GEOGRAPHIC DIFFERENCES IN PASSENGER TURNOVER DECLINE AT AIRPORTS AROUND THE WORLD IN 2020 CAUSED BY THE COVID-19 PANDEMIC

Zróżnicowanie geograficzne spadku ruchu pasażerskiego na lotniskach świata w 2020 r. spowodowane pandemią COVID-19

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Abstract: Decline types of passenger turnover of 517 airports worldwide in 2020 compared to 2019, caused by COVID-19, are analyzed. This decay was uneven in space, as well as in individual countries, areas, poles, centers and cores. The strongest decline in 2020 occurred at airports of Europe (especially in the UK, Spain, Germany, and Italy) and Asia (particularly in India and Malaysia), medium – in the countries of America (the USA, Mexico, Brazil) and Norway, moderate – in Russia, weak – in China. 48% of all airports covered by the study showed a strong decline in passenger turnover (from 65 to 85%), 32% – medium (45 to 65%), 10% – moderate (30 to 45%). A catastrophic decline (over 85%) was recorded at 14 airports (2.7%), weak (15-30%) – in 26 (5%), insignificant (3-15%) – in 9 (1.7%). Stagnation (from -3% to + 3%) was noted only in 1 airport, and growth (more than + 3%) – in 3. The largest international airports with a high proportion of international transit passengers and airports with a narrow resort and tourist specialization were most affected by the covid crisis; less – airports with a dominance of domestic traffic. The pandemic has deformed the persistent territorial structure of world air traffic, which has formed over the past 60 years, and also violated the already established hierarchy of the largest and large airports not only around the world, but also within individual mega-regions and countries with big territories and populations.

Key words: COVID-19, air transportation, air passenger flows, airports, passenger turnover, decline dynamics, decline types, Europe, world

Streszczenie: W artykule poddano analizie rodzaje spadków ruchu pasażerów na lotniskach spowodowanych skutkami pandemii COVID-19. Badanie przeprowadzono dla 517 portów lotniczych świata porównując zmiany jakie zaszły 2020 r. w stosunku do poprzedniego 2019 r. Obserwowane było niezwykle nierównomierne rozmieszczenie tego zjawiska w przestrzeni, a także w skali poszczególnych krajów, obszarów, biegunów, centrów i rdzeni. Największy spadek liczby obsługiwanych pasażerów wystąpił w 2020 r. na lotniskach Europy (szczególnie w Wielkiej Brytanii, Hiszpanii, Niemczech i Włoszech) oraz Azji (szczególnie

w Indiach i Malezji). Średnie nasilenie tego procesu wystąpiło w krajach obu Ameryk (USA, Meksyk, Brazylia) oraz w Norwegii. Natomiast w Rosji spadek liczby obsługiwanych pasażerów miał charakter umiarkowany, a w przypadku Chin wręcz słaby. 48% wszystkich portów lotniczych objętych badaniem było dotkniętych silnymi spadkami (od 65 do 85%), 32% – średnimi (od 45 do 65%), 10% – umiarkowanymi (30 do 45%). Katastrofalne zmniejszenie się ruchu pasażerów (ponad 85%) odnotowano na 14 lotniskach (2,7%), słabe (15-30%) – w 26 (5%), nieznaczny (3-15%) – w 9 (1,7%). Brak zmiany (od -3% do +3%) miał miejsce tylko na jednym lotnisku, a wzrost (ponad +3%) – w trzech innych portach lotniczych. Największe międzynarodowe porty lotnicze z wysokim odsetkiem pasażerów w tranzycie międzynarodowym oraz porty lotnicze o wąskiej specjalizacji uzdrowiskowej i turystycznej najbardziej ucierpiały w wyniku kryzysu pandemicznego – mniej natomiast lotniska z przewagą ruchu krajowego. Pandemia zdeformowała stabilną strukturę terytorialną światowego ruchu lotniczego, która ukształtowała się w ciągu ostatnich 60 lat, a także naruszyła ustanowioną już hierarchię największych i większych lotnisk nie tylko na całym świecie, ale także w obrębie poszczególnych megaregionów i krajów z dużymi terytoriami i populacjami.

Słowa kluczowe: COVID-19, transport lotniczy, lotnicze przewozy pasażerskie, lotniska, ruch pasażerów na lotniskach, dynamika spadków, rodzaje spadków, Europa, świat

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Introduction

The COVID-19 pandemic has had a profound impact on the tertiary sector of the economy, especially tourism, hospitality, entertainment, transportation and human mobility.

As a specialist in the geography of transport, it was extremely interesting for me to understand how strong the "blow" of the pandemic on transport turned out to be, how significant was the decline in the volume of traffic for each mode of transport in different countries and macro-regions of the world, in certain regions and loci within countries; what are the geographic differences in this decline for different places, regions and countries, and how this is reflected in the territorial structure of traffic.

Air transport in this respect, unlike other modes of transport, turned out to be in the most advantageous position, since for a number of airports, by the spring of 2021, accurate information on their passenger turnover for the entire 2020 had already been published. Therefore, the author's curiosity was partly satisfied with this information, the analysis of which is presented below.

Global trends

The COVID-19 pandemic has dramatically affected the volume of air passenger traffic: the borders of many countries were closed, strict controls on the movement of people were introduced, which sharply reduced the need for air travel and reduced the level of air human mobility.

The peak of the pandemic in April-May 2020 led to an almost complete cessation of flights, when passenger traffic was reduced to almost zero. In April, the number of flights around the world fell by 80% compared to 2019. More than 40 airlines have completely stopped or suspended flights; some airports were closed, and in the largest, many terminals were closed, and the remaining flights were concentrated in 1-2 terminals.

Almost all scheduled international flights have been discontinued, and several countries have even imposed bans on domestic air travel in an attempt to contain the spread of COVID-19. Thus, this crisis has hit especially hard on international air transportation. It had a much smaller impact on domestic passenger traffic. The recovery seen during the Northern Hemisphere summer season stalled in the fall, and the situation deteriorated sharply towards the end of 2020 holiday season as stricter travel restrictions were imposed due to new outbreaks of the epidemic and the emergence of new strains of COVID-19.

Thus, the coronavirus crisis in 2020 led to a strong reduction in the volume of passenger air transportation, returning the world in terms of their volume to the level of 2002-04, and in a number of countries even by the end of the 1980s. Globally, passenger traffic declined 65.9% in 2020, the steepest decline in civil aviation history[1].

If in 2019 the world civil aviation, according to ICAO, carried 4.5 billion passengers, then in 2020 – only 1.8 billion (Tab. 1), almost reaching the world minimum in 2004 (1.9 billion passengers).

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[1]   According to IATA, the International Air Transport Association, which unites 290 airlines and account for 82% of the world's passenger air passenger traffic.

Tab. 1. Decrease in the volume of passenger air traffic and airline revenues by macro-regions of the world.

Macro-regions of the world	Decrease in 2020 compared to 2019	
	Number of air passengers, million	Airline revenues, billions of dollars
Europe (including Russia, Trans-Caucasia, Turkey)	-770	-100
Central, Southern, Eastern and South-Eastern Asia, Australia and Oceania	-916	-120
Middle East (excluding Egypt and Turkey)	-132	-22
Africa	-78	-14
North America (excluding Mexico and West Indies)	-596	-88
Latin America and West Indies	-198	-26
The whole world	-2,690	-370

Source: https://www.icao.int/sustainability/Documents/COVID-19/ICAO_Coronavirus_Econ_Impact.pdf.

Most of all, due to the covid crisis, the volume of air passenger traffic decreased in the Asia-Pacific region, Europe and North America (Tab. 1); to a lesser extent in Latin America and the West Indies, in the Middle East; the minimum decline was in Africa. That is, the least economically developed countries have not suffered as much as the most developed countries, whose economies are heavily dependent on transport, especially passenger transport.

Dynamics of passenger turnover at airports in a number of countries (comparison of 2019 and 2020 for countries as a whole)

Complete statistics of passenger turnover of airports[2] for all countries in the spring of 2021 (when this article was being written) has not yet been published. Therefore, we can judge about its decline only by a number of countries for which we found it and is presented in Tab. 2.

The largest absolute loss of passenger turnover due to the coronavirus crisis was experienced by the airport systems in Spain (-199.2 million people), Germany (-190.6 million), Italy (-140.2 million), Turkey (-127.5 million), South Korea (-92.6 million), Russia (-91.3 million). In small and medium-sized (in terms of territory) countries, the share of international traffic is high; in large countries, it is high only at the largest airports and is not so significant at other large, medium and small airports.

Analysis of Tab. 2 shows that the relatively low level of decline in passenger turnover was typical for the airports of Russia as a whole (-41.3%) and Kosovo (-53.6%). This means that the duration of the covid lockdown in these countries was not as significant as in others (in addition, in Russia, domestic traffic quickly recovered, primarily in summer to resorts), and therefore the decline is so low. The decline with higher values is typical for South Korea (-58.8%), Turkey (-61.0%), Norway (-62.0%), Ukraine (-64.4%). For these countries, the decline was not so serious due to the large share of domestic traffic (in Turkey – due to tourist traffic through the soft lockdown policy). A strong decline was noted at the airports of Serbia (-68.7%), Poland (-70.5%), North Macedonia (-70.8%) and the Netherlands (-70.9%). For the latter countries, there has always been a significant share of international traffic.

The airports of the Czech Republic, Iceland, Malta, Finland, Great Britain, Denmark, Germany, Italy, Spain, Bosnia and Herzegovina suffered greatly from the lockdown (72-80%). These are countries, on the one hand, small (international traffic dominates here), on the other hand, large, but with a longer lockdown introduced due to a strong outbreak of the pandemic, and stricter quarantine rules, due to which airports were closed for longer periods.

The hardest hit were the airports of those countries where the lockdown was the longest and most severe, and the size of the countries themselves were small, and therefore international passengers strongly dominated in passenger traffic. Such countries with a catastrophic decline include Tunisia (-89.0%; with two resort airports), Georgia (-85.1%), Slovenia (-83.5%), Croatia (-81.1%).

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[2] Passenger turnover of an airport is the total sum of the number of passengers departing from it and arriving at it during the year.

Tab. 2. Decrease in the total passenger turnover of all airports in a number of countries in the world in 2019-2020 due to the COVID-19 pandemic (thousand passengers).

Countries	2019	2020	Decrease [%]	2019/ 2020 (decrease in the number of times)
Tunisia (2 tourist airports)	3,041	335	-88.98	9.08
Georgia	4,310	641	-85.13	6.72
Czech Republic	18,836.3	3,841.1	-84.92	4.90
Slovenia	1,750.2	288.2	-83.53	6.07
Croatia	11,491.7	2,175.4	-81.07	5.28
Montenegro	2,664.6	533.0	-80.00	5.00
Iceland	7,899.2	1,667.5	-78.89	4.74
Germany	248,456.5	57,800	-76.74	4.30
Malta	7,310.3	1,748.1	-76.09	4.18
Finland	26,023.9	6,400.6	-75.40	4.07
United Kingdom	300,477.3	74,608.7	-75.17	4.03
Denmark	30,256.7	7,525.4	-75.13	4.02
Bosnia and Herzegovina	1,919.3	523.2	-72.74	3.67
Italy	193,102.7	52,925.8	-72.59	3.65
Spain	275,247.4	76,064.3	-72.37	3.62
Netherlands	81,167.3	23,585.7	-70.94	3.44
North Macedonia	2,677.6	782.8	-70.76	3.42
Poland	49,083.0	14,486.8	-70.48	3.39
Portugal	59,120	17,960	-69.62	3.29
Hawaii (USA)	39,019.2	12,033.4	-69.16	3.24
Serbia	6,581.9	2,058.3	-68.73	3.20
Ukraine	24,336.6	8,664.5	-64.40	2.81
Norway	54,841.5	20,844.8	-61.99	2.63
Turkey	209,092.5	81,577.0	-60.99	2.56
Korea South (15 airports)	157,671.0	65,027.1	-58.76	2.42
Kosovo	2,373.7	1,102.1	-53.57	2.15
Russia	220,891.2	129,562.8	-41.34	1.70

Countries sorted in descending order of negative growth (in %)

Sources: various.

Methods for measuring the decline in passenger turnover of airports

We now turn to the analysis of the types of decline in passenger turnover at individual airports.

Quantitatively, the decline in passenger turnover of airports can be measured by:
1) the absolute values of the decline (decrease);
2) relative values in % in relation the value in 2020 to the value in 2019;
3) the ratio of passenger turnover values in 2019 to 2020, measured by the number of times; this indicator more prominently reflects the degree of recession than percentages and absolute figures;

4) the time lag of the retro-degression depth (how many years have passed since the passenger turnover in a covid year equaled earlier dates).

We calculated the first three indicators for all airports in the world, for which complete statistics were found (in the tables, the absolute values were removed due to the limitations of the article volume). To calibrate the values of the decline (reduction) in passenger turnover, we used the gradation of decrease of passenger air connectivity at Russian airports in 1990-2006, proposed by us several years ago (Tarkhov, 2015, p. 124; Tarkhov, 2017). There, the types of dynamics of growth and decline in air passenger traffic were empirically identified, presented in Tab. 3 (a column

Tab. 3. Types of dynamics of the volume of air passenger traffic in the conditions of cardinal socio-economic crises.

Types of dynamics	Increase and decrease, limits of variations [%]	Reduction, number of times
Low growth	+15.0 + 29.9	0.81-0.70
Slight growth	+3.0 + 14.9	0.95-0.82
Stagnation (zero growth)	-2.9 + 2.9	0.96-1.02
Slight decline	-3.0 -14.9	1.03-1.16
Low decline	-15.0 -29.9	1.17-1.42
Moderate decline	-30.0 -44.9	1.43-1.80
Medium decline	-45.0 -64.9	1.81-2.85
Strong decline	-65.0 -84.9	2.86-6.6
Catastrophic (drastic) decline	-85.0 -99.9	6.7-29.0
Disappearance of the phenomenon (closure)	-100	…

The second column shows the percentage to the base level of the beginning of decline (growth), the third column – the quotient of dividing the current value (for example, 2020) by the base (pre-covid, i.e. 2019)

Source: Compiled by the author empirically.

has been added with a new indicator – the reduction in traffic, measured by the number of times). The stronger the recession, the more the covid crisis of population amobility influenced the decrease in the passenger turnover of airports.

If you measure the decline in the number of times, then a *low* and *moderate* decline is a decrease in the base level by 1.2-1.8 times, a *medium* decline is 1.81-2.85 times, a *strong* decline is 2.9 or more times (it reached 8-9 times, in rare exceptions – 30 times). In a number of exceptions in 2020, despite a strong decline, there was an increase. These are only a few airports out of the entire sample of almost 500 airports in the world (Gelendzhik and Anapa in Russia, Gorakhpur in India).

Another indicator of decline is the time lag of the *depth of retro-degression* (or retro-recession, i.e., throwback back in time) – the number of years that have passed since the moment when the volume of traffic was approximately equal to the value in the crisis covid year. But, unfortunately, not all airports in the world have annual data on their passenger turnover over the past 25-40 years to determine such a year. Nevertheless, we succeeded in doing this for a number of European, Russian, Chinese and American airports (Tab. 4; only a few examples are left in it).

For some American airports, the lag of the depth of retro-degression can be determined only by historical charts, where there are no exact figures on the value of passenger turnover, and only by the curve

can these years be identified. So, for the New York J.F. Kennedy airport is 1965 (that is, this lag is 55 years), Seattle-Tacoma is 1995 (35 years), Dallas Airport is 1985 (that is, this lag is 35 years), Phoenix 1992 (28 years), Orlando 1993 (27 years). The lag of such a retro-lag for the rest of the airports is shown in Tab. 4.

Thus, this time lag turned out to be the largest (27-55 years) for the biggest airports with a high share of international passengers and transit (New York-Kennedy with a maximum of 55 years, Heathrow, Frankfurt am Main, Hamburg, Paris, Munich, Amsterdam, Brussels, Zurich, Vienna, Geneva), relatively medium (16-26 years) – for medium-sized or large airports with a large share of domestic traffic, relatively short (9-16 years) – for the largest airports in China (with a big share of international passengers – two airports in Shanghai, Beijing and Guangzhou) and Russia with a high share of international passengers, short (4-8 years) – for almost all other airports in China and Russia, very short (2-3 years) – for resort and tourist airports in Russia (Sochi and Kaliningrad – 2 years) and some large airports in China with an increased share of domestic passengers. Seoul Incheon Airport's passenger traffic fell in 2020 even below the level of its first year of operation (2001).

Unfortunately, it is not possible to determine the period of retro-degression at all airports; therefore, the possibilities of using this indicator for geographical comparisons are very limited.

Tab. 4. Time lag of the depth of retro-degression (backward time lag) of the passenger turnover at a number of airports due to the COVID-19 pandemic (passengers).

Airports	Passenger turnover in 2019	Passenger turnover in 2020	Passenger turnover close to 2020 or minimum (year)	Retro-lag (number of years)
London Heathrow	80,884,310	22,109,723	31,675,779 (1986)	Over 40
Frankfurt am Main	70,560,987	18,770,998	17,664,171 (1980)	40
Hamburg	17,308,773	4,557,372	4,558,939 (1980)	40
Geneva	17,926,629	5,600,914	5,150,596 (1985) 5,973,564 (1990)	Over 30
Singapore	68,300,000	11,800,000	11,203,793 (1987) 12,595,286 (1988)	32
Paris Roissy CDG	76,150,007	22,257,469	28,355,470 (1995)	30
Munich	47,959,885	11,120,224	10,485,182 (1989) 11,423,838 (1990)	30
Amsterdam	71,707,144	20,884,510	19,145,064 (1992) 21,274,269 (1993)	27
Vienna	31,662,189	7,813,938	5,928,734 (1990) 9,321,684 (1996)	27
Houston	45,264,059	24,690,222	24,690,166 (1995)	25
Barcelona	52,688,455	12,739,259	11,727,814 (1995) 13,434,679 (1996)	24
Denver	69,015,703	33,741,129	32,296,174 (1996) 34,969,837 (1997)	23
Kuala Lumpur	62,336,469	13,156,000	13,172,635 (1999)	21
Seoul Incheon (opened on 29.03.2001)	71,169,722	12,094,851	14,542,290 (2001)	19
Dubai	86,396,757	17,889,000	15,973,391 (2002) 18,062,344 (2003)	17
Tenerife Norte	5,839,638	2,795,952	2,511,277 (2001) 2,486,227 (2002) 2,919,087 (2003)	17
Beijing Shoudu	100,013,642	34,513,000	34,883,200 (2004)	16
Charlotte Douglas	50,168,783	27,205,082	25,162,943 (2004) 28,206,052 (2005)	15
Shanghai Pudong	76,153,455	30,476,650	28,235,691 (2008) 31,921,009 (2009)	11
Shanghai Hongqiao	45,637,882	31,165,700	25,078,548 (2009) 31,298,812 (2010)	10
Seoul Gimpo	25,448,416	17,446,239	17,565,901 (2010)	10
Busan	16,931,023	7,235,652	6,870,157 (2009) 8,160,546 (2010)	10
Moscow Sheremetyevo	49,438,545	19,566,402	19,123,010 (2010) 22,351,320 (2011)	10
Guangzhou	73,378,475	43,768,100	40,975,673 (2010) 45,040,340 (2011)	9
Saint Petersburg	19,581,262	10,944,421	9,610,767 (2011) 11,154,560 (2012)	8
Shenzhen	52,931,925	37,916,100	36,272,701 (2014) 39,721,619 (2015)	5
Chongqing	44,786,722	31,643,297	30,264,435 (2014) 32,402,096 (2015)	5
Sanya	20,163,655	15,412,000	16,191,930 (2015) 17,369,550 (2016)	4
Novosibirsk	6,571,396	4,531,157	4,097,490 (2016) 5,007,302 (2017)	3
Kaliningrad	2,370,157	2,117,931	2,149,413 (2018)	2
Sochi	6,772,062	6,519,554	6,343,000 (2018)	2

In the fourth column, in parentheses, the year is indicated when its value was approximately equal to the level of 2020 or was the minimum among those available.

Sources: various.

Recession in passenger turnover at the world's largest airports

As a result of the COVID-19 pandemic, the passenger turnover at the world's largest airports in 2020 compared to 2019 decreased by an average of 1.5-4 times (Tab. 5). As can be seen from this table, the decrease in passenger turnover at airports in 2020 due to the reduction in the number of flights and even the complete cessation of air traffic during the first peak of the covid crisis (April-May) was very significant. If you use the proposed above in Tab. 3 typology of the dynamics of decline, the largest world airports were dominated by a *medium* (20 airports or 39%) and a *strong* (17 or 33%) recession; these two types of recession accounted for 72% of all these airports (Tab. 5). A particularly strong decline was typical for the airports of London-Gatwick (78%), Kuala Lumpur (79%), Dubai (79%), Seoul Incheon (83%), Manila (85%); catastrophic decline – for Hong Kong airport (88%). Many the largest in 2019 airports have lost its first positions in the world hierarchy in 2020 due to drastic decrease (Atlanta, Beijing, Chicago, Paris CDG, London Heathrow, Hong Kong).

Tab. 5. Decrease in passenger turnover at a number of the largest airports in the world due to the COVID-19 pandemic (thousand passengers).

Airports	2019	2020	Decrease [%]	2019/ 2020 (decrease in the number of times)
Guangzhou	73,378	43,768	-40.35	1.68
Atlanta Hartsfield-Jackson	110,531	42,919	-61.17	2.58
Chengdu	55,858	40,742	-27.06	1.37
Dallas-Fort-Worth	75,067	39,365	-47.56	1.91
Shenzhen	52,932	37,916	-28.37	1.40
Beijing Shoudu	100,014	34,513	-65.49	2.90
Denver	69,016	33,741	-51.11	2.04
Kunming	48,076	31,989	-33.46	1.50
Chongqing	44,787	31,643	-29.35	1.41
Shanghai Hongqiao	45,638	31,166	-31.71	1.46
Xian	47,221	31,084	-34.17	1.52
Chicago O'Hare	84,649	30,860	-63.54	2.74
Shanghai Pudong	76,153	30,476	-59.98	2.50
Tokyo Haneda	85,505	30,965	-63.79	2.76
Los Angeles	88,068	28,779	-67.32	3.06
Hangzhou	40,108	28,220	-29.64	1.42
Istanbul	68,651	23,409	-65.90	2.93
Paris, Charles de Gaulle (CDG)	76,150	22,257	-70.77	3.42
Mexico	50,308	21,982	-56.30	2.29
London Heathrow	80,888	22,110	-72.66	3.66
Phoenix	46,288	21,929	-52.62	2.11
Orlando	50,613	21,617	-57.29	2.34

Zhengzhou	29,129	21,400	-26.53	1.36
Jeju	31,316	21,055	-32.77	1.49
Amsterdam	71,707	20,884	-70.87	3.43
Jakarta Soekarno-Hatta	54,921	20,545	-62.59	2.67
Sao Paulo Guarulhos	43,002	20,323	-52.74	2.12
Seattle Tacoma	51,829	20,062	-61.29	2.58
Moscow Sheremetyevo	49,438	19,566	-60.42	2.53
Changsha	26,911	19,220	-28.58	1.40
Frankfurt am Main	70,556	18,771	-73.40	3.76
Miami	45,924	18,664	-59.36	2.46
Dubai	86,397	17,889	-79.29	4.83
Seoul Gimpo	25,448	17,446	-31.44	1.46
Istanbul Sabiha Gökçen	35,953	17,206	-52.14	2.09
Madrid	61,734	17,112	-72.28	3.61
Fort Lauderdale	36,748	16,484	-55.14	2.23
Moscow Domodedovo	28,252	16,389	-41.99	1.72
Minneapolis St Paul	39,555	14,851	-62.45	2.66
Detroit	36,769	14,105	-61.64	2.61
Toronto	50,499	13,307	-73.65	3.79
Kuala Lumpur	62,326	13,156	-78.89	4.74
Barcelona	52,686	12,739	-75.82	4.14
Boston	42,588	12,618	-70.37	3.37
Salt Lake City	26,808	12,559	-53.15	2.13
Cancun	25,482	12,259	-51.89	2.08
Seoul Incheon	71,170	12,050	-83.07	5.91
Tokyo Narita	44,344	10,486	-76.35	4.23
London Gatwick	46,568	10,165	-78.17	4.58
Hong Kong	71,415	8,835	-87.63	8.08
Manila	47,898	7,276	-84.81	6.58

Airports are sorted in descending order of passenger turnover in 2020.

Sources: https://asia.nikkei.com/Business/Transportation/China-s-Guangzhou-airport-crowns-itself-the-world-s-busiest-for-2020

https://www.flightglobal.com/networks/traffic-data-shows-how-pandemic-upset-traditional-hub-dominance-in-2020/142153. article?fbclid=IwAR3WVmHGsOIXMkCBHqg8Kxywj7P1VZelLne_fpiKzBLUrANDbbuQneTvL50 and other various

Decline in passenger turnover at airports in selected countries

 To analyze the dynamics of the annual passenger turnover of airports in the world for 2019-2020, according to various sources, it was possible to collect information on more than 500 airports (Tab. 9 in Conclusions).

The largest decline in passenger traffic in 2020 was typical for the largest, large and medium-sized airports in Europe, as well as Singapore; smaller – for countries where the pandemic began to spread a little later than in Europe (Brazil, Peru), or the lockdown was introduced too late, or its terms were reduced for a number of reasons (including economic, opportunistic political), and therefore the number of months with a large fall was not the same as in Europe.

In Russia, the reduction in the size of airport's passenger turnover was much smaller than in European countries, which was due to the official termination of the lockdown on July 1, 2020 and not its introduction in late autumn and December of the same year. In China, it was even smaller compared to Russia, judging by the small number of airports for which statistics were published in January 2021, but there the decline peaked in January-February, and not in March-April, as in the rest countries of the world.

Due to the size limitations of the article, we will briefly consider only the decline in passenger turnover at airports in Europe, and, unfortunately, there is no room for other countries in it.

Airports in Europe have been hit harder by the COVID-19 pandemic than airports in other parts of the world, with their largest decline in passenger turnover. The passenger turnover decreased especially sharply at the largest European airports (Tab. 6).

Tab. 6. Decrease in passenger turnover (thousand passengers) at the largest airports in Europe due to the COVID-19 pandemic (more than 10 million passengers).

Airports	2019	2020	Decrease [%]	2019/ 2020 (decrease in the number of times)
Istanbul	68,651	23,409	-65.90	2.93
Paris Charles de Gaulle	76,150	22,257	-70.77	3.42
London Heathrow	80,888	22,110	-72.66	3.66
Amsterdam Schiphol	71,707	20,884	-70.87	3.43
Moscow Sheremetyevo	49,438	19,566	-60.42	2.53
Frankfurt am Main	70,556	18,771	-73.40	3.76
Madrid Barajas	61,734	17,112	-72.28	3.61
Moscow Domodedovo	28,252	16,389	-41.99	1.72
Barcelona	52,686	12,739	-75.82	4.14
Moscow Vnukovo	24,001	12,565	-47.65	1.91
Munich	47,960	11,120	-76.81	4.31
Paris Orly	31,853	10,797	-66.10	2.95
London Gatwick	46,568	10,165	-78.17	4.58

Airports are sorted in descending order of passenger traffic in 2020.

Sources: https://www.bloomberg.com/news/articles/2021-01-18/heathrow-loses-european-airport-crown-in-pandemic-year?srnd=premium-europe and others.

Among the largest European airports, passenger turnover decreased the most in London Gatwick (78%), Munich (77%), Barcelona (76%), Frankfurt am Main (73%), London Heathrow (73%). Istanbul Airport in 2020 has become the largest airport in Europe, ahead of London Heathrow, Paris Charles de Gaulle, Amsterdam, Frankfurt am Main.

Table 7 collected the statistical data found by the author from various sources on the dynamics of passenger turnover at almost all European airports of more than 400 thousand passengers in 2019, with the exception of a number of countries (Portugal, Moldova, most airports in France, Ireland, Romania and a number of others, they are still absent).

Tab. 7. Decline in the annual passenger turnover at European airports in 2020 due to the COVID-19 pandemic (number of passengers)

Airports	2019	2020	Decrease, %	2019/ 2020 (decrease in the number of times)
Albania				
Tirana	3,338,147	1,310,614	-60.74	2.55
Austria				
Vienna	31,662,189	7,813,938	-75.32	4.05
Salzburg	1,717,991	669,790	-61.01	2.56
Innsbruck	1,144,471	487,450	-57.41	2.35
Graz	1,036,929	199,490	-80.76	5.20
Belarus				
Minsk	5,101,766	1,939,192	-61.99	2.63
Belgium				
Brussels Zaventem	26,360,003	6,743,395	-74.42	3.91
Brussels South Charleroi	8,221,450	2,558,046	-68.89	3.21
Bosnia and Herzegovina				
Sarajevo	1,143,680	249,642	-78.17	4.58
Tuzla	593,083	228,425	-61.49	2.60
Bulgaria				
Sofia	7,107,096	2,937,846	-58.66	2.42
Burgas	2,885,776	424,252	-85.30	6.80
Varna	2,084,319	622,215	-70.15	3.35
Croatia	11,491,642	2,175,381	-81.07	5.28
Zagreb	3,435,531	924,823	-73.08	3.71
Split	3,301,930	674,366	-79.58	4.90
Dubrovnik	2,896,227	330,147	-88.60	8.77
Zadar	801,347	120,747	-84.93	6.64
Pula	777,568	83,507	-89.26	9.31
Czech Republic				
Prague	17,804,900	3,665,871	-79.41	4.86
Brno	543,633	86,089	-84.16	6.31
Denmark				
København (Copenhagen)	30,256,407	7,525,441	-75.13	4.02
Billund	3,739,267	934,706	-75.00	4.00

Aalborg	1,446,294	513,852	-64.47	2.81
Arhus	500,365	120,063	-76.00	4.17
Vágar (Faroe Islands)	424,281	179,778	-57.63	2.36
Estonia				
Tallinn	3,267,909	863,585	-73.57	3.78
Finland				
Helsinki	21,861,082	5,053,134	-76.89	4.33
Oulu	1,057,355	312,892	-70.41	3.38
Rovaniemi	661,124	268,122	-59.44	2.47
Turku	452,927	112,585	-75.14	4.02
France				
Paris Roissy Charles de Gaulle (CDG)	76,150,007	22,257,469	-70.77	3.42
Paris Orly	31,853,049	10,797,105	-66.10	2.95
Lyon Saint-Exupéry	11,739,600	3,542,357	-69.83	3.31
Nice	14,485,423	4,580,000	-68.38	3.16
EuroAirport Basel Mulhouse Freiburg	9,090,125	2,598,980	-71.41	3.50
Bordeaux-Mérignac	7,703,143	2,253,406	-70.75	3.42
Toulouse-Blagnac	9,597,311	3,124,663	-67.44	3.07
Nantes	7,227,411	2,327,718	-67.79	3.10
Paris-Beauvais	3,982,464	1,258,180	-68.41	3.16
Germany				
Frankfurt am Main	70,560,987	18,770,998	-73.40	3.76
Munich	47,959,885	11,120,224	-76.81	4.31
Berlin (Tegel + Schönefeld; since 31.10.2020 – Berlin Brandenburg)	35,645,005	9,097,788	-74.48	3.92
Berlin Tegel	24,227,570	5,867,601	-75.78	4.13
Berlin Brandenburg (Schönefeld)	11,417,435	3,223,603	-71.77	3.54
Düsseldorf	25,507,566	6,569,728	-74.24	3.88
Hamburg	17,308,773	4,557,372	-73.67	3.80
Cologne/ Bonn	12,368,519	3,076,587	-76.86	4.02
Stuttgart	12,732,670	3,213,695	-74.76	3.96
Hannover	6,324,634	1,452,361	-77.04	4.35
Nuremberg	4,111,689	911,197	-77.84	4.51
Dortmund	2,719,566	1,220,624	-55.12	2.23
Bremen	2,308,338	594,680	-74.24	3.88
Leipzig/ Halle	2,615,801	530,221	-79.73	4.93
Dortmund	2,719,566	1,220,624	-55.12	2.23
Dresden	1,595,765	383,568	-75.96	4.16
Frankfurt-Hahn	1,496,362	436,862	-70.80	3.42
Karlsruhe/ Baden-Baden	1,335,957	391,696	-70.68	3.41
Memmingen (Bavaria)	1,722,764	690,780	-59.90	2.49

Weeze	1,231,100	275,220	-77.64	4.47
Münster/ Osnabrück	986,260	220,381	-77.65	4.47
Paderborn	693,404	92,547	-86.65	7.49
Friedrichshafen	489,921	119,040	-75.70	4.12
Greece				
Athens	25,574,030	8,078,383	-68.41	3.17
Thessaloniki	6,897,057	2,317,336	-66.40	2.98
Heraklion	7,933,558	2,378,145	-70.02	3.34
Rhodes	5,542,567	1,551,123	-72.01	3.57
Corfu	3,275,897	961,037	-70.66	3.41
Chania	2,983,542	703,482	-76.42	4.24
Kos	2,676,644	800,655	-70.09	3.34
Santorini	2,300,408	572,963	-75.09	4.01
Zakynthos	1,810,427	430,255	-76.23	4.21
Mykonos	1,520,145	409,060	-73.09	3.72
Cephalonia	774,170	192,477	-75.14	4.02
Aktion / Preveza	625,790	161,408	-74.21	3.88
Skiathos	446,219	88,916	-80.07	5.02
Mytilene	496,577	206,095	-58.50	2.41
Samos	467,395	144,299	-69.13	3.24
Hungary				
Budapest	16,173,489	3,859,379	-76.14	4.19
Iceland	7,899,205	1,667,514	-78.89	4.74
Keflavík	7,247,820	1,373,971	-81.04	5.27
Ireland				
Dublin	32,907,673	7,267,240	-77.92	4.53
Cork	2,585,466	530,000	-79.50	4.88
Shannon	1,710,000	360,000	-78.95	4.75
Italy				
Rome Leonardo da Vinci-Fiumicino	43,532,573	9,830,957	-77.42	4.43
Milan Malpensa	28,846,299	7,241,766	-74.90	3.98
Orio al Serio (Bergamo)	13,857,257	3,833,063	-72.34	3.62
Catania	10,223,113	3,654,457	-64.25	2.80
Venice Marco Polo	11,561,594	2,799,688	-75.78	4.13
Naples	10,860,068	2,779,946	-74.40	3.91
Palermo	7,018,087	2,701,519	-61.51	2.60
Bologna	9,405,920	2,506,258	-73.35	3.75
Milan Linate	6,570,984	2,274,202	-65.39	2.89
Cagliari	4,747,806	1,767,890	-62.76	2.69
Bari	5,545,588	1,703,130	-69.29	3.26

Rome Ciampino	5,879,496	1,621,159	-72.43	3.63
Turin	3,952,158	1,407,375	-64.39	2.81
Pisa	5,387,558	1,315,066	-75.59	4.10
Verona	3,638,088	1,040,555	-71.40	3.50
Olbia (Sardinia)	2,978,769	1,023,964	-65.62	2.91
Brindisi	2,697,749	1,016,571	-62.32	2.65
Lamezia Terme	2,978,110	961,718	-67.71	3.10
Florence	2,874,233	669,487	-76.71	4.29
Alghero (Sardinia)	1,390,379	536,716	-61.40	2.59
Treviso	3,254,731	463,679	-85.75	7.02
Genoa	1,536,136	397,191	-74.14	3.87
Trieste	783,179	209,115	-73.30	3.75
Pescara	703,386	173,156	-75.38	4.06
Ancona	489,835	150,678	-69.24	3.25
Trapani (Sicily)	411,437	185,581	-54.89	2.22
Kosovo				
Pristina	2,373,698	1,102,091	-53.57	2.15
Latvia				
Riga	7,798,394	2,011,155	-74.21	3.88
Lithuania				
Vilnius	5,004,921	1,312,468	-73.78	3.81
Kaunas	1,160,682	369,000	-68.21	3.14
Luxembourg	4,416,038	1,446,354	-67.25	3.05
Malta	7,310,289	1,748,050	-76.09	4.18
Montenegro				
Tivat	1,367,282	189,815	-86.12	7.20
Podgorica	1,297,365	343,187	-73.55	3.78
Netherlands				
Amsterdam Schiphol	71,679,729	20,884,510	-70.86	3.43
Eindhoven	6,780,775	2,112,785	-68.84	3.21
Rotterdam The Hague	2,094,798	489,840	-76.62	4.28
Maastricht Aachen	435,977	81,080	-81.40	5.38
North Macedonia				
Skopje	2,358,548	710,711	-69.87	3.32
Norway				
Oslo Gardermoen	28,592,619	9,021,729	-68.45	3.17
Bergen	6,505,827	2,711,276	-58.33	2.40
Trondheim	4,381,921	1,802,826	-58.86	2.43
Stavanger	4,309,723	1,674,900	-61.14	2.57
Tromsø	2,370,565	1,270,337	-46.41	1.87

Bodø	1,872,649	985,014	-47.40	1.90
Oslo Sandefjord	2,073,228	650,376	-68.63	3.19
Ålesund	1,147,666	452,242	-60.59	2.54
Harstad/ Narvik	767,812	396,716	-48.33	1.93
Kristiansand	1,064,387	384,599	-63.87	2.77
Haugesund	583,935	237,459	-59.33	2.46
Molde	431,668	184,210	-57.33	2.34
Poland				
Warsaw Chopin	18,824,300	5,476,000	-70.91	3.44
Kraków	8,410,876	2,593,169	-69.17	3.24
Warsaw Modlin	3,105,576	872,059	-71.92	3.56
Gdańsk Lech Wałęsa	5,375,326	1,711,263	-68.16	3.14
Katowice	4,843,889	1,445,781	-70.15	3.35
Wrocław	3,548,921	1,007,323	-71.62	3.52
Poznań	2,379,635	640,376	-73.09	3.72
Rzeszów	772,238	235,190	-69.54	3.28
Szczecin	576,037	98,300	-82.94	5.86
Bydgoszcz	425,230	127,820	-69.94	3.33
Romania				
Bucharest Henri Coandă	14,824,830	4,456,577	-69.94	3.33
Serbia				
Belgrade	6,159,000	1,904,025	-69.08	3.23
Niš	422,255	154,233	-63.47	2.74
Slovakia				
Bratislava	2,290,242	405,097	-82.31	5.65
Košice	555,325	96,428	-82.64	5.76
Slovenia				
Ljubljana	1,721,355	288,235	-83.26	5.97
Spain				
Madrid	61,734,944	17,112,389	-72.28	3.61
Barcelona	52,688,455	12,739,259	-75.82	4.13
Palma De Mallorca	29,721,142	6,108,486	-79.45	4.87
Málaga-Costa Del Sol	19,858,656	5,161,636	-74.00	3.85
Gran Canaria	13,261,228	5,134,372	-61.28	2.58
Alicante-Elche	15,048,240	3,739,499	-75.15	4.02
Tenerife Sur	11,168,707	3,392,329	-69.63	3.29
Tenerife Norte	5,839,638	2,795,952	-52.12	2.09
Lanzarote	7,293,087	2,538,338	-65.19	2.87
Valencia	8,539,579	2,487,496	-70.87	3.43
Sevilla	7,544,357	2,315,610	-69.31	3.26

Fuerteventura	5,635,417	2,144,178	-61.95	2.63
Ibiza	8,155,626	2,110,348	-74.12	3.86
Bilbao	5,905,820	1,690,011	-71.38	3.49
Menorca	3,495,025	1,076,952	-69.19	3.24
Santiago de Compostela	2,904,102	935,394	-67.79	3.10
La Palma	1,483,778	721,337	-51.38	2.06
Asturias (Avilés)	1,417,912	498,950	-64.81	2.84
A Coruňa	1,352,584	436,775	-67.71	3.10
Granada-Jaén	1,252,019	390,218	-68.83	3.21
Santander	1,174,999	335,280	-71.47	3.50
Vigo	1,012,447	303,466	-70.03	3.34
Murcia	1,090,712	217,912	-80.02	5.01
Jerez de la Frontera	1,121,164	216,319	-80.71	5.18
Almeria	979,406	200,302	-79.55	4.89
Melilla	434,656	195,636	-54.99	2.22
Zaragoza	467,783	172,344	-63.16	2.71
Girona	1,933,049	172,213	-91.09	11.22
Reus	1,046,249	39.460	-96.23	26.51
Sweden				
Stockholm Arlanda	25,642,703	6,535,776	-74.51	3.92
Göteborg Landvetter	6,671,361	1,576,787	-76.36	4.23
Stockholm Skavsta	2,296,310	573,229	-75.04	4.01
Malmö	1,975,842	526,514	-73.35	3.75
Bromma Stockholm	2,354,051	479,400	-79.63	4.91
Luleå	1,162,424	420,231	-63.85	2.77
Umeå	960,284	292,731	-69.52	3.28
Åre Östersund	473,628	140,586	-70.32	3.37
Visby	446,864	122,744	-72.53	3.64
Switzerland				
Zurich	31,507,692	8,341,047	-73.53	3.78
Geneva	17,926,629	5,600,914	-68.76	3.20
Turkey				
Istanbul total (in 2019 including the last 3 months of operation of Atatürk Airport)	52,578,008 + 16,072,534 = 68,650,542	23,409,132	-65.90	2.93
Istanbul new (opened on October 29, 2018)	52,578,008	23,409,132	-55.48	2.25
Istanbul Atatürk (closed on 6.04.2019)	16,072,534	-	-	-
Ukraine				
Kyiv Borispol	15,260,281	5,157,548	-66.20	2.96
Kyiv Zhulyany (Sikorsky)	2,617,900	704,500	-73.09	3.72

L'viv	2,217,790	877,700	-60.42	2.53
Odesa	1,694,022	698,700	-58.75	2.42
Khar'kiv	1,340,800	659,300	-50.83	2.03
Zaporizhzhya	434,063	326,217	-24.84	1.33
United Kingdom				
London Heathrow	80,890,031	22,111,326	-72.66	3.66
London Gatwick	46,576,473	10,173,431	-78.16	4.58
London Stansted	28,124,292	7,539,689	-73.19	3.73
Manchester	29,397,357	7,034,856	-76.07	4.18
London Luton	18,216,207	5,550,821	-69.53	3.28
Edinburgh	14,737,497	3,474,879	-76.42	4.24
Birmingham	12,650,607	2,869,582	-77.32	4.41
Bristol	8,964,242	2,194,524	-75.52	4.08
Glasgow	8,847,100	1,946,474	-78.00	4.54
Belfast International	6,278,563	1,747,086	-72.17	3.59
Liverpool	5,045,991	1,338,415	-73.48	3.77
Newcastle	5,203,624	1,064,274	-79.55	4.89
Aberdeen	2,912,883	994,077	-65.87	2.93
London City	5,122,271	908,105	-82.27	5.64
East Midlands (Nottingham)	4,675,411	901,237	-80.72	5.19
Leeds Bradford	3,992,862	751,091	-81.19	5.32
Belfast City	2,455,259	542,547	-77.90	4.52
Jersey	1,762,949	424,922	-75.90	4.15
London Southend	2,035,535	401,143	-80.29	5.07
Doncaster Sheffield	1,407,862	338,829	-75.93	4.15
Southampton	1,781,457	296,161	-83.38	6.01
Inverness	938,232	241,167	-74.30	3.89
Cardiff	1,656,085	219,984	-86.72	7.53
Guernsey	882,374	188,607	-78.63	4.68
Bournemouth	803,307	175,907	-78.10	4.57
Isle of Man	854,676	162,898	-80.94	5.25
Exeter	1,021,784	148,251	-85.49	6.89
Norwich	530,328	120,258	-77.32	4.41
Glasgow Prestwick	640,055	90,790	-85.81	7.05
Newquay	461,478	67,877	-85.29	6.80

Airports are sorted alphabetically by country, within each country – in descending order (airports with a passenger turnover of less than 400 thousand passengers in 2019 are excluded from the table)

Sources: see the list of references.

A significant decline was typical not only for the largest, but also for some airports serving regional (Graz, Nottingham, Leeds, Cardiff, Southampton) and local centers (Exeter, Newquay, Paderborn), as well as small airports in large air hubs, in which the main airport „suppressed" them (for example, Girona near Barcelona; London City and London Southend near other major London airports, Glasgow-Prestwick near Glasgow airport); or a significant number of flights from small airports in this hub were discontinued despite the fact that flights to the same cities were operated from the main airport (for example, Reus near Barcelona).

The degree of decline in passenger turnover was not so significant for small airports and those airports where other types of land transport are either poorly developed or absent altogether, or they are very far from the main development area with a relatively dense population density. Thus, airports located on remote islands or very far from economically developed territories have not lost so many passengers (for example, Vágar in the Faroe Islands, Bornholm, airports in Sicily and Sardinia in Italy). In Iceland, the passenger turnover was greatly reduced only at the main international airport Keflavik (as at almost all international airports), while at the local airports it is not so significant (Reykjavik, Akureyri).

A number of tourist airports went through the covid crisis relatively mildly (Gran Canaria, Tenerife Norte, Lanzarote, Fuerteventura in Canary Islands), others, on the contrary, suffered very much from it (Tivat in Montenegro, Dubrovnik and Pula in Croatia, Girona-Costa Brava in Spain).

Due to the limitations of the size of the article, here we give very brief estimates of the decline only for a number of European countries with a large number of airports.

Germany. A catastrophic decline in passenger turnover was noted at Paderborn airport (87%); a very strong decline at the airports of Leipzig-Halle (80%), Münster and Nuremberg (78%), Cologne-Bonn, Munich and Hanover (77%). The smallest decline was observed at Memmingen (low-cost airlines' airport near Munich; 60%) and Dortmund (55%).

United Kingdom. Despite a significant share of international passengers, the country's largest airport, London Heathrow, lost only 73% of passengers. The airports of Cardiff (87%), Glasgow-Prestwick (86%), Exeter (85%), Southampton (83%), London City (83%), Leeds (81%), Nottingham (81%) lost significantly more. The least affected by the pandemic was Aberdeen airport (passenger traffic decreased by 66%).

Spain. The maximum decline was recorded at the airports of Reus (96%) and Girona (91%), a strong decline – at Jerez de la Frontera (81%), Murcia (80%),

Almeria (80%), Palma de Mallorca (79%) and Barcelona (76%). The smallest decline was typical for the airports of Gran Canaria (61%), Melilla (55%), Tenerife Norte (52%), La Palma (51%).

In Italy, the passenger turnover of airports decreased by 63-80% (at the airports of Rimini and Treviso by more than 80%). The biggest decline after Treviso was at the airports of Rome Fiumicino (77%), Florence (77%), Venice (76%), Pisa (76%), Milan-Malpensa (76%). However, at the airports farthest from the center and north of the country located in the west of Sicily and Sardinia (Trapani, Palermo, Alghero), it decreased much less (55-61%), and at the airport on the small island of Lampedusa, very slightly (36%; not included in Tab. 7, since it had less than 400 thousand passengers).

There is still no complete statistical information for all airports in France. The available data show that the decline rate varies from 68% to 71%. The latter figure was noted at the airports of Paris Charles de Gaulle, EuroAirport, Bordeaux.

In Greece, airports were the hardest hit by the pandemic, with the largest share of international tourists in their passenger traffic (Chania and Zakynthos – 76%, Santorini and Kefalonia – 75%, Mykonos – 73%, Rhodes – 72%). Skiathos airport had the maximum decline (80%). Athens and Thessaloniki, the country's largest airports, lost 66-68% of their passenger traffic. Some airports in the small islands of the Aegean archipelago, far removed from mainland (Mytilene, Naxos, Milos, Lemnos, Chios), also lost fewer passengers than other large tourist airports in this country.

Most airports in Norway are characterized by a not so significant reduction in their passenger turnover (by 35-60%), but for both Oslo ones – much more (68-69%). In the southern, most developed part of the country, the passenger turnover of airports has decreased by 61-70%. The further north the airport was from Oslo, the lower was the decline in its passenger turnover (reaching a reduction of only -25-28%). This is due to the fact that in the central and northern parts of the country, air transport remains almost the only quick means of communication, although there is a network of good roads, and most cities have seaports. The exception here is the main airport of Svalbard (-63%).

In Finland, the decline in passenger turnover is higher at the airports of the largest cities in the south (62-83%), while at the airports in the north, it is much lower (38-60%), as well as at the northern airports in Norway. At the same time, the largest reduction in passenger turnover is typical for those southern Finnish airports, which are at the same time important railway and road junctions in this most populated part of the country. The decline at Helsinki Airport was 77%, Turku 75% and northern Rovaniemi only 59%.

For <u>Swedish</u> airports, the drop was mostly 67-80%, with only the northern airports Kiruna (59%) and Luleå (64%) being an exception. The largest decline was typical for the three airports of Stockholm: Bromma (80%), Skavsta (76%), Arlanda (75%).

<u>Poland.</u> Most of all, the decrease in passenger turnover covers the airports of Szczecin (83%), Poznan (72%), Wroclaw (72%), Warsaw Modlin (72%), Warsaw Chopin (71%).

Tab. 8. The number of airports (with a passenger turnover of more than 400 thousand people in 2019) by European countries in different groups of the decline in passenger turnover caused by the COVID-19 pandemic.

Country / Decline Rate	Stagnation	Slight decline	Low decline	Moderate decline	Medium decline	Strong decline	Catastrophic decline	Closure	Total
Limits of variations, %%	+3.0 -3.0%	-3.0 -14.9%	-15.0 -29.9%	-30.0 -44.9%	-45.0 -64.9%	-65.0 -84.9%	-85.0 -99.9%	-100%	
Albania	-	-	-	-	1	-	-	-	1
Austria	-	-	-	-	2	2	-	-	4
Belarus	-	-	-	-	1	-	-	-	1
Belgium	-	-	-	-	-	2	-	-	2
Bosnia and Herzegovina	-	-	-	-	1	1		-	2
Bulgaria	-	-	-	-	1	1	1	-	3
Croatia	-	-	-	-	-	3	2	-	5
Czechia	-	-	-	-	-	2	-	-	2
Estonia	-	-	-	-	-	1	-	-	1
Finland	-	-	-	-	1	3	-	-	4
France	-	-	-	-	-	9	-	-	9
Denmark	-	-	-	-	2	3	-	-	5
Germany	-	-	-	-	3	18	1	-	22
Greece	-	-	-	-	1	14	-	-	15
Hungary	-	-	-	-	-	1	-	-	1
Iceland	-	-	-	-	-	1	-	-	1
Ireland	-	-	-	-	-	3	-	-	3
Italy	-	-	-	-	7	18	1	-	26
Kosovo	-	-	-	-	1	-	-	-	1
Latvia	-	-	-	-	-	1	-	-	1
Lithuania	-	-	-	-	-	2	-	-	2
Luxembourg	-	-	-	-	-	1	-	-	1
Malta	-	-	-	-	-	1	-	-	1
Montenegro	-	-	-	-	-	1	1	-	2
Netherlands	-	-	-	-	-	4	-	-	4
North Macedonia	-	-	-	-	-	1	-	-	1
Norway	-	-	-	-	10	2	-	-	12
Poland	-	-	-	-	-	10	-	-	10
Romania	-	-	-	-	-	1	-	-	1
Serbia	-	-	-	-	1	1	-	-	2
Slovakia	-	-	-	-	-	2	-	-	2
Slovenia	-	-	-	-	-	1	-	-	1
Spain	-	-	-	-	7	20	2	-	29
Sweden	-	-	-	-	1	8	-	-	9
Switzerland	-	-	-	-	-	2	-	-	2
Turkey	-	-	-	-	-	1	-	1	2
Ukraine	-	-	1	3	2	-	-	-	6
United Kingdom	-	-	-	-	-	26	4	-	30
Total	**-**	**-**	**1**	**3**	**42**	**167**	**12**	**1**	**226**

The distribution of the number of European airports by country by type of decline is shown in Tab. 8.

Thus, airports with a *strong decline* (65-85%) dominated in Europe – there were 167 out of 226, that is, 74%. Another 42 (i.e. 19%) airports had *medium* decline. Norway stands out, with 10 of the 12 airports having the medium decline. In Italy and Spain, the 7 airports in each also experienced a medium decline. There are almost no cases of low and slight recession in Europe, with the exception of Zaporozhye (Zaporizhzhya) airport (low decline).

In Ukraine, the decline was not so significant (with the exception of both Kiev airports) – 4 out of 6 airports had a moderate and low decline, which was not observed in the rest of Europe.

A catastrophic decline (over 85%) was recorded at 12 European airports (out of 226), including 4 British (Cardiff, Exeter, Glasgow-Prestwick, Newquay), 2 Spanish (Reus, Girona) and 2 Croatian (Pula, Dubrovnik), as well as German Paderborn, Montenegrin Tivat and Italian Treviso. Reus (96%), Girona (91%), Pula (89%), Dubrovnik (89%), Paderborn (87%) and Cardiff (87%) had the maximum catastrophic decline.

Thus, the passenger turnover of 83% of large European airports experienced a strong to medium decline as a result of the impact of the pandemic.

Conclusions

Table 9 (in it, in addition to the airports of European countries, the airports of Russia, some countries of Asia, Africa and America are added) shows that the largest decline in passenger turnover in 2020 occurred at the airports of European countries (especially in the UK, Spain, Germany and Italy), Asia (especially in India and Malaysia); medium – in the countries of America (USA, Mexico, Brazil) and Norway; moderate – in Russia; low – in China.

Tab. 9. The number of airports (with a passenger turnover of more than 400 thousand people in 2019) for a number of countries in different groups of the decline in passenger turnover caused by the COVID-19 pandemic.

Country / Decline Rate	Growth	Stagnation	Slight decline	Low decline	Moderate decline	Medium decline	Strong decline	Catastrophic decline	Closure	Total
Limits of variations, %%	over +3%	+3.0 -3.0%	-3.0 -14.9%	-15.0 -29.9%	-30.0 -44.9%	-45.0 -64.9%	-65.0 -84.9%	-85.0 -99.9%	-100%	
Europe (excluding Russia)	-	-	-	1	3	42	**167**	12	1	226
United Kingdom	-	-	-	-	-	-	**26**	4	-	30
Spain	-	-	-	-	-	7	**20**	2	-	29
Italy	-	-	-	-	-	7	**18**	1	-	26
Germany	-	-	-	-	-	3	**18**	1	-	22
Greece	-	-	-	-	-	1	**14**	-	-	15
Norway	-	-	-	-	-	**10**	2	-	-	12
Poland	-	-	-	-	-	-	**10**	-	-	10
France	-	-	-	-	-	-	**9**	-	-	9
Sweden	-	-	-	-	-	1	**8**	-	-	9
Russia	2	-	7	**10**	27	8	-	-	-	54
Asia	1	1	2	13	14	**29**	38	1	-	99
India	1	-	-	2	4	**20**	23	-	-	50
China	-	-	1	**10**	6	1	1	-	-	19
Malaysia	-	-	-	-	1	3	11	-	-	15
South Korea	-	1	1	1	3	2	1	1	-	10
Japan	-	-	-	-	-	3	2	-	-	5

America	-	-	-	2	5	**81**	35	-	-	123
USA	-	-	-	1	1	**51**	15	-	-	68
Brazil	-	-	-	-	1	**14**	2	-	-	17
Mexico	-	-	-	1	3	**13**	**-**	-	-	17
Argentine	-	-	-	-	-	-	**14**	-	-	14
Canada	-	-	-	-	-	3	3	-	-	6
Peru	-	-	-	-	-	-	1	-	-	1
Australia	-	-	-	-	-	1	-	-	-	1
New Zealand	-	-	-	-	-	1	-	-	-	1
Africa	-	-	-	-	1	3	8	1	-	13
Morocco	-	-	-	-	-	2	6	-	-	8
Ghana	-	-	-	-	1	1	-	-	-	2
Namibia	-	-	-	-	-	-	2	-	-	2
Kenya	-	-	-	-	-	-	-	1	-	1
Total	3	1	9	26	50	**165**	**248**	14	1	517
%%	0.6%	0	1.7%	5.0%	9.7%	**31.9%**	**48.0%**	2.7%	0	100
Major airports in the world	-	-	-	6	7	**20**	**17**	1	-	51

In Europe, Russia, India, all airports with a passenger turnover of more than 400 thousand passengers in 2019 are taken into account (for India – in fiscal 2019-20); Mexico – more than 1 million passengers; in the USA – more than 1 million passengers and only those for which data were available for 2020.

Of the 517 airports in the world for which there was statistical information on their passenger turnover for 2019 and 2020, 48% had a **strong** decline and 32% - **medium**, 10% - *moderate*. A *catastrophic* decline was recorded in 14 airports (2.7%), *low* – in 26 (5%), slight – in 9 (1.7%). Stagnation was noted only at 1 airport, and growth – at 3 (Anapa, Gelendzhik, Gorakhpur).

The decline and recovery in airport passenger turnover directly depended on the duration of lockdowns and repeated outbreaks of COVID-19 infection, the introduction of entry bans or the lifting of travel restrictions to certain areas, foci and countries.

The largest decrease was observed in the passenger turnover of the largest airports with a high share of international traffic (Paris Roissy-Charles de Gaulle, London Heathrow, San Francisco, Shanghai Pudong, Beijing Capital, Frankfurt am Main), to a lesser extent – airports with a low their shares.

The passenger turnover of the airports serving sea resorts and narrowly specialized tourist centers and areas (with the exception of a number of them: Antalya, Sanya, Simferopol, etc.) has significantly decreased.

Domestic airports have not been as badly affected, with the exception of centers with repeated outbreaks.

On the contrary, at many airports in the second half of 2020, passenger traffic began to increase due to the revitalization of domestic flights.

Medium and small airports in very remote areas (for example, the Far North), as well as a number of small airports located in cities with an unfavorable transport and geographical position (far from the main economic cores and centers), have not lost so many passengers in comparison with the airports of the developed ones and inhabited territories.

Some airports in China, Russia and Turkey, where quarantines were shorter, or extremely strict sanitary restrictions were imposed during an outbreak, were the fastest to restore their passenger traffic and even in some cases exceeded the pre-covid months.

Spatial and temporal unevenness of the decline. The decline in passenger traffic at more than 500 airports in the world was extremely uneven in space and in individual poles and centers. It was *strong* in Europe and a number of others countries (Singapore, Hong Kong, Taiwan) and at the largest airports with a high share of international air traffic; *medium* – in the USA, Japan, South Korea, India, as well as at medium-sized airports with a minimum share of international traffic;

moderate – in Russia (due to the rapid restoration of domestic air traffic); *low* – in China (due to the rapid closure of all airports at the end of January 2020, strict quarantine that ended in March (in other countries this happened in July-August) and the rapid recovery of domestic traffic, the growth of which was especially rapid in summer and autumn).

The largest international airports (including those with a high share of transit international passengers) and airports with a narrow resort and tourist specialization (but there were also exceptions in Turkey, Russia, South Korea and China) suffered the most from the covid crisis; less – airports with a dominance of domestic traffic (including traffic to domestic resorts).

If the peak of the decline in traffic in China fell on February 2020, then in Europe, Russia, North America and the Middle East – in April, further in Australia and Japan – in May.

Thus, the COVID-19 pandemic has had a radical impact on global air travel and nearly every airport that has not been seen since World War II. That is why the pandemic catastrophically destroyed the stable territorial structure of world air traffic, which had been forming for a long time over the past 60 years, disrupting the already existing hierarchy of the largest and largest airports not only around the world, but also within individual mega-regions and countries with large territories and populations. Many of the former largest airports in terms of passenger turnover lost their dominant positions in the hierarchy to other airports in 2020, which bypassed them due to the rapid restoration of domestic air traffic (Europe, China, South Korea).

Nevertheless, in many countries with a dominant monocentric spatial structure and a number of countries with a polycentric structure (for example, Germany), the previous hierarchy of the airport system has been mainly preserved (in some countries, however, the leading airports in such a hierarchy have changed), but their size passenger turnover decreased significantly. This hierarchy was deformed in those polycentric countries, where in 2019 international traffic dominated at the largest airports of rank 1-3, but the hierarchy of airports at lower levels of the hierarchy did not change much or changed insignificantly.

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