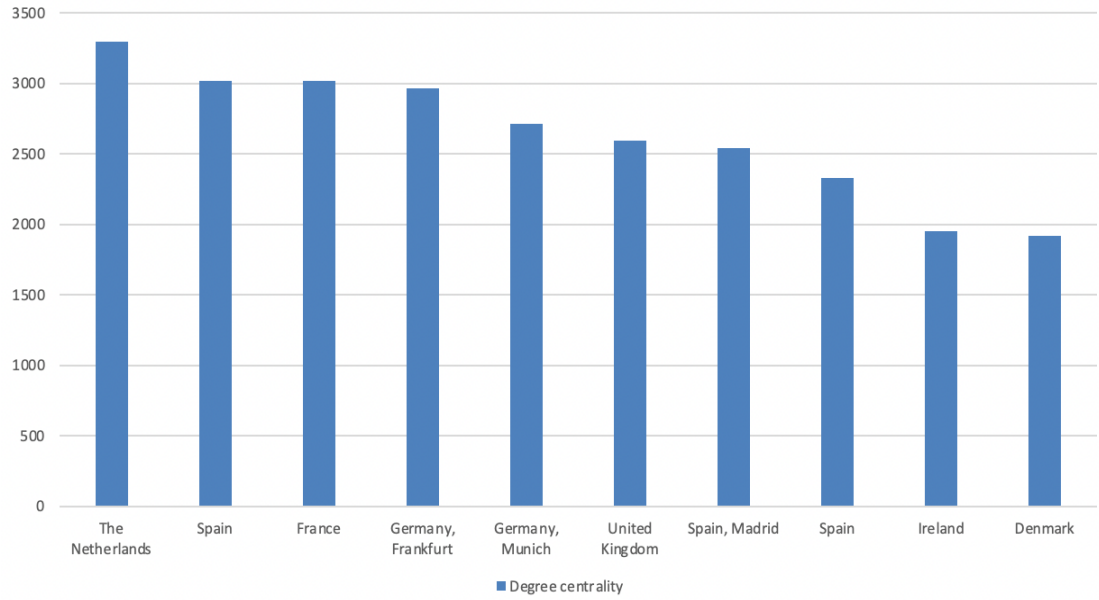
Figure 4. Top -10 Airports with the highest degree centrality score before the war and their degree centrality scores after the 24 February.



The situation has changed in June. First of all, it is worth mentioning that the number of flights generally increased. The reason for it is that the period in question is during the summer season, when number of trips always increases. Thus, the degree measurement is expectedly higher for many airports, especially if they are located next to the most popular travelling destinations.

For this reason it can be seen that it is the same countries before and after the war that have the highest degree centrality score (figure 5).

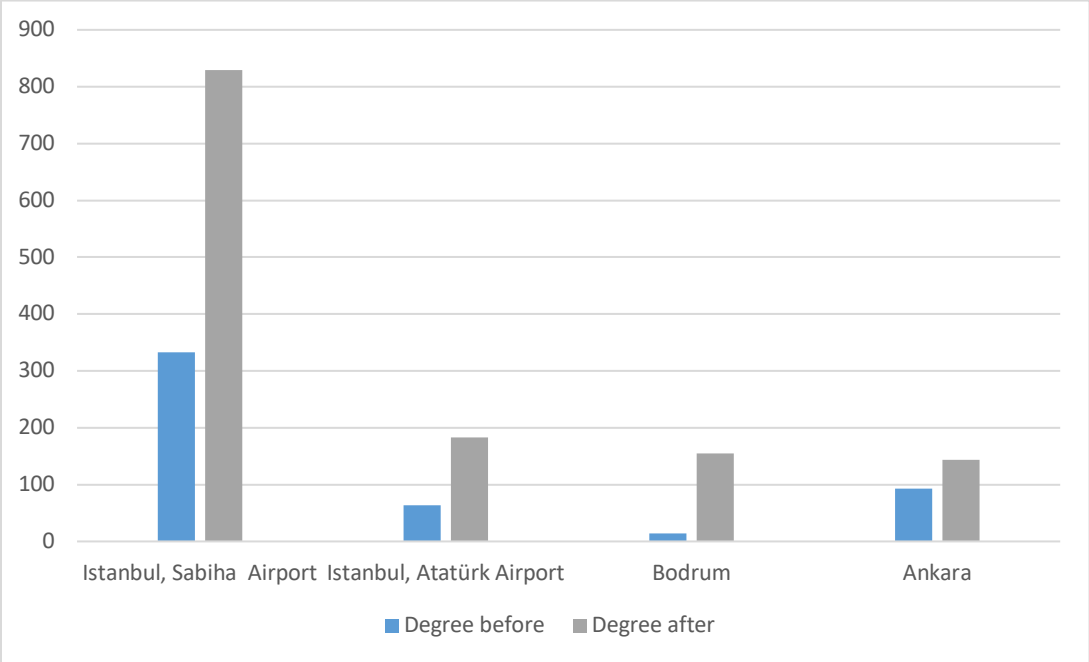
Figure 5. Top -10 Airports with the highest degree centrality score before the war and their degree centrality scores after the 24 February.



Almost the same top-ranking shows that the Western-European countries were mostly unaffected by the changing aviation network in the East. For this reason it is interesting to see how the degree centrality changed for Turkey, Serbia

and Russia. As for Turkey, before the war only four airports had flights within the four-day period. In June this number has increased. There were also more flights from and to Turkey. Thus, the Sabiha Gokcen International Airport (LTFJ) had a significant rise in its degree centrality, being the top-40th airport out of 511. The rise of the degree centrality occurred for the majority of Turkey's airports but Ankara Esenboga Airport.

Figure 6. Top - 4 Airports in Turkey with the highest degree centrality score before and after the 24 February.

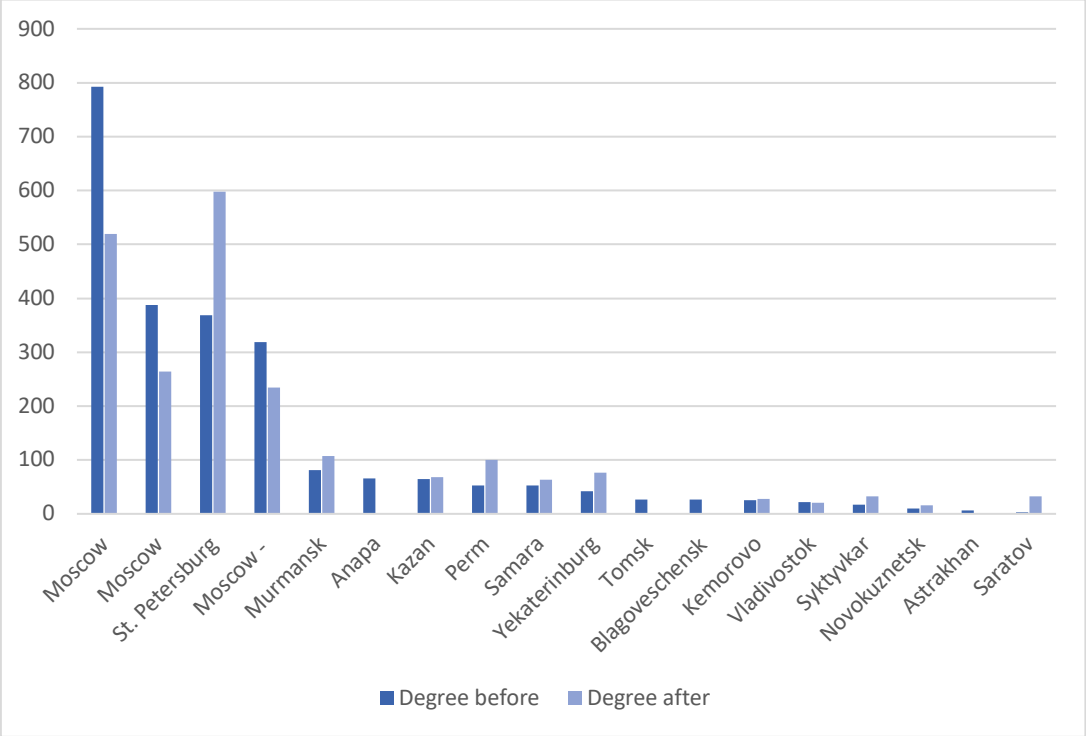


For Serbia the degree centrality has also increased from 174 (91th out of 391) to 476 (61 out of 511).

When it comes to Russia, figure 7 shows that the degree centrality score has lowered for the majority of its airports. This is due to the cancellation of the all

flights to the European countries. On the contrary, some airports, such as Murmansk Airport, Kazan Airport, International Airport Kurumoch in Samara, Koltsovo Airport in Yekaterinburg, Kemerovo Airport, Syktyvkar Airport, Novokuznetsk Airport and Saratov Tsentralny Airport experienced higher centrality scores. Interesting that most flights that happened from or to these places were domestic, only a small portion of them covered international flights to Turkey and/or United Arab Emirates.

Figure 7. The degree centrality score for Russian airports before and after the 24 February.



5.2. Betweenness centrality

When talking about the airport network connection it is important to also look at the betweenness centrality score. This score takes into account how many short paths go through certain airport. Thus, this score can help to identify which airports are more likely to be used for the transferring.

Betweenness centrality has also increased for the majority of the airports as the result of the rising number of flights. However, it is worth mentioning that Sheremetyevo - A.S. Pushkin international airport was the fourth airport with the highest betweenness centrality score (4229.071). From such position of the airport in the network it can be concluded that this airport was often used to transfer to other flights to reach further located countries. However, after the war this is not the case anymore. It is now on the 21st place with the betweenness centrality score 2402.14. Such situation is true to all Russian airports. They were central to the network due to the good flight connection but have lost its importance because of the war.

Istanbul Sabiha Gökçen International Airport has on the contrary increased its centrality. If before the war its score was close to zero, after the beginning of war it reached the 15th place (4814.63). The similar situation is with the Belgrade Nikola Tesla Airport. Even though the number of flights is relatively smaller comparing to some major airports, its betweenness centrality is 16th largest (4322.93).

5.3. Eigenvector/Bonacich centrality

It is important to look at the eigenvector centrality as it shows which node has more central neighbors. In our case is which airport has the most connections (flights) with the central airports.

The unchangeable leaders that have the most connections with the central nodes are all airports located in the Western Europe, such as Amsterdam, Paris, London and Frankfurt airports. These airports are one of the biggest, and, thus, are well-connected to many others.

The cancellation of some of the popular routes and also the need to meet a new market condition, made airports to establish new routes. Thus, the Eigenvector centrality has increased for some of the airports. Istanbul Sabiha Gökçen International Airport can be the example of such changes. The Eigenvector centrality has increased for it reaching the score of 0.218 (5.64e-19 before the war).

Russian airports as expected have lost its centrality to the network. If before the war Moscow Domodedovo Airport had a score of 0.0512, after war their score has decreased to 0.0055.

CHAPTER 6. CONCLUSIONS AND RECOMMENDATIONS

The full-scale invasion of Russia in Ukraine had a great influence on the global aviation industry. It has resulted not only in closed airspace over Ukraine but also in the cancellation of almost all flights to or from Russia. These changes have also affected the aviation network in the European region.

When creating and comparing an aviation network before and after the 24 of February, it can be seen that Russian airports were quite central to the overall network. This means that these airports were often a connecting point to the other far-located places. The cancellation of flights has almost eliminated Russia from the network.

With the beginning of the military actions Russian airports have lost its importance to the network. The majority of them became less central and had fewer connections with the central airports. A better situation was for smaller airports that are mostly covering domestic flights and a few international ones

As for the influence the rest of the network, the following must be mentioned. First of all, since the cancellation of flights was due to the political reasons, the demand for travelling from or to Russia continued existing and, thus, had to be satisfied. This created a prerequisite for countries, that are closer to Russia and are friendly or neutral to it, to intensify their airspace connection. Secondly, since these countries were often not the final destination for the travelers in question, these airports also had to increase their connections with other central airports in the network.

This was the case for Turkey. Being located between Russia and Europe and also not that far from the Middle Asia and Afrika, Turkish airports initially had a great potential. When Russian airports were excluded from the network Turkey did not cancel their airspace connection, remaining on of the few connection points

between Europe and Asia. Thus, many Turkish airports increased their number of flights not only to Russia but also to the other countries. All of that had an influence on the position of the airports in the network.

This is exactly the case with the Sabiha Gokcen International Airport. After the beginning of the full-scale invasion this airport had more incoming and outcoming flights than in December. Additionally, more short paths were going through this airport in June. And finally, it has increased its connection to some of the other central airports. Thy centrality measures prove that this airport has definitely responded to the changes in the world and became one of the connection points between Europe and Russia.

Of course, Sabiha Gokcen International Airport is far from having critical centrality scores just as some of the biggest and most popular airports in Europe, such as Amsterdam airport, have. However, it is rising importance and popularity also means that there is a greater stress to the operational facility to the airport. An increase in the centrality of the airport means more passengers start using it than it was before. When the airport is not prepared to serve new demand it can face some severe disruptions to its operations, starting with the overcrowded airport, longer ques at the terminals and cancelled flights. Additionally, if the airport is understaffed, it can increase the workload to the workers. The management of the airport should take the respective measures now to prevent the possible issues.

Changes in the centrality does not only affect the airport in question. Such changes have an influence on the whole network too and, thus, must also be taken into consideration. Central nodes in the network may not only have many ties with the other nodes, but also connect some other clusters and far-reaching nodes. In the aviation network such central airports become the main areas to transfer to another flights. If such an airport experiences some issues that result in its exclusion from the network (even temporary), it can influence all other airports too. In other

words, if one critically central airport stops working, it can cause issues to the operation of the other airports. Thus, it is important to be aware of which airports are in the higher risk.

The increase in the betweenness centrality measure for the Sabiha Gokcen International Airport shows that it is more likely to be used as a transferring point for travelers. This means that more passengers rely on the services of these airport to reach to the other places. Thus, the sudden disruption in the operations of this airport can create some additional losses to the network.

This analysis can be further improved by completing the following steps. Firstly, it would be better to use the data with one year difference, i.e. December 2021 and December 2022. This would help to exclude the seasonality from the research. Secondly, the research could be further improved by looking at the scenarios when airports, that became more important to the network after the exclusion of Russia, are omitted. This could further help to determine the consequences of the operational disruption of such airports on the network.

Finally, it would be also useful to extend the research across the whole world. This can capture all the connections between the nodes and show any changes to their centrality. This is important as this research did not include all other flights to or from Russia that happened within the Asia. As the result, the researcher would receive a more accurate centrality measure.

Overall, the following research has depicted the way airlines and airports rerouted their logistics as the result of the war. When military actions occurred, there were no room for a simple route-building procedure. All decisions were mostly based on the overall countries' position on the subject matter and the capacities of its airports.

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APPENDIX

Figure 8. The airport connection before 24 February, 2022.

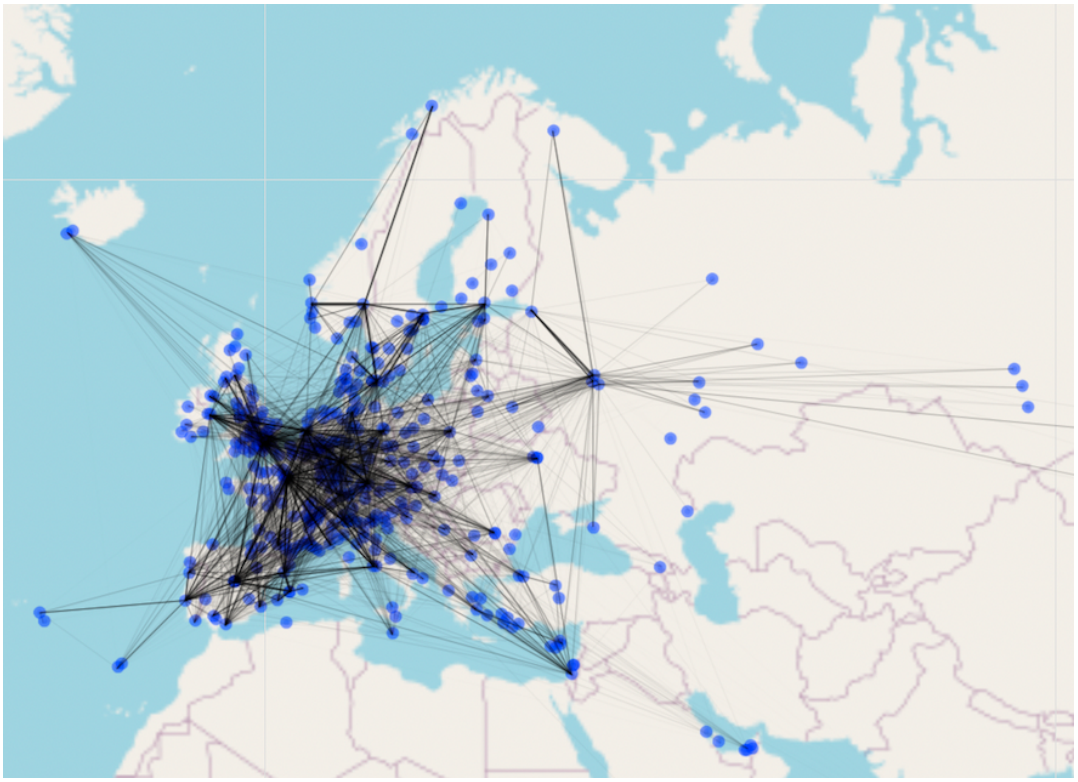

Figure 9. The airport connection after 24 February, 2022.