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AVIATION AND COVID-19 PANDEMIC: TOWARDS THE 'NEXT NORMAL'

Peter J. RIMMER
Australian National University, Canberra, ACT 0200, Australia

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Abstract:
An account is given of the effect of the novel COVID-19 pandemic on the global commercial aviation industry in September 2020. Recurrent features of the effects of past crises upon the aviation industry since the Second World War are identified before proceeding to gauge if they can be recognized in the current situation. This analysis is aided by pinpointing key components of the aviation ecosystem: demand, airlines, airports, network connectivity and governance. Each of these components are examined, in turn, in September 2020, before proceeding to determine how they will fare once an effective vaccine is introduced, and the pandemic is over. Then attention is given to how logisticians and corporate strategists can contribute to the realization of the 'next normal' by benchmarking and monitoring the recovery.

Keywords:
Airlines, Airports, Demand, Governance, Networks, Passengers

1. Introduction
Since March 2020 the novel coronavirus-19 pandemic (COVID-19) has had an ongoing catastrophic effect upon the global commercial aviation industry. Not only is the aviation industry a key contributor to exchange, development and economic growth, but also the prime means through which the virus 0.1 microns wide is spread between countries. Singling out the highly visible aviation industry for analysis does create problems because the sector handles both air passengers and air cargo. Given 40 per cent of annual air cargo is carried in the 'belly' of passenger aircraft, attention is focused primarily upon scheduled passenger flights to gauge how air transport management has grappled with the logistics questions occasioned by the pandemic.

A series of issues are raised in concentrating upon the air passenger sector's logistics. How was the sector situated prior to the pandemic? How has the sector been affected by the pandemic? And, looking ahead, how is the management of sector likely to react to the current challenges posed by the ongoing pandemic to enable it to succeed when it is finally over?

Initially, these issues are addressed by distilling the effects of past crises. This pre-pandemic investigation leads to a study of the aviation ecosystem's major components. This ecosystem can be used to gauge the effects of the ongoing pandemic upon the air passenger sector by drawing upon data provided by the Airports Council International (ACI, 2018; 2020a,b), the Centre for Pacific Aviation (CAPA, 2020), the European Organisation for the Safety of Air Navigation (EUROCONTROL, 2020), the International Air Transport Association (IATA., 2020a,b), the International Civil Aviation Organization (ICAO, 2020a,b), the weekly and monthly coronavirus updates since January 2020 versus the same period for 2019 supplied by the global data provider, the Official Airline Guide (OAG, 2020a), and Statista (Mazarreanu, 2020). Then the ecosystem's components can be redeployed to look at the pandemic's likely medium and longer-term effects on the 'next normal', and how air transport management must change to accommodate them. Finally, the study concludes by considering how the task of analysing the aviation ecosystem can be improved to assist the return to the 'next normal' once an effective vaccine has been developed.

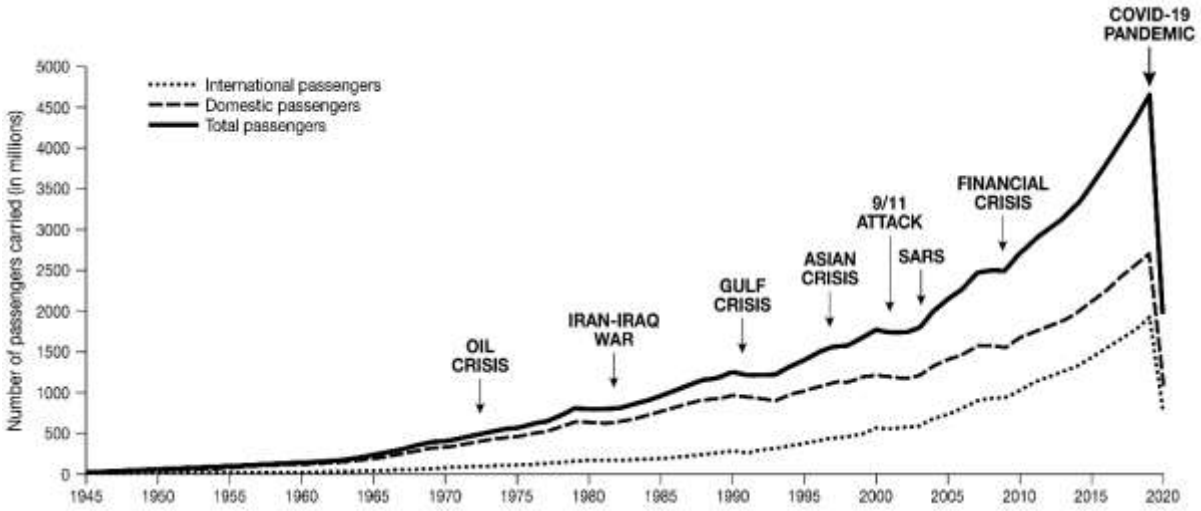

Figure 1. World passenger traffic evolution, 1945-2020 (Source: Based on IATA, 2020a, b). A decline of between 54 and 60 per cent in world total passengers in 2020 is projected.

2. Pre-pandemic

This COVID-19 pandemic is but the latest in a series of crises that have punctuated global aviation since the Second World War (1939-45) (Fig. 1). An Oil Crisis in October 1973, triggered by a price increase of 400% and a decline in production of 240%, reduced the air traffic growth until 1975 (Teyssier, 2009). Another recession occasioned by the early stages of the Iran-Iraq War (1980-88) also stalled air traffic growth. During the Gulf Crisis (1990-91) jet fuel prices more than doubled but, even after they had eased, airlines still experienced a revenue problem that sent Eastern Airlines, Pan American and Midway out of business and reduced Trans-Atlantic traffic by 50 per cent (Silk, 1991; Thomchick, 1993). In 1998-99 the Asian Financial Crisis had a marked effect upon aviation in Indonesia, Malaysia, Singapore and Thailand (Rimmer, 2000). On 11 September 2001 the four attacks on commercial aviation in the United States occasioned the industry's temporary, but complete, shut down (Clark, McGibany and Myers, 2009). In 2002-03 the spread of the severe acute respiratory syndrome (SARS) was added to this series of crises, which have affected airlines with a strong presence in the Asia Pacific. Accounting for 916 lives and lasting less than one year, SARS nevertheless had a greater impact than the Iraq War (2003) (Carey, Stringer and Trottman, 2003). This near-pandemic beginning in southern China cut flights by 3 per cent in mid-June, cost the aviation industry US$7 billion and diminished the number of tourists arriving and departing from Australia (Dwyer, Forsyth and Spurr, 2005; Rubin and Joy, 2005). Also, the response to SARS highlighted the efficacy of work-sharing, temporary pay cuts and furlough in the aviation industry as an alternative to dismissing staff (Harvey and Turnbull, 2010).

In 2008-09 the next crisis to affect major civil aviation markets in the Asia-Pacific, Europe and North America, costing US$16 billion, was the Global Financial Crisis occasioned by the failure of major financial institutions (Harvey and Turnbull, 2010). By 2013, harking back to SARs, Sarah Begley (2013) noted presciently that the next pandemic would trigger a global recession. However, the milder and short-lived avian flu in 2013 was not a pandemic. Also, in 2015 the Middle East respiratory syndrome coronavirus (MERS-CoV), an often-fatal illness, did not measure up to becoming the next pandemic (Ahmad, 2014). Although MERS resulted in a sharp 12 per cent decline in revenue passenger kilometres in traffic to, from and within South Korea during the first month, there was a return to pre-outbreak levels within six months (IATA, 2020b). Nevertheless, these developments were sufficient to raise the need to streamline pandemic control to reconcile regional public health and airport business activities (Chung, 2015).

Recurrent features of these past crises, given aviation's high perishability factor, have been: (1) a reduction in airline capacity; (2) an over reliance on labour as the primary adjustment mechanism; and, reflective of pro-cyclical management, (3) a quick slowdown and slow recovery (Harvey and Turnbull, 2002, 2010). Will the precipitous

decline in the world domestic, international and total passenger evolution occasioned by COVID-19 be any different? Is this the pandemic that Sarah Begley (2013) feared would occasion a global recession?

3. Pandemic

At the end of 2019, when the commercial airline industry was worth US$2.7 trillion in value added output and in an upward trajectory, there was no inkling that ubiquitous travel would be ravaged by the COVID-19 tsunami (ICAO, 2020a). Although the industry had experienced 'headwinds from a weaker global economy and international trade tensions, expectations were for a strong performance in 2020' (IATA, 2020a: 3). Already, World Airport Traffic Forecasts (WATF) 2019-2040 had provided the basis for short, medium and long-term airport planning and determination of future capacity needs in regional and country markets by anticipating the number of aircraft movements, passenger traffic throughput and air cargo volume (ACI, 2018). The growth of international passenger traffic in the Asia-Pacific over this period was expected to be 37 per cent, Europe over 31 per cent, the Middle East over 12 per cent, North America almost 9 per cent, South America 7 per cent and Africa 3 per cent. A pandemic such as COVID-19 did not appear among the downside risks in the forecasts of demand growth.

When the COVID-19 pandemic occurred aviation was struck fast and hard, and planes were grounded quickly. After the declaration of the pandemic by the World Health Organization (WHO) on 11 March 2020 American Airlines grounded 67 Boeing 777 aircraft between 15 March and 22 March 2020 (Boon, 2020). Despite such precipitate action, ICAO (2020a) expected that the effects upon air passenger traffic, airlines, airports, tourism, trade and the global economy would be manageable and short-lived. Reflecting past crises, labour was again used as the primary adjustment mechanism once movable assets were secured. But the scenarios promulgated in April and May 2020 for a quick slowdown and slow recovery to reinstate the original trend within six months via a V-curve were not being followed, prompting revisions of the original forecasts in June and August 2020 (Table 1). Unlike SARS some of the first wave infections are still being played out and there has been a second wave of infections and even, if a vaccine is not found, the prospect of a third wave being flagged. Whereas SARS was easily detectable by airport temperature checks and resolved by isolation, COVID-19 has a two-weeks incubation period. As a result, it was evident by August 2020 that it was having a deeper and more prolonged effect upon aviation, tourism, trade and the global economy than any previous post-war crisis. Many of fears expressed by senior airline executives, interviewed by Suau-Sanchez, Voltes-Dorta and Cugueró-Escofet (2020) during the first four months of 2020, are being realized.

Table 1. Estimates of likely impact of covid-19 on aviation, tourism, trade and the global economy in April, June and August 2020 compared with 2019

		27 April 2020	5 June 2020	26 August 2020
Air passenger traffic	International passengers	-80%	-40-62%	-54-60%
Airlines	Revenue passenger km (RPKs)	-48%	-48%	-54.7%
Airports	Passenger traffic	-40%	-48%	-50%
	Revenues	-US$76bn	-US$97 bn	-US$97bn
Tourism	Receipts	-US$300-450bn	-US$910-1170bn	-US$910-1170bn
Trade	Global merchandise trade volume	-13-32%	-13-32%	-13-32%
Global economy	World GDP	-3%	-3%	-4.9-5.2%

Source: Based on data from ICAO (2020a). Updated 5 June and 26 August 2020.

Before examining this pandemic's effects upon the aviation industry's ecosystem's in greater depth and reflecting upon its recoverability, it is important to identify the interactions between its major component subsystems (Fig. 2). These include: (1) governance covering regulatory agencies controlling funding, guidance, design and planning mechanisms, quarantining, slot use and testing; (2) demand derived from business and leisure passengers, and air cargo logistics firms; (3) airlines covering full network service providers (FNSP) and low-cost carriers (LCC), and their corporate strategies; (4) airports and air navigation services providers (ANSP); and (5) network connectivity.

These interactions are underpinned by regulators, travel and cargo agents, cabin and ground crews, aircraft manufacturers, airport managers, air traffic controllers, flight schedulers, fuel suppliers, non-aeronautical franchisees (involving food and retail outlets), ground transport providers and network planners. The non-aeronautical franchisees alone accounted for almost 40 per cent of world airport revenue in 2018 (ACI, 2018). On average, one job in aviation supports 24 others (IATA, 2020c).

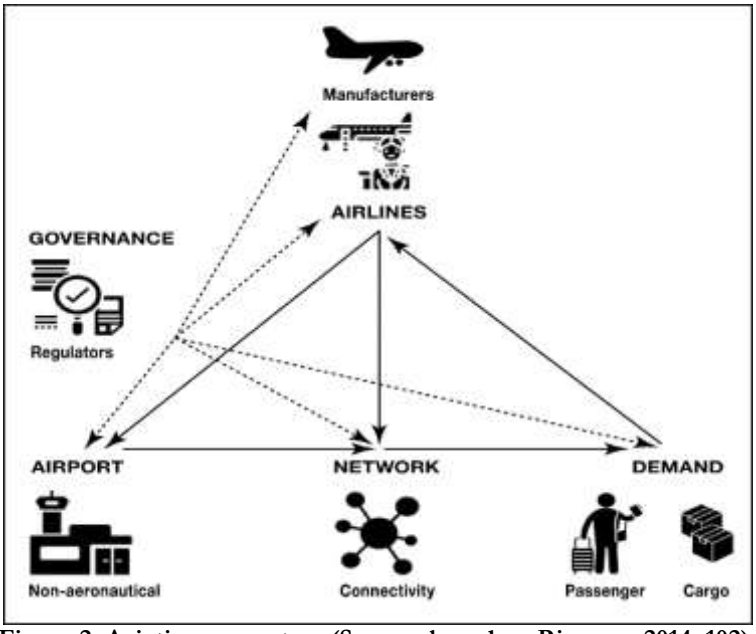

Figure 2. Aviation ecosystem (Source: based on Rimmer, 2014: 102).

Each of the five components of the aviation ecosystem in Figure 2 — governance, demand, airlines, airport and network — are examined in turn. Drawing upon this analysis attention is given to the post-pandemic situation. Then lessons can be drawn from this study to help logisticians and corporate strategists address 'the next normal'.

4. Governance

Since January 2020 widespread intervention by government authorities in the workings of the aviation ecosystem has escalated in response to the COVID-19 pandemic. Government mandated interventions to control the spread of the virus have suppressed demand by closing international, provincial, metropolitan and district borders, limiting domestic and overseas travel, and imposing two-week quarantining of travellers at their own expense. This intervention has affected airlines, airports and network connectivity, and harmed ancillary activities. The effects of government intervention upon all these components are discussed in turn, before returning to the task of governance in charting the 'next normal' once the pandemic is over.

A major issue in undertaking this analysis is that changes have occurred in the effects of new regulations affecting aviation at regular intervals since the intensification of the crisis in March 2020. As illustrated by developments in the United Kingdom, the span of analysis needs to be quite narrow to accommodate these changes. On 3 July 2020, for example, the United Kingdom Government (UKG, 2020) listed an array of Coronavirus (COVID-19): travel corridors (Fig. 3). Since then countries, territories and regions have been added and subtracted to and from the list. This experience suggests that travel corridors, bridges or bubbles have been difficult to institute and sustain even between countries with relatively low rates of infection such as Australia and New Zealand.

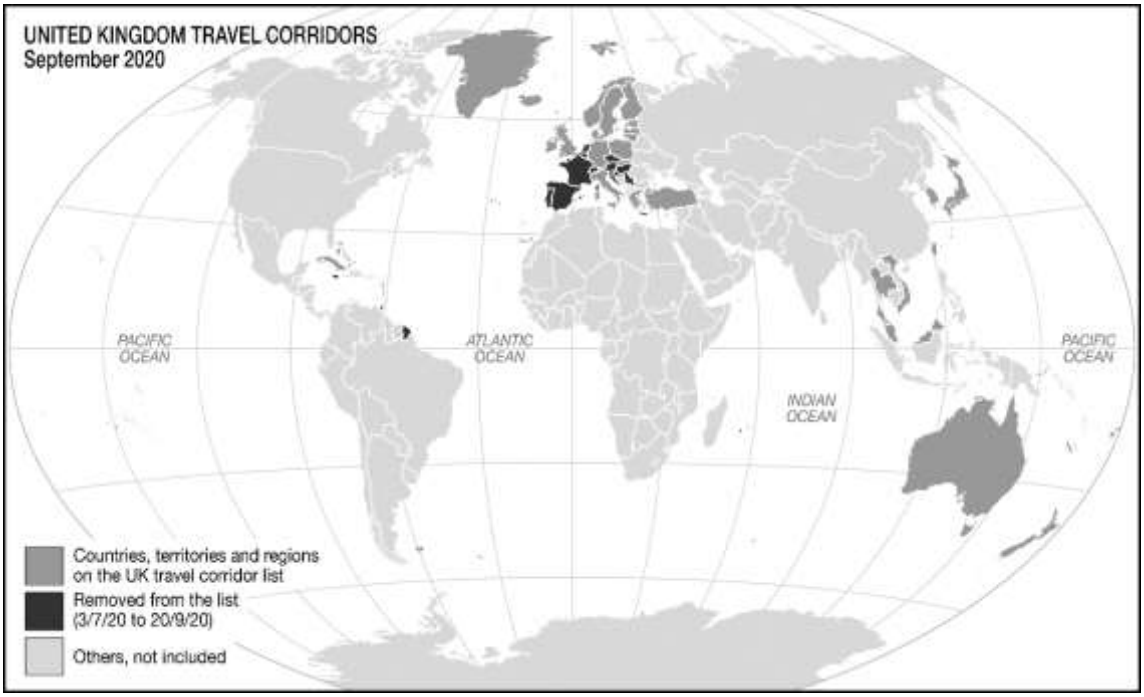

Figure 3. United Kingdom's travel corridors (Source: Drawn from data in UKG, 2020). Passengers from countries, territories and regions on the list do not have to quarantine for 14 days. Since its implementation on 3 July 2020 there have been several additions and removals from the list by 20 September 2020.

These constant changes make any analysis over time difficult. Consequently, only a broad conspectus of the first eight months of 2020 has been provided. From the heady potential in scheduled seat capacity in early January 2020 demand reached its nadir in April and May 2020 when airlines grounded 80-90 per cent of their planes (OAG, 2020a). By August 2020 signs of a recovery had occurred before tailing off after the northern hemisphere's school holidays. Instead of tracking this general trend, attention is concentrated on the situation in September 2020 compared with September 2019. This task is undertaken by using OAG (2020a) data to operationalize the aviation ecosystem by tracking regional shifts in demand, changes in airline standings, variations in airport rankings and fluctuations in international connectivity between these two dates. Mapping these deviations is all part of a COVID-19 geography that differs in so many respects from its pre-pandemic counterpart.

5. Demand

By 3 September 2020 the decline in the global demand for air passenger transport occasioned by the pandemic was reflected in the monthly 49 per cent reduction in the number of seats on offer to 250 million compared with 487 million in September 2019 (Fig. 4). While this loss was spread across all major regions, there were marked differences in its extent. Asia fared best with a 33 per cent loss followed by Europe and North America with losses over 50 per cent. The net outcome has been that Asia had reinforced its position as the COVID-19 world's most dominant aviation region. While Central America and the Caribbean performed slightly better than North America with a 49 per cent loss, the Middle East (including Qatar and United Arab Emirates) was more akin to major regions in the global south with a loss of almost 63 per cent. This reinforcement of the north-south divide was due to changes stemming from the pandemic. The highest losses were all recorded by the three major regions in the southern hemisphere: Africa experienced almost a 60 per cent loss, South America over 70 per cent and the Southwest Pacific 73 per cent.

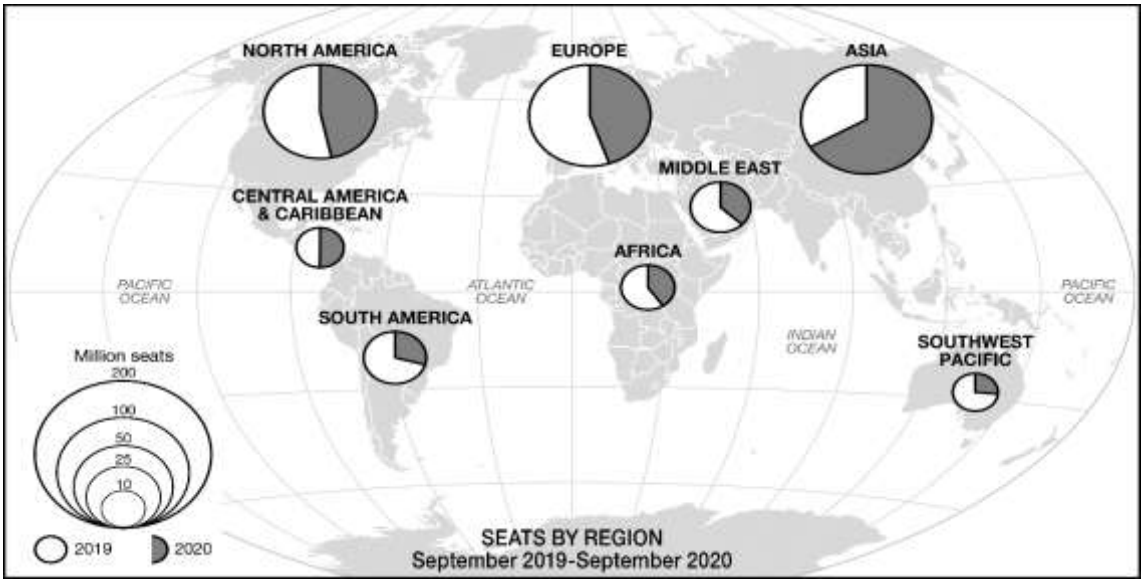

Figure 4. Decline in major regional demand in September 2020 from the number of seats available in September 2019 (Source: Drawn from data in OAG, 2020a).

The broad pattern within Figure 4 masked marked variations within sub- regions (Table 2). Northeast Asia, buoyed by China's domestic market, had a loss of 20 per cent. Also, Eastern/Central Europe, underpinned by the Russian Federation, with a loss of 40 per cent performed better than Western Europe and other regions in Asia respectively, which were bedevilled by ongoing travel restrictions. Conversely Southern Africa with almost 80 per cent and Upper South America (including Colombia, Ecuador, Peru and Venezuela) with a loss of almost 81 per cent contributed most to the poorer showing of their major regions.

Table 2. Changes in seats handled by regions and sub-regions in September 2020 compared with September 2019

Regions and sub-regions	Sept 2019	Sept 2020	Change v 2019	Regions and sub-regions	Sept 2019	Sept 2020	Change v 2019
	million	Million	%		million	Million	%
Central Asia	1.7	0.8	-51.1	***Middle East***	***19.3***	***7.2***	***-62.7***
North East Asia	105.8	84.4	-20.2	Lower South America	15.5	5.3	-65.8
South Asia	20.8	9.7	-53.2	Upper South America	7.4	1.4	-80.6
South East Asia	41.1	17.8	-57.6	***South America***	***22.9***	**6.7**	**-70.6**
Asia	***169.4***	***112.7***	***-33.4***	Central/Western Africa	2.6	1.3	-49.1
Eastern/Central Europe	21.3	12.9	-40.0	Eastern Africa	3.3	1.5	-53.1
Western Europe	113.3	47.3	-58.2	North Africa	5.0	2.2	-55.5
Europe	***134.6***	***60.2***	***-55.2***	Southern Africa	3.4	0.7	-79.7
North America	***102.5***	***47.9***	***-53.3***	***Africa***	***14.3***	***5.7***	***-59.5***
Central America	9.3	4.9	-47.1	***Southwest Pacific***	***12.1***	***3.2***	***-73.6***
Caribbean	3.2	1.4	-57.1	***Global***	***487.8***	***250.1***	
Central America and Caribbean	***12.5***	**6.3**	**-49.2**				

Source: Calculated from data in OAG (2020a).

Figure 5. Proportionate reduction of flights in September 2020 by top 20 ranked airlines in September 2019 (Source: Source: Drawn from data in OAG, 2020a). Airlines are based on the location of their headquarters.

These patterns are illuminating, but an examination of the top 20 airlines is required to comprehend the changed demands occasioned by the pandemic, which have contributed to global commercial aviation's expected loss in annual revenue of more than US$400 billion in 2020 (ICAO, 2020a). These airlines have lost revenue from passengers, air cargo and ancillary activities such as bag fees and seat selection. Only the major American airlines and Qantas Airways have lucrative frequent flyer programs to offset losses. Nevertheless, the revenue shortfall has prompted Qantas Airways to eliminate sports sponsorships and inflight entertainment content, and Singapore Airlines to turn one of their superjumbo A380s into a restaurant.

6. Airlines

In September 2020 flights among the top 20 airlines were almost 53 per cent lower compared with September 2019, declining from 1.29 million to 0.68 million (Fig. 5). As is evident from Figure 5, the aviation landscape was dominated by airlines in North America, Europe and Asia. Collectively, they accounted for 19 of the top 20 airlines; there was one outlier in South America.

Within North America the six airlines domiciled in the United States, including the 'big three' full network service providers — American (allied with Alaska and Jet Blue), Delta and United — and the low-cost carrier Southwest Airline, lost collectively 50 per cent of their flights (Table 3). Nevertheless, they fared better than their counterparts in the rest of North America and the Western Hemisphere due to their relatively strong domestic market (Garrow, 2020). South America's largest carrier, the LATAM Airline Group, headquartered in Santiago, Chile, experienced a reduction of over 73 per cent that reflected a downturn in Brazil, its biggest market (Cambero and Rochabrun, 2020). This reduction was exceeded the by Air Canada, which lost almost 78 per cent of its flights, due to the indefinite shut down of 30 domestic routes and suspension of flights to the United States (Financial Post Staff, 2020).

In Europe the United Kingdom was the only country to have two operators in the top 20. Collectively, they had lost over two-thirds of their flights, with low-cost carrier EasyJet performing better during September 2020 than the full-service network provider British Airways due to its reliance on European destinations. Overall the five airlines in the rest of Europe lost proportionately fewer flights than their United Kingdom counterparts. Nevertheless, there were extremes among the group: Lufthansa German Airlines, owning airlines in Germany, Austria, Switzerland and Belgium, lost over two-thirds of its flights; Turkish Airlines, the Aeroflot Group and SAS, advantaged by the Scandinavian travel bubble, lost over half their flights; and Air France, buoyed by its intra-European and North African markets, lost two-fifths of its flights (EUROCONTROL, 2020).

Table 3. Reduction in number of flights undertaken in September 2020 by top twenty airlines in September 2019

Airline	Flights			Airline	Flights		
	Sept 2019	Sept 2020	Change v 2019		Sept 2019	Sept 2020	Change v 2019
	thous	thous	%		thous	Thous	%
American Airlines	193	94	-51.0	Lufthansa	48	15	-68.3
Delta Airlines	159	86	-45.9	Turkish Airlines	42	19	-54.8
United Airlines	149	65	-56.4	Air France	34	20	-42.1
Southwest	111	64	-42.4	Aeroflot Group	31	15	-51.8
Alaska Airlines	38	23	-40.2	SAS	28	13	-54.6
Jet Blue Airways	30	9	-71.3	***Other Europe***	183	82	-55.4
USA	*680*	*341*	*-49.9*	China Southern	67	63	-5.0
Air Canada	47	11	-77.8	China Eastern	67	61	-7.8
North America				Air China	41	38	-8.7
LATAM Airlines	41	11	-73.6	***China***	*175*	*162*	*-6.9*
Western Hemisphere				IndiGo	43	21	-51.4
EasyJet	57	22	-61.7	All Nippon Airways	30	25	-18.1
British Airways	32	7	-78.1	**Other Asia**	73	46	-37.3
United Kingdom	*89*	*29*	*-67.6*	***Total***	1,289	681	-52.9

Source: Calculated from data in OAG (2020a).

Within Asia the three Chinese companies in the top-20 — China Southern, China Eastern and Air China — lost less than 7 per cent (even this small loss was erased during China's semi-annual 'Golden Week' between 1 and 7 October 2020). This was due to relaxation of travel restrictions and keeping the COVID-19 virus under control, and aggressive promotional fares allowing unlimited travel within the country's strong domestic market to overcome earlier losses and lock-in customer loyalty (Liu and Wang, 2020). In the rest of Asia, All Nippon Airways experienced a relatively small decline in the number of flights because the strong domestic market in Japan had held up until the resurgence of COVID-19 infections in August 2020 (JT, 2020). The low-cost carrier IndiGo, India's largest airline based in New Delhi took advantage of international charter and repatriation flights, and, after a two-month cessation, resumed domestic flights in May to cut its loss by September 2020 to 51 per cent (Pengonda, 2020). Besides reducing the number of flights, airlines have responded to these changes across all regions by grounding hundreds of aircraft, seeking government assistance to avoid bankruptcy and the time-honoured methods of cutting staff.

By September 2020 this slump in demand had resulted in long-haul planes being parked in the Mojave Desert in California for protection. These included the ageing Boeing 747 jumbo jets operated by British Airways and KLM Royal Dutch Airlines, whose retirement has been brought forward by the pandemic. Some Airbus A380s, the world's largest passenger aircraft, launched in 2007 to carry 555 passengers in three classes on popular routes operated by airlines such as Air France, British Airways and Lufthansa German Airlines, were mothballed in the USA and at a facility in France. Airlines outside the top 20, notably Qantas Airways and Singapore Airlines, also operated A380s, but, indicative of their overall plight have been reduced to flagging scenic 'flights to nowhere' taking off from and landing at the same airport (Fan 2020). A handful of the Airbus A380s had been temporarily converted to all cargo aircraft by Hi-Fly based in Portugal. Other airlines, notably American Airlines, Air Canada and IndiGo, had also switched some of their aircraft to carry cargo, including personal protective equipment (PPE), to offset revenue losses.

Before September 2020 several troubled airlines, including Avianca Holdings in South America, Thai Airways and Virgin Australia Airlines, had already entered bankruptcy protection (Slotnick, 2020). Their number also included one top 20 airline, the LATAM Airlines Group, which had filed for Chapter 11 bankruptcy in the United States on 26 May 2020 but continued operating during the pandemic. Other airlines among the top 20 have survived the

pandemic through cooperation with their respective governments. Where the state had equity in an airline, the conventional rescue plan involved a mixture of loans and aid, and, to appease activists, stricter environmental conditions over emissions have been implemented. In April 2020 there had been a US$25 billion bailout of ten United States airlines to support payrolls until 30 September 2020 and a further U$25 billion in loans with warrants for the federal government to buy shares in the airlines under the US CARES Act to safeguard the economy; a further bailout of US$25 billion has been sought (Rappeport and Chokshi, 2020). Within Asia Singapore Airlines has received US$8.7 billion and Hong Kong's Cathay Pacific US$3.8 billion from their respective governments (Rowland, Grant and Clayton, 2020). In Europe, Lufthansa German Airlines has received US$12 billion in return for a government stake of 20 per cent (Fan, 2020). A package of US$11.7 billion has been extended to Air France-KLM, but Greenpeace Netherlands (GN, 2020) has started a lawsuit against the Dutch government's component because climate conditions were not attached. In the United Kingdom, the Government, less prone to handouts, has extended a rescue plan of US$1.45 billion to the private operator IAG (International Consolidated Airline Group) SA operating British Airways; this sum draws upon the United Kingdom's COVID Corporate Financing Facility, which was also made available to low cost carriers such as EasyJet and Ryan Air. These facilities were designed to assist airlines in retaining employees, but they have still proceeded to reduce staff. Also, the variations in government support suggest that the competitive level playing field for airlines has been further disrupted.

By September 2020, among the top 20 airlines in the United States, it had been reported that United Airlines experienced a reduction of 36,000 employees, American Airlines 25,000, Delta 17,000 and at Southwest 17,000 opted to depart or take paid leave; the further bailout being sought from 1 October 2020 is to continue furloughing a further 32,000 airline employees across the country (Josephs, 2020). Among the other top 20 airlines, Lufthansa German Airlines had cut 22,000 jobs from its staff of 135,000, Air Canada 20,000, LATAM Airlines Group 12,600, Air France 12,500, Easyjet 4,500 and IndiGo 2,400. Also, British Airways had reduced its 42,000 strong work force by 12,000, furloughed 22,000 staff and considered changes to terms and conditions of the remaining staff to compete with low-cost carriers; this may have saved the airlines in the short term but soured industrial relations in the longer term (BBC, 2020a). Meanwhile, British Airways has responded to the reduction of flights by concentrating its long haul and short haul activities at Heathrow Airport and closing Gatwick as its secondary hub (Grant, 2020a), which highlights the need to examine the effect of COV-19 on airports. In April 2020 the Airports Council International (ACI, 2020c) had calculated world passenger traffic had declined by 94 per cent and air freight traffic by almost 24 per cent compared with a year earlier. Had there been a recovery at leading airports by September 2020?

7. Airports

By September 2020 the seats available at the world's top 20 airports had plummeted by over 54 per cent to less than 39 million compared with 84 million in September 2019 (Fig. 6). In the process there was a remarkable shake-up in the rankings of individual airports. China's Guangzhou airport had risen from thirteenth position to topple Beijing Capital from first position and relegate it to third behind Atlanta, aided by the opening of second Beijing Daxing International airport and possibly benefitting from social unrest and a second wave of infection in Hong Kong. Rather than concentrate on such shifts in individual rankings, attention is focused upon analysing an eastern group of ten top 20 airports incorporating those in China and other Asian countries, and a western group of ten top 20 airports covering those in the United States and Europe.

Figure 6. Proportionate reduction of seat capacity in September 2020 by top 20 ranked airports in September 2019 (Source: Drawn from data in OAG, 2020a).

Within the eastern group China's large domestic market and quicker recovery from the pandemic has allowed the country's three airports ranked in the top 20 to boost their overall share of the seats available in the smaller aviation market (Table 4). Conversely, the greatest losses between 70 and 90 per cent were incurred at other Asian airports that were marked by smaller domestic markets, notably Dubai, Hong Kong, Singapore, Seoul Incheon and Bangkok (Cheung, Wong and Zhang, 2020). Previously, these airports, concentrated on one or two dominant carriers, had featured among the global economy's key transit hubs benefitting from being able to carry passengers or cargo from a second country to a third country by stopping in one's own country (i.e. unofficial sixth freedom rights). Tokyo Haneda and Delhi with larger domestic markets fared better. These cumulative losses resulted in the eastern group of airports having a smaller proportion of the number of seats in September 2020, despite being almost on a par with the western group of airports in September 2019.

Table 4. Loss of Sats in September 2020 Compared with Those Handled by Top 20 Airports in September 2019

Eastern	Seats			Western	Seats		
Airport	Sept 2019	Sept 2020	Change v 2019	Airport	Sept 2019	Sept 2020	Change v 2019
	million	million	%		Million	%	Million
Beijing Capital	5.2	2.8	-45.8	Atlanta	5.1	3.0	-41.9
Shanghai Pudong	3.9	2.7	-32.3	Chicago O'Hare	4.5	1.9	-58.5
Guangzhou	3.8	3.3	-11.0	Los Angeles	4.2	1.6	-62.1
China	***12.9***	***8.8***	***-31.6***	Dallas Fort Worth	3.7	2.3	-37.9
Tokyo-Haneda	4.6	2.6	-43.1	Denver	3.5	2.2	-35.3
Dubai	4.6	1.3	-71.9	***USA***	***21.0***	***11.0***	***-47.8***
Hong Kong	3.6	0.4	-87.8	London Heathrow	4.3	1.4	-68.4
Seoul Incheon	3.5	0.8	-78.7	Frankfurt	4.1	1.3	-68.9
Singapore Changi	3.4	0.3	-91.7	Paris CDG	4.0	1.5	-61.8
Delhi	3.4	1.5	-55.5	Istanbul	3.7	1.4	-62.1
Bangkok	3.3	0.8	-75.5	Amsterdam	3.7	1.7	-53.3
Other Asia	***26.4***	***7.7***	***-70.9***	***Europe***	***19.8***	***7.3***	***-63.2***
Sub-total	***39.3***	***16.5***		***Sub-total***	***40.8***	***18.3***	

Source: Data calculated from OAG, 2020a.

Within the western group the United States with five airports in the top 20 did not do as well as its Chinese counterparts. Nevertheless, they increased their overall share of the reduced number seats available. Not only did this reflect the country's large domestic market but also the variable performance of individual airports with Denver, Dallas Fort Worth and Atlanta having coped better than Los Angeles and Chicago O'Hare. Collectively, European airport hubs, with a greater reliance on international travel across the continent, did not do as well as their American counterparts. London Heathrow, Frankfurt, Paris CDG and Istanbul, lost more than three-fifths of their seats and Amsterdam more than one-half (EUROCONTROL, 2020).

Indeed, the number of seats at London Heathrow, Europe's busiest airport had plunged to 1.4 million seats in September 2020 compared with 4.2 million seats in September 2019. Reflecting this reduction in activity, the airport incurred a loss of US$1.3 billion between March and August 2020 and told frontline staff to take a pay reduction of between 25-30 per cent or face job losses, (Topham, 2020). While caution needs to be exercised in drawing conclusions from only the top 20 airports, this analysis highlights that the adverse effects of COVID-19 on airport operations arose from the culling of seats from the international air passenger network. Airports generate their profits from international traffic because aeronautical charges for landing, parking and servicing are higher than for domestic flights and its passengers drive duty-free revenue at retail outlets.

8. International Networks

By September 2020 the effects of COVID-19 on international traffic connectivity can be distilled from a comparison with the top 20 country pairs based upon their number of seats available compared with those in September 2019. The number of seats handled by the top 20 country pairs had declined by almost 74 per cent to less than 12 million seats compared with over 43 million seats twelve months earlier. As the top 20 country pairs were not interconnected in a single system, the effect of this reduction is discussed by examining two separate networks and a single link country pair (Fig. 7). The first network involves connections between country pairs involving Europe and the United States; the second network covers country pairs in East Asia; and the third is an isolated link between India and the United Arab Emirates.

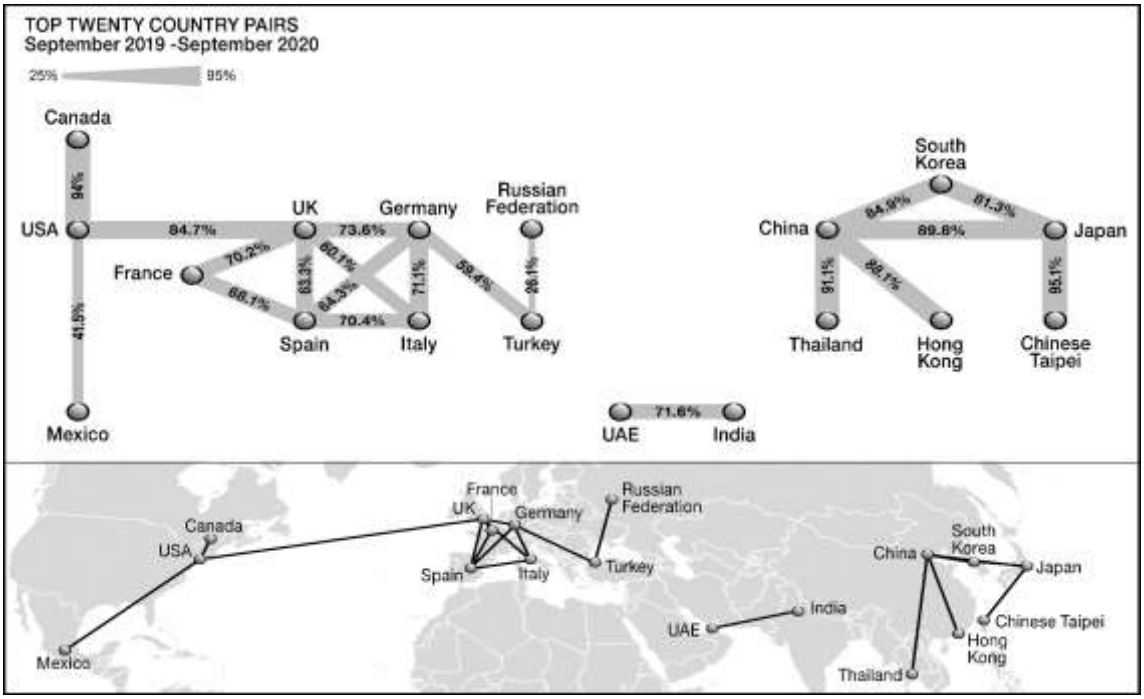

Figure 7. Percentage reduction in the number of seats in September 2020 in the top 20 country pairs identified in September 2019 (Source: Drawn from data in OAG, 2020a).

The first network, pivoted on the United Kingdom, had links to both Europe and North America. These regional arenas are considered separately (Table 5). Within the European sector the share of the ten country-pairs had declined by 63 per cent to 8 million seats in September 2020 compared with over 22 million seats in September 2019, following travel restrictions and bans that affected the northern hemisphere's school holiday season. These losses were spread evenly across all routes except for the smaller loss between Turkey with Russia and, to a lesser extent, Germany, which followed Ankara's lifting of all travel restrictions in mid-June 2020 (Spurrel, 2020). Conversely, within the more lucrative Trans-Atlantic sector, there was a sharper decline of almost 77 per cent among the three country pairs to 2 million seats in September 2020 compared with 8 million a year earlier (Grant, 2020b). Although the loss between the United States and Mexico was limited to 41 per cent at North America's busiest frontier, extending essential traveller restrictions to the pairing with the United Kingdom resulted in a loss of 84 per cent and over 94 per cent with Canada (Calder, 2020). The extent of these losses, arising from travel being limited to US citizens, permanent residents or their family members, diplomats and air crews, were matched by those in the East Asian network.

Within the East Asian network, the number of seats had declined by 88 per cent to 1.2 million in September 2020 from almost 11 million in September 2019. International flights between China and Thailand, Japan, South Korea and Hong Kong had fallen markedly due to travel restrictions imposed from March 2020 like those between Japan and South Korea and Chinese Taipei, which also involved the revocation of visas. These losses were exceeded by the link between India and the United Arab Emirates, which, even after it was re-opened in August 2020, the upsurge of coronavirus in India reduced the number of seats to a trickle. This reduction of international connectivity raises issues about when global aviation will return to normality, especially where closed borders and an ongoing pandemic still make firm bookings for international flights a virtual impossibility. This uncertainty has resulted in little forward booking activity.

Table 5. Reduction in Number of Seats in September 2020 Compared with Those Offered by the Top Twenty Country Pairs in September 2019

Country pair	Seats			Country pair	Seats		
	Sept 2019	Sept 2020	Change v 2019		Sept 2019	Sept 2020	Change v 2019
	thous	thous	%		thous	Thous	%
Spain-UK	5,190	1,905	-63.3	Canada-US	3,158	189	-94.0
Germany-Spain	3,312	1,182	-64.3	UK-US	2,894	365	-84.7
Germany-Turkey	2,197	892	-59.4	Mexico-US	2,369	1,386	-41.5
Germany-Italy	1,936	560	-71.1	***Trans-Atlantic***	**8,421**	**1,940**	**-76.9**
UK-Italy	1,779	710	-60.1	China-Thailand	2,145	191	-91.1
Spain-Italy	1,761	521	-70.4	China-Japan	2,115	216	-89.8
Spain-France	1,609	513	-68.1	China-South Korea	2,026	305	-84.9
Germany-UK	1,564	413	-73.6	Japan-South Korea	1,814	339	-81.3
Russia-Turkey	1,431	1,057	-26.1	Japan-Chinese Taipei	1,411	69	-95.1
France-UK	1,397	416	-70.2	China-Hong Kong	1,383	165	-88.1
Europe	***22,176***	***8,169***	***-63.2***	***East Asia***	***10,894***	***5,165***	**-88.2**
UAE-India	1,847	52	-97.1	***Top 20 total***	***43,338***	***11,447***	***-73.6***

Source: Calculated from data in OAG (2020a).

9. Post-pandemic: Towards the 'Next Normal'

Estimating the demand for flights, air passenger throughput and air cargo volume after the pandemic's end will be a challenging exercise for logisticians analysing the aviation ecosystem in the 'next normal'. By the end of 2020 IATA (2020a) expects passenger revenues from the almost 290 airlines it represents to have fallen by US$314 billion — a decline of 55 per cent compared with 2019. Further, international passenger demand is not expected to recover to the level of 2019 before first 2023 and now 2024 at the earliest (and even that is seen as being optimistic). Both Asia

and Europe are expected to be the first regions to return to 2019 levels in international passenger transport with North America making a slower recovery ahead of other regions. Conversely, cargo demand is anticipated to exceed its 2019 level of 62.3 million tonnes with 63.5 million tonnes by 2021 (Mazarreanu, 2020).

The rationale for this differing response between air passenger and air cargo is attributed to the likelihood that air freight forwarders will flourish along trade lanes and the reluctance of passengers to return to air transport, especially if mask wearing is not obligatory and the practice of blocking off the middle seat is terminated (Condon, et al.,2020). A 'green shoot' recovery among air passengers is likely to occur first in domestic and regional markets rather than in international markets. In Australia, for example, Qantas Airways has deferred its international long-haul resumption plans to July 2021 in the hope that the country's borders will be open to business travel and general tourism and hospitality. However, recovery in business travel may be much slower than anticipated due to the cancellation of meetings, incentives, conferences and exhibitions (MICE) at physical locations around the world, and the progressive switch to virtual meetings, particularly to overcome the uneven removal of travel bans between and within countries. Not only does this greater familiarity with digitalization save strapped companies and institutions expenditure upon travel and insurance, but also it may lead younger, rather than older, company members undertaking the essential business journeys. The faster recovery of the leisure class is expected after 2024, particularly among younger passengers, especially millennials and generation Z in Asia, who are less likely to be concerned about catching the virus while travelling (OAG, 2020b). Nevertheless, reduced disposal income may be an overriding issue and cut this optimistic forecast. Also, promotional fares pioneered by airlines in China will inevitably give way to rising ticket prices. On shorter domestic and regional hauls in Europe and parts of Asia there may be a defection of younger travellers to high-speed rail travel.

Airline companies, in response to these trends, are likely to be smaller in size, offering fewer flights, making boarding more regimented, downsizing the size of their business classes and even contemplating making the absence of in-flight food permanent on shorter-distance flights. Among the international network carriers, Middle Eastern airlines such as Emirates and Qatar Airways are expected to be smaller by 20 per cent; British Airways 25 per cent; Air New Zealand 30 per cent; and Air Canada 50 per cent (ABC, 2020). Even the low-cost carrier, Air Asia, is expected to be reduced in size by 50 per cent, despite not having to compete with state-backed carriers like its European counterparts such as Easy Jet and Ryan Air.

These reductions in size during this period of readjustment are likely to stem from the adoption of smaller, more agile and easier-to-fill aircraft. As part of their fleet restructuring both British Airways and Qantas Airways, for example, are likely to switch from four-engine aircraft Airbus 380s and Boeing 747s to fuel-efficient twin-engine aircraft such as the Airbus A350s and Boeing 787s to reduce financial risks stemming from cheaper operating costs and being easier to fill their capacity to capitalize on regional connectivity. Similarly, the low-cost operator, Air Asia, anticipating lower demand after the pandemic, has already heralded a shift away from Airbus A321s with 230 seats to the Airbus A320s with 180 seats. Greater scope for even smaller aircraft such as the 70-seat ATR 72-600 and the 40 seat ATR 42-600 is envisaged on regional routes. Within Australia, for instance, Regional Express Airlines (REX) operating Saab 340 turbo prop, seating 34-36 passengers, has extended its network with support from the Federal Government to incorporate routes axed by Virgin Airlines Australia. Not only will this shift to smaller aircraft help re-establish connectivity networks as quickly as possible after the pandemic and create new ones, but it will also help airlines to attain their net-zero carbon emissions targets to 'fly green' by mid-century.

The trends will have an impact on aircraft manufacturers, exemplified by Airbus, Boeing and the French-Italian company ATR, and jet engine producers such as General Electric and Rolls-Royce Holdings. Since the start of COVID-19, for example, Airbus sales have stalled amidst several cancellations. Conversion of super-jumbos into cargo planes may provide an opportunity for newer companies such as Amazon to establish a deeper foothold in the air freight market and help resuscitate smaller airports. These developments herald a sharp reduction in the workforce in aviation and ancillary activities through voluntary or involuntary retirement. This has raised concerns by Geraint Harvey, Daniel Winterberger and Peter Turnbull (2020) that many skilled professional aviation jobs will lapse into the gig economy.

Airports, in turn, will have to refocus on both safety and health requirements to accommodate the new era of touch-free, post-pandemic travel. An array of biosecurity measures will have to be introduced into touchless airports and applied in a consistent manner. These actions will range from reducing tension through social distancing solutions and personal hygiene, airport cleaning, deep cleansing of aircraft to protect both crew and passengers, lounge limits,

pre-flight temperature checks, and retail restoration to new architectural post-pandemic airport archetypes (Kelleher, 2020). Much will hinge on reducing queues, avoiding crowds at departure gates, and accommodating slower aircraft turnaround prompted by enhanced cleansing requirements. An opportunity needs to be undertaken to extend the discussion from the top 20 airports to incorporate secondary airports and their varying reliance on long haul routes (Rowland, 2020).

International network connectivity will be an important barometer of the 'next normal' in aviation. Not only does greater connectivity translate into higher economic growth but also, with the restoration of long-haul international flights, offers the opportunity of linking the separate networks among the top 20 country pairs together into a single system and re-establishing the importance of global transit hubs in Asia and the Middle East, notably Bangkok, Dubai, Hong Kong, Seoul Incheon and Singapore. Conversely, should the network continue to shrink, non-stop options will diminish, and multiple itineraries will be required by travellers.

The governance agenda for the aviation ecosystem in the 'next normal' will likely focus on issues associated with the shift in emphasis from survivability to sustainability. Demand will need to be stimulated by rejuvenating the economy with a stress on positive messaging to encourage leisure travel. After the difficulties of getting cash refunds after flight cancellations during the pandemic, an Airline Passengers' Bill of Rights (Eliot, 2019) needs to be introduced following the lead of the European Commission (EC, 2020a, b). Assistance to airlines will have to be reassessed, according to a government's predilection towards either state ownership or free market, to enable them to be non-polluting by removing carbon emissions before 2050 (Dayen, 2017). Airports will be subject to increased health-screening procedures to minimize risk. Network connectivity will need to be revived with either a stress on city-pairs that have hitherto been the pivots of the global economy, or recognition that regionalization is the new norm. Finally, regulators will need to look at themselves, and at relations with each other, by coordinating and streamlining universal procedures and processes in a coherent and consistent way to facilitate the aviation industry's role of carrying passengers and cargo in the 'next normal'.

10. Conclusion

The COVID-19 pandemic is not over. Nevertheless, aviation, like higher education and the commercial real estate market, may never be the same. Hence, this study has offered only an interim account and recommendations for the 'next normal' because the pace of infections worldwide on 20 November 2020 was still accelerating beyond 56.4 million infections and 1.36 million deaths ahead of the northern hemisphere winter (BBC, 2020b). Lockdowns, quarantining (except for privileged passengers) and second waves were still occurring amidst grudging governmental support for the commercial aviation industry and its workforce.

As in past crises affecting the world aviation industry, the COVID-19 pandemic has occasioned a high perishability factor. The over-reliance on labour as the primary adjustment mechanism has continued throughout the pandemic, which will necessitate the retraining of pilots, crews and air traffic controllers following a resumption of business. What has been different with COVID-19 is that the anticipated sharp dip in traffic followed by a slow recovery within six months, as happened with SARs (2002-03) and the outbreak of MERs in South Korea (2015), has not occurred. After both SARs and MERs there was no second wave of infection, as has happened with COVID-19, to further depress the recovery in travel demand. Also, there was no second terrorist attack after 9/11 in 2001. Already, by November 2020 the effects of COVID-19 were many times worse than 9/11 on a global scale and, given ongoing policy variations between and within countries, uncertainty still prevails.

No longer can the continued growth of the shuttered global aviation industry be guaranteed. The industry's past propensity to accommodate an array of crises is now requiring a great leap of faith by shareholders to underpin the rebuilding of the shrunken industry with new liquidity. Given this lengthy disruption of aviation, there will be no current accumulated experience to reset the industry beyond cost cutting, having cash-in-hand and reliance on partnerships with other airlines. Nevertheless, recovery under this 'next normal' can be helped through analysis by a new generation of corporate strategists and logisticians to forecast and plan likely outcomes. This will involve the continuation of the provision of readily available data on which this study is based, including additional information on city-pairs, to benchmark and monitor the demand for air transport, airlines, airports, network connectivity and the effects of changing regulations. Decision-makers and aviation industry leaders will be better able to use these findings to identify opportunities for scenario development and commercial and operational strategies within the aviation ecosystem to ensure a rapid recovery from the pandemic during the 'next normal'.

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