AVIATION BENEFITS BEYOND BORDERS

DECEMBER 2024



Powering global economic growth, employment, trade links, tourism and support for sustainable development through air transport.

ATAG
AIR TRANSPORT ACTION GROUP



The air transport industry is the global network of commercial aircraft operators, airports, air navigation service providers, manufacturers of aircraft and their components, maintenance providers and new energy companies. It is responsible for connecting the global economy, providing millions of jobs and making the modern, internationally connected quality of life possible. The Air Transport Action Group (ATAG), based in Geneva, Switzerland, represents the full spectrum of this global business. ATAG brings the industry and related suppliers together to form a strategic perspective on commercial aviation's sustainable development and the role that air transport can play in supporting the sustainability of other sectors of the economy.

www.atag.org

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INTRODUCTION



HALDANE DODD

ATAG Executive Director

Chicago, December 2024

Having grown up in a world of air travel, it's hard to imagine that it was just 80 years ago that significant steps were being taken in the establishment of what is now the global air transport system. When 700 delegates met at the Stevens Hotel in Chicago for 37 days in late 1944, the world war which had ravaged many countries was still raging. And yet these negotiators were already putting in place a system that would make use of the advances in aerospace that the war had helped accelerate. As the war neared its end, the question became how civil aviation could help to open up a new world and be used as a tool to foster long-lasting peace?

The Chicago Convention was signed on 7 December 1944. Even before the United Nations (UN) itself had been established, the Conference set up a new international agency for the development of global air transport: the International Civil Aviation Organization (ICAO). It also set the tone for how countries could use the connectivity that air travel would make possible as an agent of growth, development and prosperity.

> **"The future development of international civil aviation can greatly help to create and preserve friendship and understanding among the nations and peoples of the world" – preamble of the Chicago Convention**

It would be fascinating to hear what those negotiators from 52 States in 1944 would think of today's air transport system. From those early days of multi-stage hops in flying boats to today's 20-hour non-stop flights. From a very shaky safety record to the safest form of transport on earth. From prioritising speed and opulence to prioritising fuel efficiency and value for passengers. From paper tickets to buying flights with a few finger swipes on a computer which fits in your pocket. The details of the way we work have evolved significantly. But I like to think that the spirit of those who work in aviation hasn't changed all that much: working together to serve our passengers, to run a global transport system and – most importantly – to bring people together.

As this edition of *Aviation: Benefits Beyond Borders* shows, aviation supports some 86.5 million jobs worldwide today, contributing 3.9% of global economic activity, transporting a third of world trade by value, enabling 58% of tourist arrivals and connecting people all over the planet.

The Chicago Conference proved to be a catalyst for helping to shape our entire industry. The rules set in place helped us in the industry build an interconnected world. As we explore in the first chapter, today's aviation professionals would be in a very different place if the system of standards and recommended practices were not established and updated through ICAO. However, we are also faced with issues unforeseen to those in Chicago in December 1944: the threat of cyber terrorism; the threat of climate change and our sector's role in helping to mitigate aviation's climate impact; the need to transition to new forms of energy; the need to further democratise access to air travel connectivity; the lessons we should learn from a global pandemic.

All of these are significant challenges in their own right. But I am confident that we can master them as well as our predecessors did. The first 80 years of internationally-coordinated civil aviation have provided a model of how to collaborate for joint success. The next 80 years will be just as exciting!

FROM CHICAGO TO THE WORLD: 80 YEARS OF ICAO



In December 2024, the Council of the International Civil Aviation Organization (ICAO) celebrates the 80th anniversary of the Chicago Convention.

THE CONVENTION ON INTERNATIONAL CIVIL AVIATION

“With full recognition of the sovereignty and juridical equality of all nations, let us work together so that the air may be used by humanity, to serve humanity.” – President Roosevelt’s invitation to States to join the Chicago Conference

New York or Buenos Aires, Tokyo or Nairobi – no matter where in the world a pilot navigates an airport, they will encounter the same signage and markings leading them to their designated runway. At night or in low visibility conditions, they can rely on standardised lighting systems to land their aircraft safely. Air traffic controllers communicate in the same manner with every cockpit crew, using a common language and procedures. Airlines have the same safety, maintenance, and operational standards across the world. These are just a few examples of how the International Civil Aviation Organization (ICAO) makes the modern global aviation network possible.

Over the last 80 years, ICAO has created a harmonised system across 193 countries to ensure safe and efficient worldwide air travel. When the Chicago Convention was agreed in December 1944, it outlined the crucial role of aviation in helping create and preserve friendship and understanding between nations and their people, for countries to work together and avoid conflicts. ICAO was born with the mission to coordinate the safe development of civil aviation. In the post war period, ICAO helped countries realise a rapid and dependable network of global air mobility, connecting families, cultures, and businesses all over the world.

Today, the importance of coordinated action in civil aviation is as essential as it was eight decades ago and requires ICAO and all its stakeholders to constantly adapt and respond to arising needs. ICAO assists States in managing the global aviation system by adopting over 12,000 standards and recommended practices (SARPs) that shape many aspects of flying today. SARPs have helped to significantly reduce aviation accidents,



ensuring that almost 5 billion air passengers can safely travel to their destinations every year. Thanks to the implementation of SARPs, countries can align their aviation regulations, creating a smoother and safer operational framework. And it is not just in the area of safety. SARPs developed by ICAO cover most aspects of air transport's daily operations, ensuring a globally-harmonised world, where possible, and through dedicated capacity building, fulfilling the mantra of 'No Country Left Behind':

Air traffic management: An aircraft flying from the Middle East to North America relies on consistent air traffic control (ATC) handovers between countries, which is made possible thanks to protocols established by ICAO's SARPs. This includes standards for ATC, airspace organisation, and communication protocols[1].

Airworthiness of aircraft: SARPs set global standards for the design, manufacturing, and airworthiness of aircraft, allowing aircraft produced in Brazil, China, Europe or the United States to be flown globally without additional certification[2].

Environmental protection: The first SARPs on environmental protection had already been adopted in 1971 when ICAO introduced global standards for noise emissions. Since then, ICAO has been instrumental in the decarbonisation of the aviation sector, defining carbon dioxide (CO_2) emission standards and facilitating a collective global long-term aspirational goal of net-zero carbon emissions by 2050 and a short-term vision to reduce the carbon intensity of the fuels aviation uses by 5% by 2030. ICAO also facilitated the definition of standards for the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). The CORSIA SARPs contain requirements for the monitoring reporting and verification of international aviation CO_2 emissions and fuel burn[3].

Passenger health and safety: Aircraft flying internationally must have the same emergency medical kits onboard and follow standardised health screening procedures if required. The Covid-19 pandemic highlighted the need for a coordinated response to global crises. ICAO played a key role in facilitating alignment of response measures between States and developing guidelines for safe travel, helping the aviation sector adapt and recover. These SARPs were instrumental in coordinating public health procedures at airlines and airports worldwide[4].

Personnel licensing: SARPs also establish common requirements for the licensing of pilots, air traffic controllers, and maintenance personnel, ensuring that these aviation professionals meet consistent training and competency standards. This facilitates mutual recognition of licenses across ICAO member states, enabling some aviation personnel to operate internationally[5].

These are just some areas where ICAO provides harmonisation across the globe. Over the last 80 years, SARPs were adopted on all aspects of civil aviation such as dangerous goods handling, search and rescue operations, accident investigation, customs and facilitation, meteorological services, air operator certification, flight crew fatigue management, or flight documentation.

Given the increasing complexity of the world's air transportation system, a new era of innovation, and the sector's goal to achieve net-zero carbon emissions by 2050, air transport is relying as much as ever before on ICAO's technical and diplomatic guidance to harmonise global aviation and chart the future for international flight.

5,500,000

Passengers in 1944[6].

↓

4,964,000,000

Passengers (scheduled) expected to be transported in 2024[7].

An increase of

90,155%

Compared to a global population increase of around 300% in a similar timeframe[8].

98,261,500,000

Passengers estimated to have been transported since the signing of the Chicago Convention until end 2023[9].

9,601,339,000

Revenue passenger-kilometres (RPKs) for scheduled traffic in 1945[10].

↓

8,173,170,124,000

RPKs for scheduled traffic in 2023[11].

An increase of

85,025%

52 States signing the Chicago Convention on 7 December 1944 (others were to follow in the years afterwards).

↓

193 States currently members of ICAO.

31,094

Direct airline jobs in the United States in 1944[12].

↓

552,025

Direct airline jobs in the United States in 2023[13].

An increase of

1,675%

1.55

Fatalities per 100 million RPKs in the USA, 1944[14].

↓

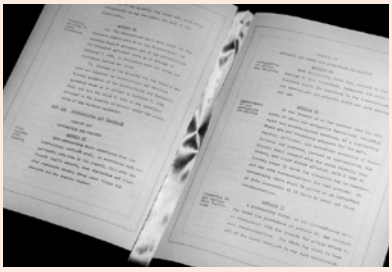
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Fatalities per 100 million RPKs (worldwide), in 2023[15].

A decrease of

99.94%





































2,400 km

Range of the Douglas DC-3, in commercial service in 1944.

↓

15,000 km

Range of today's longest-range aircraft.

An increase of

525%

4 days

The time it took to fly from London to Sydney in 1945[16].

↓

22 hours

The fastest current commercial flight from London to Sydney (with Project Sunrise expected to reduce this to just over 19 hours from 2026).

The Super Constellation took over the Sydney-London route in 1947 and reduced flight times to 93 hours. Stopping in Darwin, Singapore, Calcutta, Karachi, Cairo and Tripoli, the return fare was £585 (approx. $21,000 in today's money), equivalent to 130 weeks' average pay in Australia in 1947[17]. Today, the same journey can cost $1,500 in economy (just over one week of the average Australian salary in 2023).

14:35 hours

Scheduled service from New York to Los Angeles, 1945[18].

↓

6 hours

Current scheduled flight time average, New York John F. Kennedy (JFK) airport to Los Angeles (LAX) airport non-stop.

A decrease of

8 hours 35 minutes

8.5%

Average fuel expenditure as a total of airline costs in the USA, 1945[22].

↓

32%

Average fuel expenditure as a total of airline costs globally, 2023[23].

Wages in 1945 were around 50% of US airline costs. Today in the USA they represent 32.5% of airline costs[24].

Today's top 10 global airports which did not exist in 1944: Dubai, Dallas Fort Worth, London Heathrow, Denver, Istanbul and New Delhi[19].

228

Aircraft in the US fleet in 1944[20].

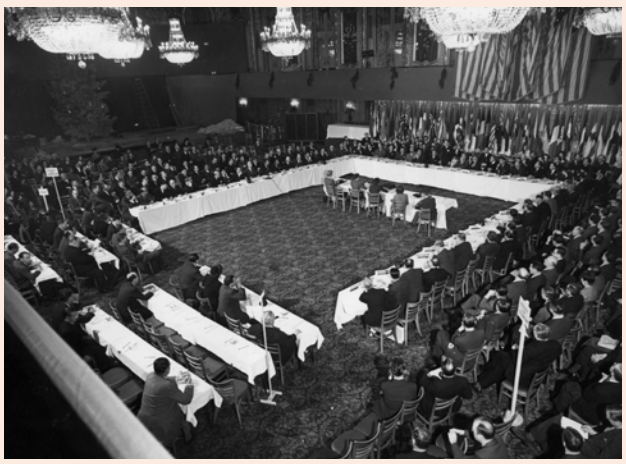
↓

7,222

Aircraft in the US fleet in 2024[21].







EXECUTIVE SUMMARY



Key facts and figures from
the world of air transport

86.5 million jobs

Jobs supported by aviation worldwide[25].

$4.1 trillion economic impact

Aviation's total global economic impact (including direct, indirect, induced and tourism catalytic)[32].

3.9% GDP

Global GDP supported by aviation[33].

All employment and GDP figures are for 2023, unless otherwise stated, to give a single set of data for one year. Where available, traffic and financial statistics data are for 2023.

These figures do not include other economic benefits of aviation, such as the jobs or economic activity generated when companies or whole industries exist because air travel makes them possible. They also do not include the intrinsic value that the speed and connectivity of air travel provides nor domestic tourism and trade. Including these would increase the employment and global economic impact numbers several-fold[34].

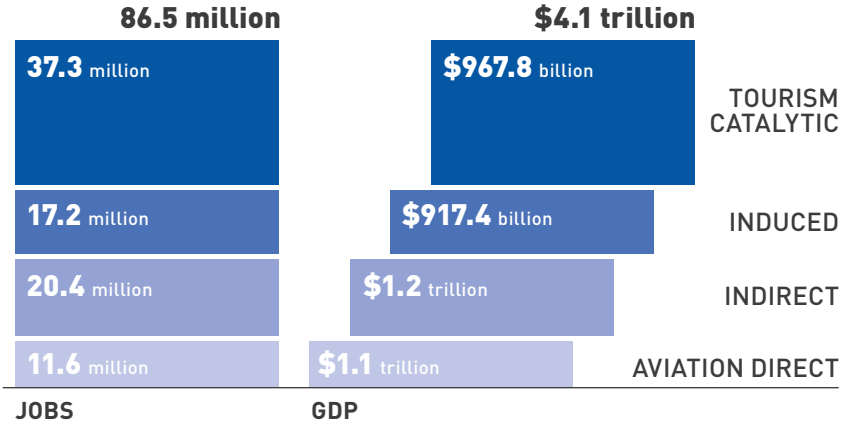
The figures in *Aviation: Benefits Beyond Borders* should be viewed as a snapshot of the aviation sector in 2023 and not as part of a trend. Differences in data sources mean the reports from previous years are not directly comparable.

In the latest study, Oxford Economics introduced data and methodological improvements that enhance the accuracy of the study results. These mainly include introducing new data sources on the share of inbound tourists arriving by air, improving estimates of tourists' in-country spend, and incorporating improved estimates from Tourism Economics' Global Travel Service on bilateral visitor flows.

Specifically, the tourism catalytic category of jobs and GDP have been revised. If the same methodology were applied to the results from the previous *Aviation: Benefits Beyond Borders* report, tourism catalytic jobs in 2018 would have totalled 41 million and the total aviation supported jobs would have been 83.9 million. See the methodology section for further details.

Beyond the industry

Aviation's global employment and gross domestic product (GDP) impact[26].



DIRECT JOBS

Airport operators[27]: 609,000

(operations, planning, engineering, security)

Other on-airport[28]: 5.9 million

(retail, car rental, government agencies such as customs and immigration, freight forwarders, some catering)

Airlines[29]: 3.1 million

(flight and cabin crews, executives, ground services, check-in, training and maintenance staff)

Civil aerospace[30]: 1.7 million

(engineers and designers of civil aircraft, engines and components, manufacturing technicians, logistics, maintenance, quality assurance, research and development and executives)

Air navigation service providers[31]: 214,000

(air traffic controllers, engineers, executives)

20th If aviation were a country, it would rank 20th in size by GDP (similar to Saudi Arabia and equivalent to 1% of global GDP for 2023)[35].

3x Globally, each aviation job generated $92,000 in gross value added (GVA). Aviation jobs are, on average, 3 times more productive than other jobs[36]. By opening markets and enabling knowledge transfer and other catalytic effects, aviation also makes jobs in other sectors more productive.

67,300 routes

Routes served globally in 2023[37]. Of these, around 21,000 are unique city pairs[38].

35.3 million flights

Scheduled commercial flights worldwide, 2023[41] (in 2024, 38.7 million flights are expected). Airports handled some 96 million aircraft movements (landing and take-off, including non-scheduled traffic) in 2023[42].

4.4 billion passengers

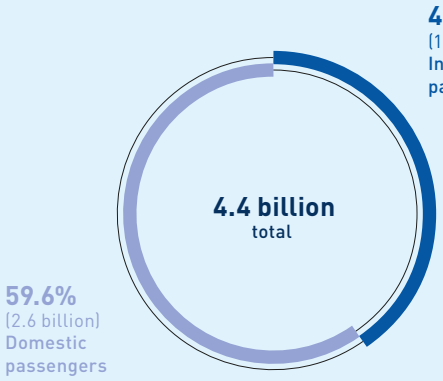
Passengers transported, 2023[39] (in 2024, 5 billion are expected). Airports, which count passengers on arrival and departure, handled 8.7 billion passenger movements in 2023[40].

8.17 trillion RPK

Scheduled revenue passenger kilometres (RPK), 2023[43].

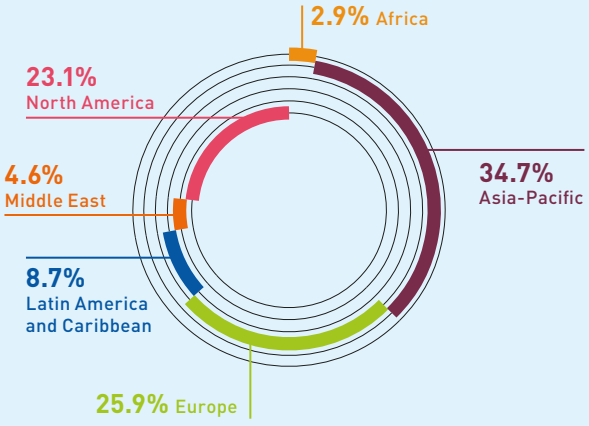
Global passenger split

International/domestic, millions[44].



Asia-Pacific in the lead

Regional passenger traffic split[45].



1,138 Commercial airlines[46].

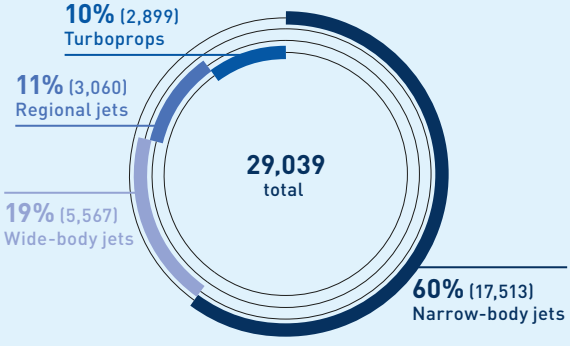
4,072 Airports with scheduled commercial flights[47] (it is estimated there are 45,527 airports and airfields in the world, including military and general aviation aerodromes[48]).

162 Air navigation service providers[49].

29,039 Commercial aircraft in service[50].

Aircraft types

Aircraft in commercial service, by type 2023[51].

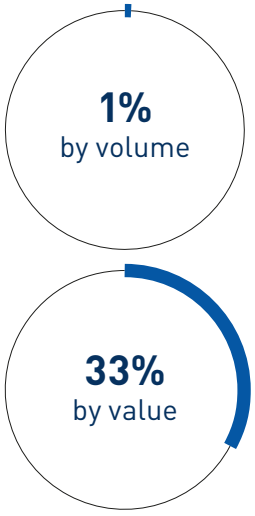


33% world trade

Air transport carries around 33% of world trade by value[52] and less than 1% by volume[53].

High value, time sensitive

Proportion of global trade transported by air.



61.4 million tonnes/freight

Tonnes of freight handled by air, 2023[54].

$8 trillion cargo/value

Value of cargo handled by air, 2023[55].

245.9 billion cargo tonne/kms

Scheduled cargo tonne kilometres, 2023[56].

58% international tourists

Percentage of international tourists who travel by air[57].



348.75 bn litres

Litres of jet fuel used by commercial operators (279 million tonnes), 2023[58]. This is 7-8% of global liquid fuel use[59].



$271 bn

Amount the world's airlines paid for fuel, 2023. This is 32% of airlines' expenses[60].

CLIMATE TARGETS

2050: Fly net-zero

Civil aviation has a goal to achieve net-zero carbon emissions by 2050, supported by accelerated efficiency measures, energy transition and innovation across the sector and in partnership with governments around the world.

2030: 5% less carbon intensive fuel

The sector also has a collective goal – reached through the UN specialised agency, ICAO – for aviation fuel to be 5% less carbon intensive by 2030, compared to today's fossil fuels, as part of a gradual shift towards sustainable aviation fuel and other cleaner energies.



882 m tonnes

Tonnes of carbon dioxide (CO_2) emitted by airlines, 2023[61]. This is 2.05% of the global human CO_2 emissions of around 43 billion tonnes[62]. Around 80% of aviation CO_2 is emitted from flights covering distances of over 1,500 kilometres (km), for which no other mode of transport exists.



6.1 m tonnes

Tonnes of carbon offsets or carbon removals purchased by airlines in 2023[63].



625 m litres

Litres of neat sustainable aviation fuel used by commercial flights in 2023 (500,000 tonnes). This was blended with traditional fuel[64]. While this only represents around 0.18% of the current fuel used in aviation globally, as this new source of fuel takes off, we will see this figure rise substantially. In 2023, sustainable aviation fuel (SAF) production was more than double the 300 million litres produced in 2022[65]. SAF production estimates for 2024 are at nearly 1.9 billion litres, accounting for 0.53% of airlines' total fuel consumption in 2024[66]. As at October 2024, there are 140 identified SAF projects underway, by 100+ producers in 31 countries[67].

ENVIRONMENTAL PROGRESS

The air transport industry has made significant progress in reducing its environmental impact:

- Decoupling CO_2 emissions growth (2% average from 1990) from air traffic growth (4.5%)[68].
- CO_2 emissions per seat kilometre down over 80% since the first jet aircraft in the 1950s.
- Civil aerospace spends $15 billion per year on efficiency-related research and development.
- A typical new generation single aisle aircraft coming off the production line today emits around 50 grams of CO_2 per seat kilometre (equivalent to 2 litres fuel burn per passenger for 100km, lower than that of compact cars, although aircraft travel much faster).
- Over 14.6 billion tonnes[69] of CO_2 avoided between 1990 and 2023 through a combination of new technology, operational efficiencies and infrastructure improvements, including airlines spending over $1 trillion on 19,360 new aircraft since 2009[70].
- In addition, airlines are investing in future fleet with a current aircraft production backlog of some 15,700 new technology aircraft due to enter the fleet over the next decade, further improving fuel efficiency[71].
- The industry has invested in new technology, better operations and improved infrastructure.
- Latest generation aircraft have up to a 75% reduction in the noise footprint since the first jets.
- Air traffic management modernisation, including the introduction of new technologies and procedures, is increasing capacity, shortening routes, improving efficiency and reducing delays, saving millions of tonnes of CO_2.

82.2%

Average aircraft occupancy, 2023[72]: much higher than other forms of transport[73].

Landing zone

Top 10 airports by total passengers, 2023[74].

Rank	Airport	Passengers 2023	Annual change
1	Atlanta Hartsfield-Jackson (ATL)	104.7 million	▲ 11.7%
2	Dubai (DXB)	87 million	▲ 31.7%
3	Dallas Fort Worth (DFW)	81.8 million	▲ 11.4%
4	London Heathrow (LHR)	79.2 million	▲ 28.5%
5	Tokyo Haneda (HND)	78.7 million	▲ 55.1%
6	Denver (DEN)	77.8 million	▲ 12.3%
7	Istanbul (IST)	76 million	▲ 18.3%
8	Los Angeles (LAX)	75.1 million	▲ 13.8%
9	Chicago (ORD)	73.9 million	▲ 8.1%
10	New Delhi (DEL)	72.2 million	▲ 21.4%

Passport, please

Top 10 airports by international passengers, 2023[75].

Rank	Airport	International passengers 2023	Annual change
1	Dubai (DXB)	87 million	▲ 31.7%
2	London Heathrow (LHR)	74.9 million	▲ 28.6%
3	Amsterdam Schiphol (AMS)	61.9 million	▲ 17.9%
4	Paris Charles de Gaulle (CDG)	61.4 million	▲ 18.6%
5	Singapore Changi (SIN)	58.4 million	▲ 83.1%
6	Istanbul (IST)	58.2 million	▲ 20.0%
7	Incheon (ICN)	55.8 million	▲ 212.9%
8	Frankfurt (FRA)	54.1 million	▲ 20.8%
9	Doha (DOH)	45.9 million	▲ 28.5%
10	Madrid (MAD)	43.8 million	▲ 20.9%

Due to an extended recovery period from Covid-19 restrictions, many Asian airports were not back to normal traffic situations by the end of 2023 which would impact the rankings.

This report provides a global view of a truly global industry. Oxford Economics analysed the economic and social benefits of aviation at a national level in 85[78] countries and used the results of that assessment to build the most comprehensive global picture of air transport's many benefits. Working with partners across the industry, the Air Transport Action Group (ATAG) has expanded the analysis to build a unique view of the air transport system, which creates and supports jobs, trade, connectivity, tourism, vital lifelines for many remote communities and rapid disaster response.

On average, every day in 2023...

- over **12 million** passengers travelled by air;
- **96,577** scheduled flights took place;
- **$21.9 billion** worth of goods were carried[79].

Air transport is a major contributor to global economic prosperity

Aviation provides the only rapid worldwide transportation network, which makes it essential for global business and tourism. It plays a vital role in facilitating economic growth and prosperity, particularly in developing countries and is important to the global distribution of goods, wealth and employment.

The industry transported 4.4 billion passengers in 2023 (noting that a number of people made multiple journeys by air), with scheduled revenue passenger kilometres (the distance flown by all passengers) totalling 8.17 trillion[80].

Air transport facilitates world trade. It helps countries contribute to the global economy by increasing access to international markets and allowing the globalisation of production. Some 61.4 million tonnes of cargo[81] was carried by air in 2023.

The total value of goods transported by air, $8 trillion, represented 33% of all international trade by value[82].

Aviation is indispensable for tourism, a major engine of economic growth, particularly in developing economies. Globally, 58%[83] of international tourists travel by air.

Connectivity contributes to improved productivity by encouraging investment and innovation, improving business operations and efficiency, and allowing companies to attract high-quality employees.

Aviation's global economic impact (direct, indirect, induced and tourism catalytic) was estimated at $4.1 trillion, equivalent to 3.9% of world gross domestic product (GDP)[84].

These figures do not include other economic benefits of aviation, such as the jobs or economic activity that occur when companies or industries exist because air travel makes them possible, the intrinsic value that the speed and connectivity of air travel provides, or domestic tourism and trade. Including these would increase the employment and global economic impact numbers several-fold.

Some 4,072 commercial airports[85] are served through a route network of several million kilometres managed by 162 air navigation service providers[86] with 1,138 airlines operating a total fleet of 29,039 commercial aircraft[87].

Long-haulage

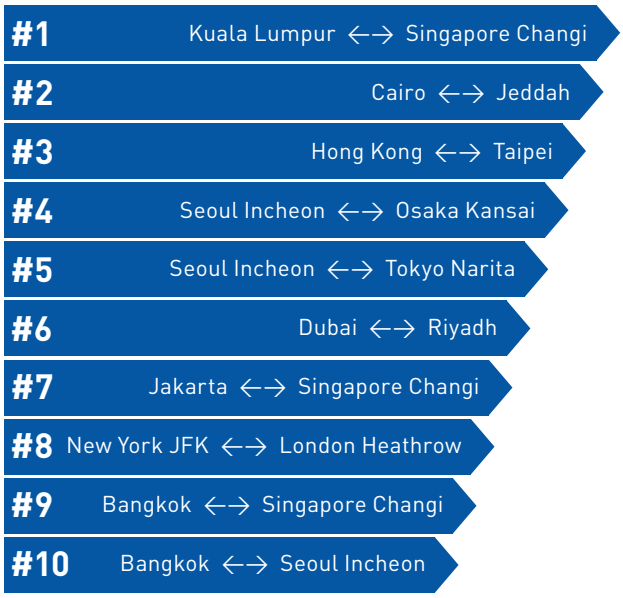
Top 10 airports by cargo tonnes, 2023[76].

Rank	Airport	Metric tonnes of cargo 2023	Annual change
1	Hong Kong (HKG)	4.3 million	▲ 3.2%
2	Memphis (MEM)	3.9 million	▼ 4.0%
3	Shanghai Pudong (PVG)	3.4 million	▲ 10.4%
4	Anchorage (ANC)*	3.4 million	▼ 2.4%
5	Incheon (ICN)	2.7 million	▼ 6.9%
6	Louisville (SDF)	2.7 million	▼ 11.1%
7	Miami (MIA)	2.5 million	▲ 1.0%
8	Doha (DOH)	2.4 million	▲ 1.5%
9	Los Angeles (LAX)	2.1 million	▼ 14.9%
10	Taipei (TPE)	2.1 million	▼ 16.8%

**Includes transit freight*

High capacity

Top 10 busiest global international flight routes (by seats), 2023.[77]



Air transport is a major global employer[88]

The air transport industry supported a total of 86.5 million jobs globally.

It provided 11.6 million direct jobs. Airlines, air navigation service providers and airports directly employed nearly 4 million people, and the civil aerospace sector, which manufactures aircraft systems, airframes and engines, employed 1.7 million people. A further 5.9 million people worked in other on-airport positions.

There were 20.4 million indirect jobs generated through the purchases of goods and services from companies in the air transport industry supply chain.

Industry employees supported 17.2 million induced jobs through the spending of wages.

Aviation-enabled tourism generated around 37.3 million jobs globally.

Air transport invests substantially in vital infrastructure

Unlike other transport modes, the air transport industry pays for a vast majority of its own infrastructure costs (runways, airport terminals, air traffic control), rather than being financed through taxation and public investment or subsidy (as is typically the case for road and railways).

In 2022, airports invested around $49.2 billion in construction projects, creating jobs and building new infrastructure[89].

Air transport provides significant social benefits

Air transport contributes to sustainable development. By facilitating tourism and trade, it generates economic growth, provides jobs, improves living standards, alleviates poverty and increases revenues from taxes.

The increase in cross-border travel is a reflection of the closer relationships developing between countries, both between individuals and at state level. In the same way, eased restrictions on the movement of goods and people across borders facilitate the development of social and economic networks that will have long-lasting effects. This improved flow of people and goods benefits the host and the originating countries, encouraging increased social and economic integration.

Air transport offers a vital lifeline to communities that lack adequate road or rail networks. For many remote communities and small islands, access to the rest of the world and to essential services, such as health care, is often only possible by air.

Aviation's speed and reliability are perhaps most immediately apparent in the delivery of urgently needed assistance during emergencies caused by natural disaster, famine and war. Air services are particularly important in situations where physical access is problematic.

Air transport is working to mitigate its environmental impact

The industry is taking active steps to address the environmental impact of aviation, particularly linked with carbon dioxide emissions. Airline operations produced 882 million tonnes of carbon dioxide (CO_2) in 2023, 2.05% of the total human carbon emissions of around 43 billion tonnes.

The aviation sector agreed in 2008 to the world's first set of sector-specific climate change targets. In October 2021, the aviation industry took its climate commitment one step further by raising its ambition to achieve net-zero carbon emissions by 2050 for global civil aviation operations; a goal which was subsequently adopted by ICAO in 2022.

This assumes the right level of support from governments, the finance sector, the energy industry and research institutions. The industry itself will also need to redouble efforts.

The ATAG *Waypoint 2050* (see p36) report outlines a number of key elements to achieve the decarbonisation of air transport, including: scaling-up of sustainable aviation fuel (SAF) and new energy sources; evolutionary and revolutionary technology to improve aircraft efficiency; efficient operations and improved infrastructure; and investments in high-quality carbon offsets in the near term and carbon removal opportunities in the longer term, to fill the remaining emissions gap.

Today's sustainable aviation fuels can reduce CO_2 emissions by up to 80% over their lifecycle compared with conventional fuels from fossil sources. Aviation may need up to 490 million tonnes of sustainable aviation fuel per year by 2050 in order to achieve its net-zero goal. The capital investment required has been estimated at some $1.5 trillion over 30 years – or 6% of traditional oil and gas capital expenditure when averaged out each year.

Besides addressing CO_2 emissions, the industry is also taking steps to reduce wider environmental impacts, including technologies to enable significantly quieter aircraft, reductions in non-CO_2 emissions including nitrogen oxides (NOx) and non-volatile particulates, and more sustainably-minded business practices to improve material recycling and reduce waste.

Aviation brings unparalleled connectivity

Aviation is an integral part of any future transport ecosystem. It provides overall global mobility and is in many cases the only practical connection in a national and international context: both for global routes between developed and emerging economies, between international business centres and also access to remote communities where building rail or road infrastructure would be too costly.

Restrictive trade policies will dent future global benefits of aviation

Forecasts suggest that in 2043 aviation could support 135.4 million jobs and $8.5 trillion in economic activity.

However, if growth were to slow due to restrictive trade, immigration and/or political factors, the total number of jobs supported by the air transport sector (including air transport-supported tourism) could be reduced by more than 18.5 million below the baseline forecasts. The air transport sector would contribute 5.6 million fewer jobs and $1.2 trillion less in world GDP.



A GLOBAL INDUSTRY DRIVING SUSTAINABLE DEVELOPMENT



Aviation's **global economic, social and environmental profile** in 2023

The global air transport industry supports 86.5 million jobs worldwide and contributes $4.1 trillion (3.9%) to global GDP.

Aviation plays a critical role in sustainable development. Although the core economic, social and environmental elements of sustainability have long been understood, the United Nations 2030 Agenda for Sustainable Development set 17 more specific sustainable development goals (SDGs) that the world should aim to achieve by 2030. A number of these goals are based on improving the living conditions and economic prosperity of people all over the globe. The SDGs are backed up by around 170 statistical indicators.

To realise these ambitious goals, the international community must work towards shared sustainable economic growth, creating jobs and boosting economic activity worldwide. The following section provides a high-level overview of how the aviation sector contributes to the SDGs through its economic and social benefits.



1
NO POVERTY



2
ZERO HUNGER



3
GOOD HEALTH AND WELL-BEING



4
QUALITY EDUCATION



5
GENDER EQUALITY



6
CLEAN WATER AND SANITATION



7
AFFORDABLE AND CLEAN ENERGY



8
DECENT WORK AND ECONOMIC GROWTH



9
INDUSTRY, INNOVATION AND INFRASTRUCTURE



10
REDUCED INEQUALITIES



11
SUSTAINABLE CITIES AND COMMUNITIES



12
RESPONSIBLE CONSUMPTION AND PRODUCTION



13
CLIMATE ACTION



14
LIFE BELOW WATER



15
LIFE ON LAND



16
PEACE, JUSTICE AND STRONG INSTITUTIONS



17
PARTNERSHIPS FOR THE GOALS

ENABLING ECONOMIC GROWTH

Direct impacts

The industry itself is a source of considerable economic activity, creating jobs that directly serve passengers at airlines, airports and air navigation service providers (ANSPs). These include check-in, baggage handling, on-site retail, air traffic controllers, cargo and catering facilities. In addition, aviation directly enables high-skilled jobs in the manufacturing sector with those companies that produce aircraft, engines and other vital technologies.

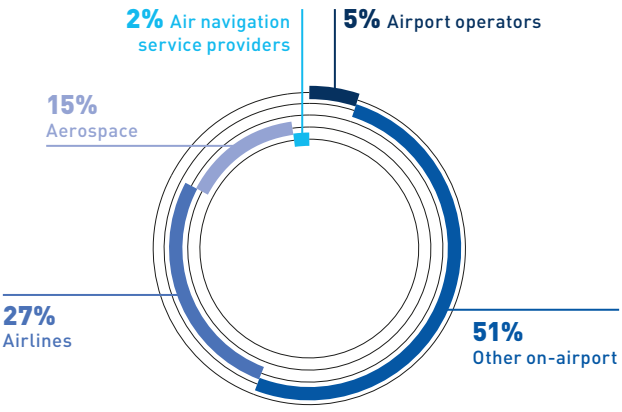
The world's 1,138 airlines[90] collectively transported 4.4 billion passengers[91] to 4,072[92] commercial airports all over the globe in 2023 and carried 61.4 million tonnes[93] of freight. To enable this activity, the industry generated 11.6 million direct jobs and added $1.1 trillion to global gross domestic product (GDP). To put that into context, that is equivalent to 1% of global GDP, or similar to the global motor vehicle manufacturing sector ($1.1 trillion)[94].

The air transport industry directly provided an estimated 11.6 million jobs worldwide:

- The airport sector accounted for 6.5 million jobs (56% of the total). Of these, 609,000 positions were with airport operators (such as airport management, maintenance and operations). On-site employment (for example at retail outlets, restaurants, hotels, government agencies) created an extra 5.9 million jobs, or 51% of the total.
- 3.1 million jobs (27%) were provided by airlines (for example, flight crew, check-in staff, maintenance crew, reservations and head office staff).
- In the civil aerospace manufacturing sector, 1.7 million jobs (15%) were supported, employing people in the building of civil aircraft and their associated parts, such as engines, electronic systems and components.
- Air navigation service providers employed an additional 214,000 people (2%).

What we do

Direct employment in air transport by segment [95].



Growth in traffic at airports also brings growth in the direct jobs generated. A common rule-of-thumb calculation is for every million passengers an airport handles around a thousand jobs are created on-airport[96]. This impact reduces slightly as airports grow (due to efficiencies of scale), and this only relates to direct jobs at an airport and not the wider employment and economic benefits of connectivity growth across the economy (or even in indirect and induced employment).

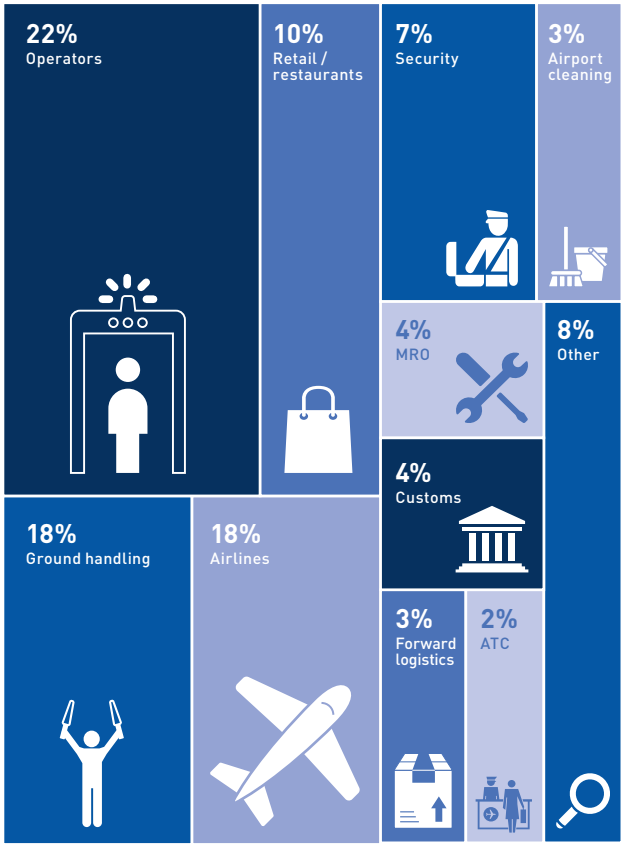
Growing in tandem

How growth in passenger numbers helps support growth in direct employment[97].

Airport size	Each 1,000 passenger movements generates
0 — 1 million passengers	+1.20 jobs
1 — 10 million passengers	+0.95 jobs
Over 10 million passengers	+0.85 jobs

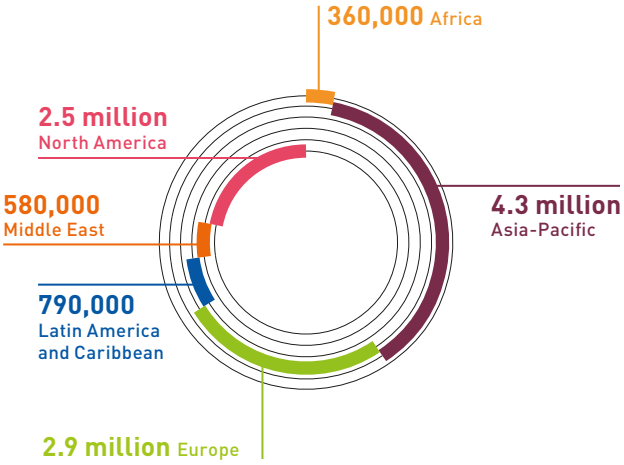
On the ground

Overview of the types of jobs at a typical European airport[98].



Where we work

Direct employment by air transport by region[99].



The role of many parts of the industry is well known, but there are a number of players who are not quite so visible. Ground handlers provide contract services for airlines, often when the airline has a limited number of flights into an airport and employing its own staff would not make sense. These can be check-in and gate agents, dispatch, fuelling and cleaning services for airlines. Four of the world's largest independent ground handling companies, dnata, Menzies, SATS, and Swissport employ more than 200,000 staff between them[100]. Many airports and airlines also employ their own ground handling teams.

The economic impact of the aviation industry does, however, go further than just its direct impacts. The consequential economic benefits of both additional jobs and GDP should also be considered. These benefits demonstrate at least partially the breadth of air transport's economic reach.

Indirect impacts

Indirect impacts include employment and activities of suppliers to the air transport industry – for example, aviation fuel suppliers; construction companies that build airport facilities; suppliers of sub-components used in aircraft; suppliers of products such as radars and satellite-based navigation systems to the air traffic management industry; manufacturers of goods sold in airport retail outlets; and a wide variety of activities in the business services sector (such as call centres, consultancies, information technology and accountancy).

Just over 20.4 million indirect jobs globally were supported through the purchase of goods and services by companies in the air transport industry. This supply chain activity contributed approximately $1.2 trillion to global GDP.[101]

Induced impacts

The spending of those directly or indirectly employed in the air transport sector supports additional jobs in industries such as retail outlets, companies producing consumer goods and a range of service industries (such as banks, telecommunication providers and restaurants). Worldwide, 17.2 million induced jobs globally were supported through employees in the air transport industry (whether direct or indirect) using their incomes to purchase goods and services for their consumption[102].

The induced contribution to global economic activity was estimated at $917.4 billion.

Supporting wider economic development

Although this report has explored the direct, indirect and induced impacts of the global aviation industry, there is far more to air transport's economic impact. Many other industries rely on effective air links to function.

- One of the industries that relies most heavily on aviation is tourism. Without the connectivity provided by flight, many countries that rely on a steady inflow of tourists (particularly developing countries in regions remote from their source tourism markets) would not be able to enjoy their present levels of economic growth.
- World trade in a vast range of commodities and services is facilitated by air travel, increasing countries' access to international markets and allowing the globalisation of production.
- Countries also need connectivity to fully participate in the worldwide economy, encouraging higher productivity, investment and innovation. Connectivity helps businesses operate efficiently and attract high-quality employees.
- Air transport plays an especially pivotal role in 'just-in-time production' where parts are only produced and delivered in the quantity and at the time actually required to fulfil customer orders, and in speeding fresh produce to global markets.
- Airports play an increasingly important role in supporting the communities they serve through direct and indirect employment, diverse economic activity and the catalytic economic benefit they bring to local, regional and national economies.
- These wider economic benefits were acutely felt in 2020 with the global shutdown of travel and tourism. A significant proportion of the economic damage was caused by a halt in connectivity.

Other than for tourism, the exact economic impact of these wider benefits is difficult to determine given the complexity of the global economy. Tourism's effects are easily assessed. Since reliable data exists, its flow-on impacts and the economic links between the two industries are explored below.

Aviation supports tourism

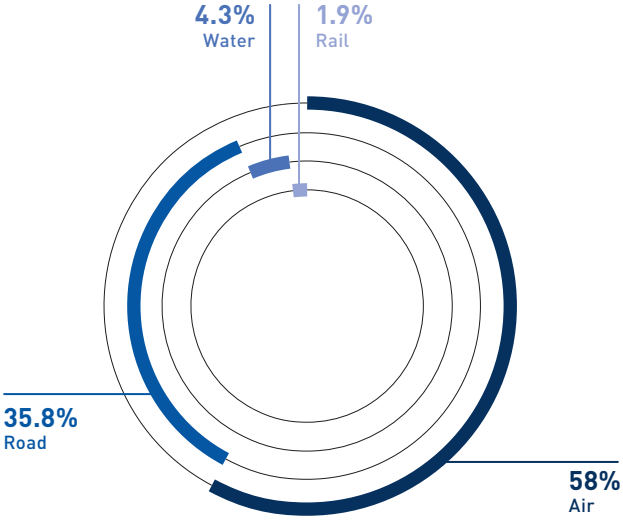
Tourism represents a significant contribution to the worldwide economy, providing employment and boosting global economic activity. In 2023, travel and tourism supported 330 million jobs and made up 9.1% of world GDP, a total of $9.9 trillion[103]. The link to aviation is clear, for example these employment figures include the people who work for the world's 56,951 International Air Transport Association (IATA)-accredited travel agencies[104].

According to the World Travel & Tourism Council (WTTC), the sector's growth will continue into the future, with an average annual growth of 3.7% forecast up until 2034. If these predictions prove correct, by 2034 travel and tourism should account for 11.4% of global GDP ($16 trillion) and provide 449 million jobs globally (12.2% of total employment)[105].

Tourism's growth, which is above the average of wider economic growth, is dependent on travel, particularly air transport. In 2023, 58% of international tourists travelled to their destination by air[106]. Tourists spent approximately $1.2 trillion in 2023, a 1% increase on the year before[107]. For developing countries in particular, air links provide a vital economic lifeline to communities. In Africa, an estimated 5 million people are employed in areas supported by the steady influx of overseas visitors, most of whom arrive in the region by air. In addition, these arrivals by air supported an estimated $42 billion contribution to GDP in African economies in 2023.

Getting you there

Travel modes of international tourists, 2023[108].



For small island states, the economic input provided by international tourists is invaluable. These countries, many of which are in remote parts of the world, enjoy tourism-induced economic boosts which would not be available without air links.

The contribution of air transport to tourism employment and GDP:

» Direct: An estimated 16.4 million direct jobs in tourism globally were supported by the spending of foreign visitors arriving by air. This includes jobs in industries such as hotels, restaurants, visitor attractions, local transport and car rental, but excludes air transport industry jobs.

Tourism supported $10 trillion of economic activity and 330 million jobs.

» Indirect and induced: A further 21 million jobs were supported through the tourism industry's supply chain spending and the wage-financed consumption of employees.

When these factors are viewed together, air transport supported 37.3 million jobs within the tourism sector, supporting $967.8 billion a year to global GDP[109].

Travel and tourism competitiveness is increasing worldwide, especially in Europe, Asia-Pacific, the Middle East and North Africa[110]. The trends show that tourism from and between developing economies is growing steadily; however, as incomes rise in emerging economies and airfares fall, one of the obstacles to international travel remains restrictive visa regimes, even for tourism purposes. The good news is that the trend shows countries are realising the unnecessary barrier that these entry procedures place on their own tourism sector, curtailing economic opportunities and job creation.

According to UN Tourism, 47% of the world's population is required to obtain a traditional visa prior to travelling, a significant improvement from 2008, when 77% of the world's population required a traditional visa. Some 21% of the global population is exempt from visa requirements, 18% of the population can benefit from electronic visas and 14% from a visa-on-arrival[111]. At the same time, the tourism sector is coming under pressure as local populations react to stresses on services and accommodation, and the tourist sector responds to climate concerns. In both areas, the tourism and transport sectors will need to work to alleviate these challenges.

A driver of global trade

The international trade of goods and services is one of the key drivers of global economic growth and development. The rise of e-commerce and the ability of people and businesses to trade with others all over the world is one of the key features of our modern, globalised society. Alongside the internet and other transport modes, air transport is a vital enabler of the global economy.

$8 trillion worth of goods was transported internationally by air in 2023.

Air transport is, of course, not the only means of transporting goods over long distances, with shipping and trucking representing a larger proportion of freight by volume. For time-sensitive global industries, however, such as those that require components produced in multiple parts of the world, air freight is the best way to ensure that production lines run smoothly and efficiently.

In the past years, driven by advances in internet commerce, a whole new sector of rapid delivery 'e-commerce' businesses have been established and are thriving entirely based on the ability to move goods to consumers safely and quickly. E-commerce was particularly important during the Covid-19 pandemic, with 2.14 billion people shopping online in 2021. In 2022, e-commerce sales increased by 28.5% in the United Kingdom and 55.6% in China[112].

Around 80% of cross-border e-commerce is transported by air. A 2022 forecast estimated e-commerce sales would reach USD 2.1 trillion in 2023, a 13% increase in a single year. The same forecast estimates that 95% of all purchases will be made through e-commerce by 2040[113].

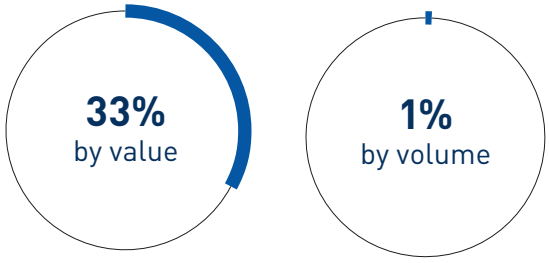
The pharmaceutical industry is a sector which relies heavily on air transport to move medicines and vaccines across long distances under strictly regulated storage conditions. In some cases, it is the perishable nature of the goods that requires swift transportation. In other situations, such as vaccines, it is the necessity of getting the products to the people who need them as quickly as possible. At the height of the Covid-19 response, air transport's unique airlift capabilities allowed governments to rapidly accelerate the delivery of medicines and vaccines, ventilators, personal protective equipment and to repatriate citizens in an effort unlike the world has ever seen.

In the Americas, the Pan American Health Organization has a significant immunisation programme against measles, rubella, polio, and hepatitis and in 2022 and 2023 delivered 130 million doses covering 80% of children in the Americas[114]. Similarly, in Africa, air cargo supply chains using drones have significantly enhanced healthcare. Zipline International, with funding from Gavi (the vaccine alliance) and the UPS Foundation, has operated in Ghana and Rwanda for several years and in 2023 delivered a total of 28,754 units of blood to patients in Rwanda in a critical condition. Most were women in critical moments of childbirth which has led to a 51% reduction in deaths caused by postpartum haemorrhage in the country. In sub-Saharan Africa, 26% of maternal haemorrhage deaths are due to lack of access to blood[115].

The specialist nature of air freight is highlighted by comparison with other modes of transport. While air freight accounts for less than 1% of the tonnage, it makes up around 33% of the value of international trade.

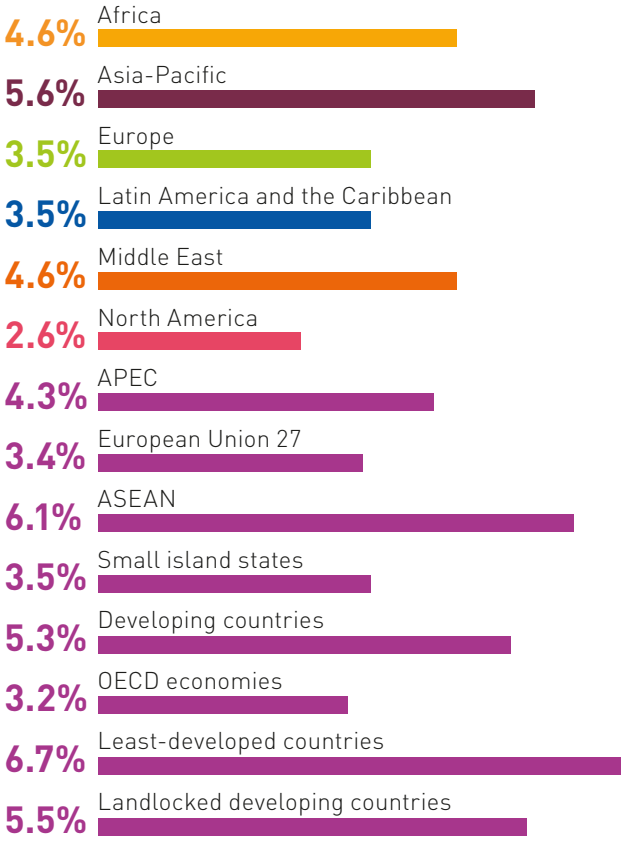
Small volumes, big values

Air freight by volume, 2019 and by value, 2023[116].



Sustaining growth

Projected average annual growth rate for international traffic by region, 2023-2043[117].





Bringing business partners together

The sharp increase in the level and quality of telecommunication technology has made meetings between business partners easier to undertake without travelling long distances in person. However, while virtual meetings are useful in some situations (and particularly showed their worth during the Covid-19 shutdown), in many cases professionals feel that in-person interactions are far more effective. This is often due to the fact that rich details can be seen from each other during face-to-face meetings: from body language, mannerisms and subtle tone of voice to how one enters the room and the small talk shared in side-line conversations – factors that can be crucial for decision making, negotiations and team building.

Some of these factors can be captured with live video of virtual meetings but they are still limited to a flat representation of a person and the quality of the connection. The personal relationships built up between representatives of companies are considered to be an important part of business. In some countries, for example Japan, China and Brazil, it is customary to interact and bond with a client or possible business partner on a personal level before carrying on with important business. To earn trust, in-person meetings are an essential investment[118].

A Harvard Business Review survey found that despite advances in technology, business travel remained essential, with 79% of respondents viewing in-person meetings as the most effective way to meet clients and sell business, and 89% saying that face-to-face meetings are essential for sealing a deal[119]. Face-to-face requests have also been shown to be 34 times more likely than virtual communications alone to garner positive responses[120]. While the industry is experiencing a gradual return to business travel in the post-Covid environment, this segment will eventually return as businesses confirm the richness of interaction available via in-person meetings.

Infrastructure at its core

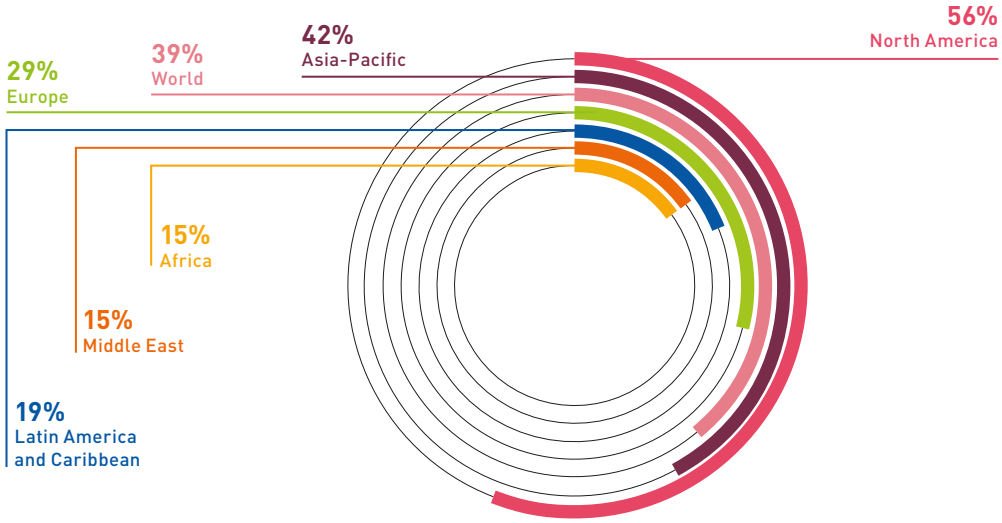
When one looks at the array of air transport infrastructure around the world, such as airport terminals, runways and air traffic management, it is easy to forget that the vast majority is financed by its end users: passengers and shippers. The aviation industry on the whole pays for its infrastructure, rather than relying on government investment or subsidies. This is in stark contrast to other modes of transport, such as rail and road.

The investments made by the industry in developing its infrastructure, particularly on-airport, lead to further benefits for local communities, often providing skilled labour for construction as well as long-term regional benefits from improved surface access and employment around airports. Airports are wealth generators as a result of increased economic activity. Their socio-economic impact and multiplier effects extend to the broader economy. Some $49.2 billion was invested in airport infrastructure in 2022[121]. Asia-Pacific was still in Covid-19 recovery mode in 2022, so the best data for airport construction spending comes from pre-Covid ratios, with most investment taking place in North America, followed by Asia-Pacific and Europe.

To give a sense of the potential magnitude of the increase in passenger numbers from airport infrastructure investment, Oxford Economics compared the per capita airport infrastructure investment in 50 countries with the increase in air arrivals relative to each country's population over the same period[123]. This analysis found that an increase in airport infrastructure investment of $100 per capita over the nine-year period is associated with nearly 50 more passenger arrivals per capita, on average[124]. These additional passengers would have spent money on goods and services, forged friendships and cultural connections, and done business, all of which would have stimulated economic activity and jobs.

Building the future

Airport infrastructure investment as % of total revenue, per region 2019[122].



Operational costs in aviation are funded through user charges (on passengers and airlines) and airport commercial revenue. Passenger-based charges are generally included in the price of the airline ticket, while aircraft-based charges are directly invoiced to airline clients. When investing in modern aircraft and airport construction to meet industry growth, it is vital that air traffic management is also upgraded and modernised to cater to increasing demand. Investment is needed to increase capacity, efficiency and avoid congestion and delays.

Paying our own way

Relative to other modes of public transport, such as rail and road which are subsidised, aviation covers most of its infrastructure costs and air transport compares favourably as a cost-effective sector. Analysis for the European Commission[125] shows the cost of infrastructure and externalities for different transport modes, comparing them to taxes and charges levied. All modes of passenger and freight transport were considered including road, rail, inland waterway, maritime and aviation. Externality costs include accidents, air pollution, climate change, noise, congestion, well-to-tank emissions and habitat damage. Airlines and their passengers pay the cost of the infrastructure they use in the European Union (EU), both on the ground and in the air (air traffic management). By contrast, the infrastructure costs for rail are significantly higher relative to aviation. The total infrastructure costs for rail are estimated at €81 billion (versus €14 billion for airports). The revenue from taxes and charges on rail users covers only a relatively small portion of infrastructure costs for diesel, electric and high-speed trains.

According to the European Commission, rail subsidies in Europe totalled roughly $38.7 billion (€35bn) in 2022[127]. Meanwhile, aviation subsidies for public-service obligation routes to remote communities and small islands came to €244 million in 2022[128] – or less than 1% of the subsidies given to rail. In 2022, the EU state aid data shows that some $76 million (€71.1m) in support was provided to aviation partners for normal operational elements. In addition, some $1.4 billion (€1.3 bn) was provided as part of Covid-19 support or compensation for natural disaster impacts. In 2023, these figures returned to a more normal level, with $250 million (€227m) granted, although this also includes compensation for the impact of conflict in Ukraine and €60m in support for environmental programmes in the Netherlands.

In developing economies, some air transport infrastructure is financed through World Bank project loans. In 2022, this amounted to $1.02 billion in investment, an increase of 9% compared to the previous year. This amounts to only 2.65% of the World Bank's $38.32 billion transport portfolio[129].

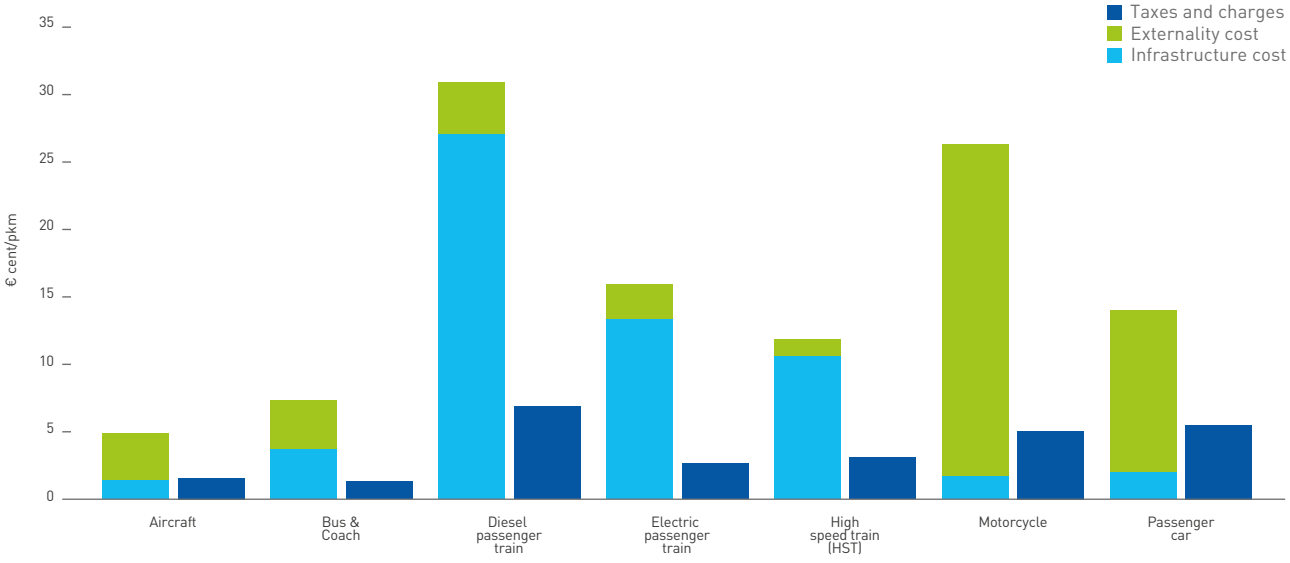
There is significant scope for international financing to help improve connectivity, particularly for remote regions. Governments could ensure that air transport is part of their mobility planning for both urban and rural access and could access funding from multilateral institutions.

The Single African Air Transport Market (SAATM) is a flagship project of the African Union Agenda 2063 to create a single unified air transport market in Africa to advance the liberalisation of civil aviation, and act as an impetus to the continent's economic integration. SAATM will ensure aviation plays a major role in connecting African countries, promoting its social, economic and political integration and boosting intra-Africa trade and tourism as a result.

Air traffic management (ATM) investment needs long-term planning as there are long lead times for procuring new equipment and systems. It is critical that ANSPs have the ability to appropriately finance such investments to support the timely modernisation of their systems.

European transport

Comparison of the costs of transport infrastructure, versus the tax and charge revenue[126].





Stimulus for greater productivity

Arguably, the largest economic benefit of increased connectivity comes through its impact on the long-term performance of the wider economy by enhancing the overall level of productivity. A rise in productivity in firms outside the aviation sector comes through two main channels: the effects on domestic firms of increased access to foreign markets and increased foreign competition in the home market and the freer movement of investment capital and workers between countries.

Improved connectivity

- » opens new markets, boosts exports and increases competition and choice in the home market from foreign-based producers, encouraging firms to specialise in areas where they possess a comparative advantage;
- » drives down costs and prices for firms that have a comparative advantage (such as innovative products and services), benefitting domestic consumers in the process;
- » opens domestic markets, which can also be an important driver for reducing unit production costs, either by forcing domestic firms to adopt best international practices in production and management methods or by encouraging innovation; and
- » benefits domestic customers through competition by reducing the mark-up over costs that firms charge their customers, especially where domestic firms have hitherto enjoyed some shelter from competition.

Improved connectivity can further enhance an economy's performance by making it easier for firms to invest outside their home country, which is known as foreign direct investment. This necessarily entails some movement of staff, whether for technical know-how, management oversight, or servicing and meeting customers. Increased connectivity also allows firms to exploit the speed and reliability of air transport to ship components between plants in distant locations, without the need to hold expensive stocks of inventory as a buffer.

Less tangibly, but just as importantly, improved connectivity increases passenger traffic and trade. This, in turn, can lead to a more favourable environment in which foreign firms can operate – greater links to the outside world often drive a more conducive global business environment.

A driver of innovation

Since the dawn of air travel, aviation has been at the forefront of technological innovation, researching and developing disruptive, ground-breaking technology with each new generation of aircraft. There are many motivations for this drive in technological advancement. Not only do more efficient aircraft, engines and air navigation systems have a positive environmental impact through reduced fuel use and associated emissions, but they also lower fuel costs for airlines in the long-term, also leading to more affordable air travel.

Aviation's focus on technological innovation has other benefits for society. It encourages research at universities and results in a highly skilled section of a country's workforce.

Aerospace also drives the development of technologies that can be used in other sectors. The aviation sector was one of the pioneers in the use of additive layer manufacturing (also known as 3D printing). Many components of next-generation aircraft will be made using this technique. Composite materials, such as carbon fibre and ceramic composites, also owe much of their development to aviation research and development – and make up significant proportions of the finished product of modern, lightweight aircraft, such as the Boeing 787 and Airbus A350 XWB.

In economic impact, the aerospace sector plays a substantial role in the regions where it is based. According to the Aerospace, Security and Defence Industries Association of Europe (ASD), civil aeronautics in Europe created a $118 (€114) billion turnover in 2022, with $10.6 (€10.2) billion invested by private and public stakeholders in research and development in 2022[130]. Exports from European civil aerospace manufacturers totalled $101.9 (€98.3) billion in the same year[131]. In the United States, total civil aerospace exports amounted to a $114 billion contribution to the national economy in 2023[132].

Affordability of air travel

A key driver in the growth of passenger traffic has been the steady decrease in the real price of air travel. Since the 1950s, air travel costs have decreased by almost 75%[133]. This decline is attributed to several factors, including economies of scale, improved efficiency in service delivery, and advancements in aircraft fuel efficiency. Also contributing was the deregulation of the aviation market in the 1980s, the development of more fuel-efficient aerospace technologies and the introduction of low-cost carriers. Compared to twenty years ago real air transport costs have more than halved. It is now more affordable for more of the population to travel by air.

In the United States, for example, the average domestic round-trip airfare fell by 28.4% between 2000 and 2023[134]. This decrease in cost has led to an increase in the accessibility of air travel – the democratisation away from a pursuit just for the wealthy to a part of normal, middle-class life, especially in the developed world. According to a recent survey, 68% of Americans with household incomes under $50,000 have flown in their lifetime. Some 86% of American adults have flown at least once in their lives, with 49% in the past 12 months[135]. Statistics in the United Kingdom for 2023 show similar results. The majority of UK adults (54%) had flown within the last 12 months – a 23% increase compared to 2022[136]. But flying is also becoming increasingly accessible in the developing world, with low-cost carriers opening up business and leisure travel to more and more citizens.

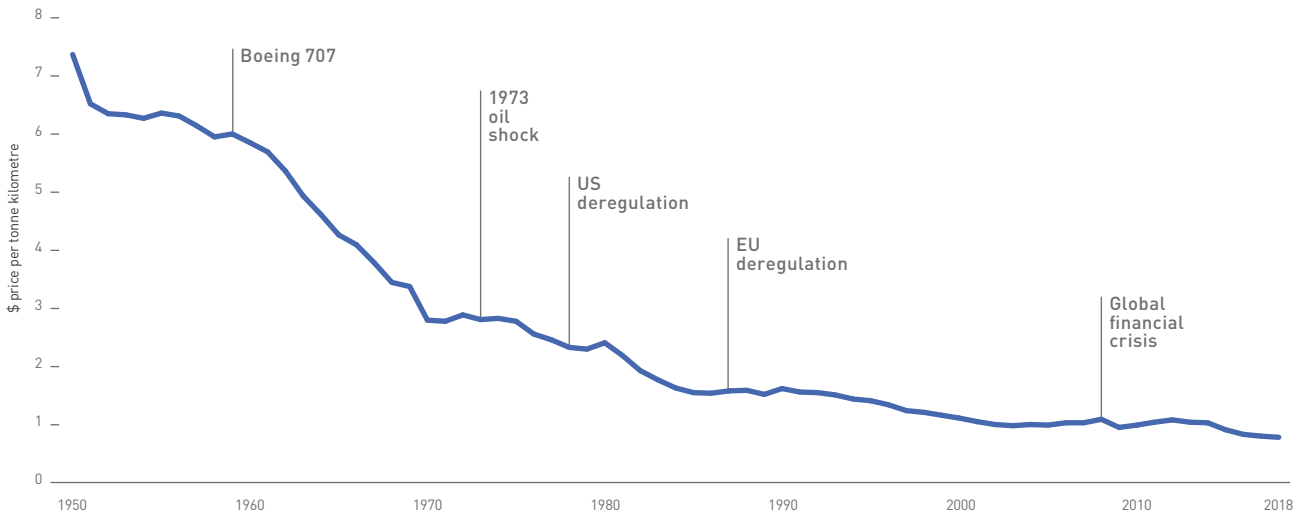
The impact of taxes

Tax revenues are vital to finance social and economic programmes administered by the state. However, a tax that is levied on individual consumers or firms could represent a market distortion. There are jurisdictions where providers and users of aviation infrastructure face a significant tax burden. This, in turn, may lead to a loss in competitiveness and opportunities for air service development aimed at enhancing connectivity and trade. Inefficient and burdensome tax measures that increase the cost of air travel will have a negative effect on demand and may hamper economic growth.

Consistent with the International Civil Aviation Organization (ICAO) Policies on Taxation in the Field of International Aviation, taxes on international air transport services should only be levied in a justifiable, equitable and non-discriminatory manner.

A good deal

Evolution of the average price of air travel ($ per revenue tonne kilometre), in real terms[137].



The impact of Covid-19

2020 marked the year of the greatest disruption in the history of civil air travel. As the Covid-19 pandemic shook the world and countries imposed lockdowns and travel bans, international passenger traffic plunged 94.4% in April 2020 vs April 2019 with 64% of the global fleet grounded [138].

There had been reductions in passenger traffic caused by shocks in the past, but never a near total shutdown of the global system. This had a devastating impact on travel and tourism, and on the frontline companies operating the aviation system and the rest of the supply chain. Airlines lost $372bn of gross passenger operating revenues in 2020 alone and airports lost $72.7 billion, or 43%, in the same year[139]. Aircraft manufacturers incurred $12 billion in losses. By July 2022, more than 2.3 million jobs had been lost across airlines, airports and civil aerospace groups – a 21% reduction compared with pre-pandemic levels[140].

However, air transport was not only negatively impacted by Covid-19, it also supported the fight against the virus with what it does best: transporting people and goods to where they are needed: 39,200 special registration flights by airlines transported over 5.4 million citizens to their homes after borders were closed around the world in March 2020. As one of the first measures to support the fight against the virus, airlines around the globe started to transport medical and personal protective equipment to the regions most affected by the public health crisis. Around 46,600 special cargo flights transported some 1.5 million tonnes of cargo to areas in need during the height of the pandemic response[141].

Aircraft and engine manufacturers joined the effort to combat Covid-19 in an unconventional way by putting their infrastructure, resources, skills and technologies into use to produce ventilator parts and filtration systems for the healthcare sector or face shields for medical professionals[142].

Later on, air transport played a crucial role not just in expediting the distribution of Covid-19 vaccines around the globe, but also in transporting critical equipment such as ultra-cold chain freezers, syringes and safety boxes. In 2021, 34 million vaccines were administered globally every day. There was a need for fast global distribution as vaccine production was centralised in Europe, the United States and India. With many vaccines having short expiration dates, shipping by sea would have been impractical. Some vaccines require a temperature of -70 degrees Celsius for cooling and the air cargo sector has a well-built and certified network of airlines and facilities to meet these special handling requirements[143]. It was estimated that vaccinating the world would require up to 15,000 flights between 2021 and 2023 to transport almost 15 million cooling boxes[144].

Today, the pandemic lies behind us and the industry is back on track. By February 2024, air travel had surpassed 2019 levels. Despite facing the worst crisis in its history, by the end of 2024, the air transport sector has largely recovered from the shock of the global shutdown. However, there will likely be a long-term reduction in growth projections as a result. The shutdown in traffic in 2020 has reset the baseline for growth of aviation out until 2050, with an expected 16% reduction in forecast traffic in 2050 compared with the pre-Covid forecasts[145].



Despite facing the worst crisis in its history, by the end of 2024, the air transport sector has largely recovered from the shock of the global shutdown.

SUPPORTING SOCIAL DEVELOPMENT

Sustainable development is not just about working towards economic progress in an environmentally sustainable way. A significant aspect of this concept is improving the lives of people in ways other than financial prosperity. These socially based ambitions are an important part of the sustainable development goals and are supported in many ways by civil aviation.

For many people all over the globe, the ability to travel to any other country is an invaluable asset, relied on to visit friends and relatives, move abroad for work and study or, of course, go on holiday. Without air transport, being able to travel and experience new countries and cultures would be far more difficult – and certainly impossible in a short time span. And when the most acute crises happen, air transport can literally make the difference between life and death.

Ensuring well-being: visiting friends and relatives

The third sustainable development goal, which relates to well-being, is about more than just physical health. Families in the 21st century are a prime example of how globalisation has changed the modern world. Many families are now spread all over the world as people move for employment opportunities, education or simply for personal choice. This has resulted in far greater cross-border ties between individuals and countries.

The United Nations' International Labour Organization (ILO) estimates that in 2019, 169 million people were migrant workers – a rise of 12.7% compared to 2013, when they numbered 150 million. Globally, it is estimated that migrant workers make up 4.9% of all workers. The majority of migrant workers (86.9%) are employed in high- or upper middle-income countries, including in North America, the Arab States and Northern, Southern and Western Europe. Collectively, these three regions hosted 60.6% of migrant workers in 2019. The large presence of migrant workers in high-income countries is reflected in their share of all workers in those countries, at 18.4% for Northern, Southern and Western Europe, 20% for North America and 41.4% for the Arab States[146].

Many of the host countries of migrant workers, particularly in Europe, have ageing populations. This makes the international labour market essential for their long-term economic well-being, supporting those of pensionable age.

A prime example of how cross-border ties have strengthened is the geopolitics of the European Union and associated countries, where the free movement of people and goods has been enabled by the Schengen Agreement of 1985. Although recent political developments have dented confidence in this arrangement, it remains one of the cornerstones of European integration. Naturally, many European citizens are able to travel across national borders by modes of transport other than air travel, such as rail, road, or even by foot. However, in many cases, flying is the quickest, most secure and most cost-efficient means of travelling between European nations. Almost every intra-European flight can be completed in less than three hours, allowing individuals and businesses to connect seamlessly and consolidating personal ties and business relationships.

Connecting you, wherever you are

There are 4,072 airports globally, the best known of which handle millions of passengers each year. However, perhaps some of the most important airports are not very well known at all, except to the small communities they help connect to the outside world. Almost half of these airports rely exclusively on regional-sized aircraft due to capacity constraints and 34% are limited to turboprop aircraft[147]. In the Arctic, across vast stretches of wilderness and on small island states all across the world, air services can provide connections to regional centres and the rest of the world that otherwise would not be available and without the need for expensive and challenging road infrastructure development.

Studies have shown that access to air services not only helps remote communities with vital lifeline needs but also economic development, including the ability to attract and retain businesses and professionals, particularly those with travel needs to maintain proficiency in their field. Greater aviation activity in a region is correlated with some increase in the growth in population, employment, and/or per capita incomes[148].

One study found that a 1 percent increase in traffic at an airport receiving a subsidised Essential Air Service in the United States was related to a 0.12 percent increase in per-capita income. US government support for otherwise un-economic air routes results in a considerable benefit for 177 communities, of which 65 are in Alaska, far beyond the cost of the subsidy to the government[149].

In Europe, support is provided to 165 'public-service obligation' routes, most of which are in France and Greece with its thousands of islands[150]. In Australia, the Remote Air Services Subsidy Scheme helps connect 269 communities across a vast continent – some of these cattle stations and indigenous communities are as small as six people, others have up to 200 residents[151]. In Malaysia, the Transport Ministry signed an agreement in 2019 to operate 40 rural air service routes in Sabah and Sarawak on the island of Borneo to help promote national connectivity and provide support for remote communities.

In studies of regional economies in Sweden, Indonesia and Brazil, a 10% increase in airport connectivity was shown to support an increase in foreign direct investment of 4.7%, up to a 0.5% increase in regional GDP, up to a 0.7% increase in local wages and up to a 0.9% increase in employment. In some regions, these impacts were shown to be significantly higher: an 8% increase in foreign direct investment; a 5% increase in tourism and a 6% increase in regional GDP[152].

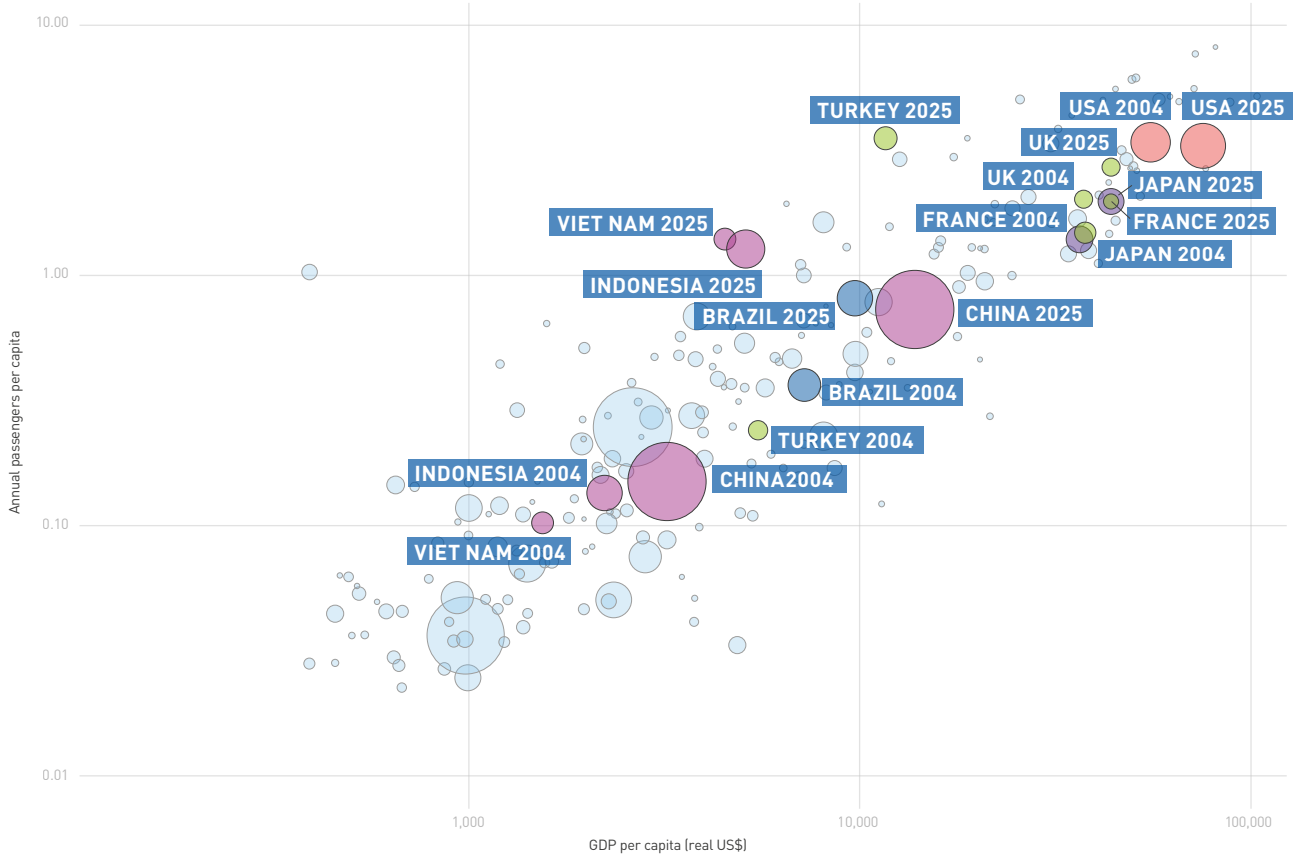
To take advantage of efficiencies of scale and scope, some airports work in networks to connect less-busy regions with higher-traffic hubs. Globally, 1,780 small airports (with fewer than one million passengers per annum) – over half of all small airports – are operated in these network structures

and collectively served over 345 million passengers in 2018[153]. Indeed, small airports and airlines act as catalysts in feeding traffic into hub airports for onward journeys to other major national and international destinations. Smaller airports within a network generate traffic that ensures the sustainability of larger airports, resulting in improved load factors and optimal aircraft utilisation by airlines.

It is not surprising that the greatest increase in propensity to travel between 2023 and 2043 will be in developing and emerging economies: Nepal (6.3%), Bangladesh (5.6%), Thailand (5.5%), China (5.4%), Ivory Coast (5.1%) and India (5%)[155]. Data also show that the rate of growth in some so-called south-south routes is increasing at a much higher rate than the global average. The last decade has seen substantially more traffic between China and Africa, for example. In addition, half of the top 20 countries for passenger traffic are now developing or emerging economies[156].

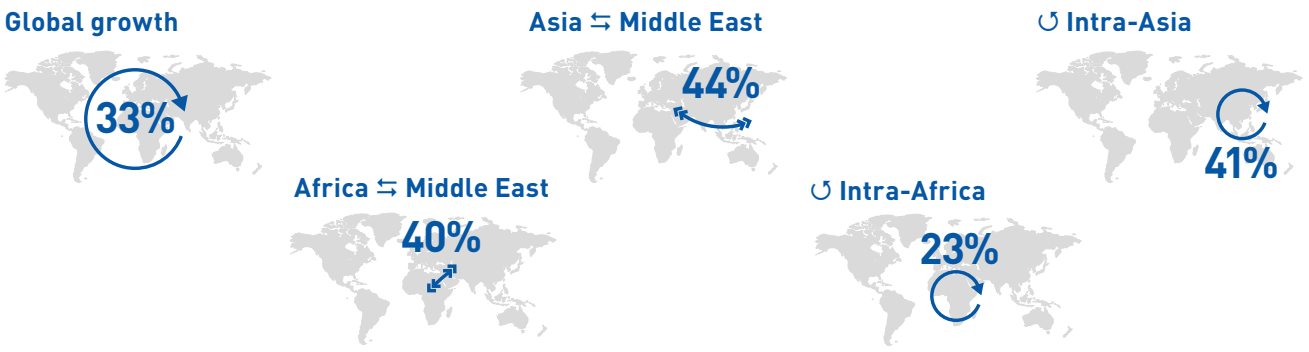
Who's travelling?

Global propensity to travel in illustrative key markets, 2004 compared to 2025[154].



The growth is out there

Passenger growth between select developing and emerging regions, 2014-2023[157].



Leapfrogging development issues

There are other ways that air transport can bring about rapid change in development for remote communities and emerging markets. Airfields can provide access to areas where road construction proves too challenging or expensive, and the latest air traffic management technology is enabling developing countries to leapfrog to the latest cost-effective technologies. These countries can avoid installing country-wide ground-based infrastructure, such as radar systems and networks, which are cost and resource intensive, and install more sophisticated Automatic Dependent Surveillance – Broadcast (ADS-B) coverage systems or even to simply buy surveillance as a service from a satellite-based supplier. They can also take advantage of remote tower technology and digitalisation, that are now operating across the globe and allow controlled conditions at remote or seasonal airports without having to build or upgrade air traffic control towers. This is labour cost-effective as air traffic controllers have the capability to control traffic for multiple airports from one centre[158].

Supporting families back home

According to the United Nations, the number of international migrants worldwide reached 281 million in 2020, which equates to 3.6% of the global population[159]. In 2019, 169 million were migrant workers who move abroad for employment purposes[160]. Migrants collectively contributed $831 billion in remittances worldwide in 2022 (of which $647 billion were sent to low- and middle-income countries)[161].

Remittances, where someone working abroad sends part of their earnings to family back home, have exceeded official development assistance – by a factor of three – since the mid-1990s. According to the World Bank, in 2023, officially recorded remittance flows to low- and middle-income countries grew by 0.7% to reach $656 billion. They continued to be their main source of external finance, also outperforming foreign direct investment (FDI)[162].

The continuity of remittances is supported by the maintenance of family and cultural ties – aided by air transport links. This source of overseas income plays a significant role in some nations and does not only help alleviate poverty in less-developed countries but also helps achieve the SDGs more widely. For example, remittances accounted for 41% of GDP in Tonga, 39% in Tajikistan, 31% in Lebanon, 28% in Samoa and 27% in Nicaragua[163].

Quality education

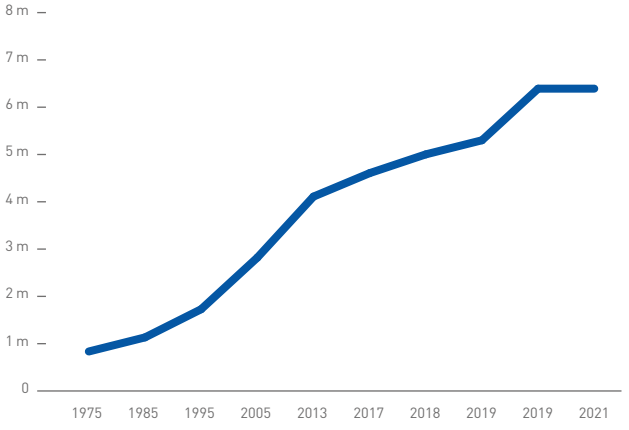
Ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all is a stand-alone sustainable development goal. To access higher-quality education for many means travelling to another country, sometimes in another region of the world. Without air transport, these opportunities simply would not be feasible, particularly for shorter-term university exchange programmes, such as the European Erasmus+ Programme[165].

Sub-goals of the SDG include the aim of expanding global scholarships and, by 2030, substantially increasing the number of youths and adults who have relevant skills, including technical and vocational skills, for employment and entrepreneurship. Air transport connectivity can make these ambitions far more likely to be realised.

For students from developing countries, the opportunity to travel to established universities for higher education is invaluable, as well as benefitting the university and surrounding communities. This helps the individual's personal improvement and creates benefits for their home country, as students return armed with knowledge to contribute to their home economy and with strengthened links to the global economy[166].

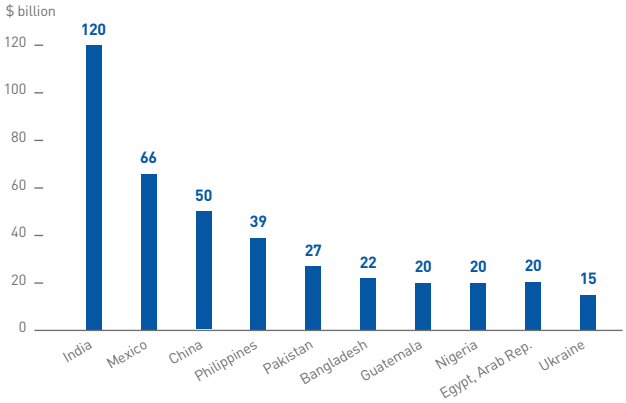
Learning overseas

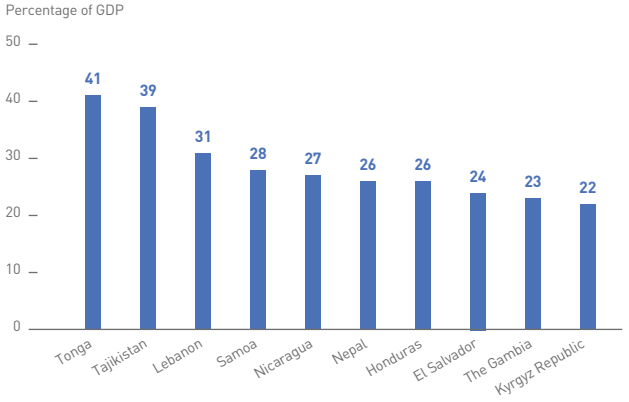
Growth in higher education students studying abroad, 1975–2021[167].



Supporting those at home

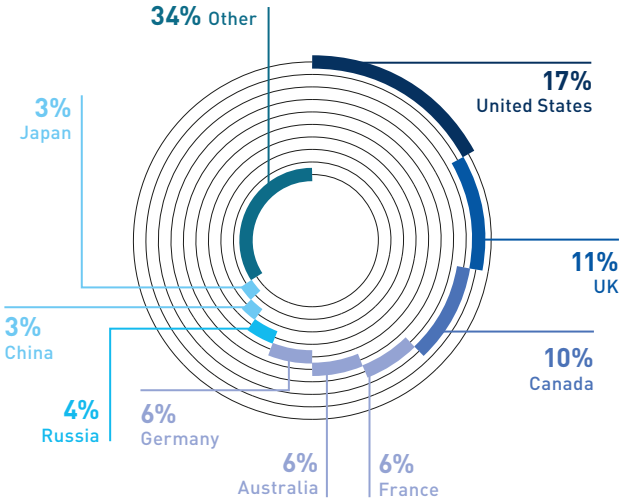
Top remittance-receiving low- and middle-income countries, 2023[164].





Soft power, hard learning

Global top ten destinations for higher education students studying abroad, 2023[168].



Flying in to study

Global top ten countries of origin for international, tertiary students, 2022[169].

	Origin	Students
1	China	1,052,283
2	India	621 623
3	Uzbekistan	150 488
4	Viet Nam	134 141
5	Germany	126,241
6	United States	115,026
7	France	113,515
8	Nigeria	112,416
9	Syria	104,987
10	Pakistan	90,614

Aviation helps foster educational connectivity for students and it has also been shown to increase scientific collaboration, particularly when airfares become more affordable in a market. Analysis of data from 1991-2012 shows that the entry of a low-cost carrier into a route increased scientific collaboration by 30%[170]. Moreover, the quality of the scientific output increased, as researchers were able to collaborate more effectively face-to-face: "Cheaper air travel, by counterbalancing how geographic distance constrains collaboration choices at stages when face-to-face interactions cannot be substituted for remote interactions, may have a significant effect on the generation and recombination of scientific knowledge."

Highly skilled workforce

Jobs in air transport cover a wide range of activities that require diverse skill sets. These include:

- » technicians and engineering jobs, from aircraft and engine design, to component production, and aircraft maintenance and repair;
- » air traffic control and airspace design planning and occupations such as air traffic controllers;
- » satellite systems providing communications, surveillance and tracking of aircraft and air navigation services;
- » logistics for airlines and airports;
- » complex information and communication technology systems that link aircraft, airports and air traffic management to ensure efficiency of operations;
- » systems on board aircraft and in areas such as baggage handling systems design;
- » airport operators and airport on-site service industry jobs, such as chefs in catering companies and customer service professionals in airline ticketing, check-in and retail;
- » creative positions in design and marketing;
- » manual labour on airfields, such as baggage loaders;
- » flight and cabin crew;
- » emergency response personnel at airports; and
- » leadership, management and executive roles.

As this list indicates, many roles in the air transport sector require highly qualified workers and a significant amount of training. Value-added per employee in the air transport sector (direct employees, excluding non-airside activity at airports) generates 4.3 times as much value-added per employee as jobs in the economy overall – indicating a more productive workforce.

In addition, growth in the aerospace sector is helping to drive innovation and skills development in countries that have not normally been associated with aircraft manufacturing. This is just one of many examples of air transport-related companies investing in developing countries.

According to analysis by SEO Economics in 2024 for Airports Council International (ACI) Europe, the direct economic impact of the average employee at European airports stands at approximately $74,007 (€67,000), based on $134 billion (€121bn) of direct economic impact for 1.8 million direct jobs. This figure is considerably higher than the average income in the overall economy. In all countries, the average income of direct airport employment was higher than the national average. This reflects the large number of highly skilled positions that are supported by airport activity[171].

In the United States, the average wage for an air transportation employee in 2023 was $117,400, which is 46.6% higher than the average US private-sector employee wage of $80,100[172]. Globally in 2023, airlines paid their employees $211 billion in wages[173].

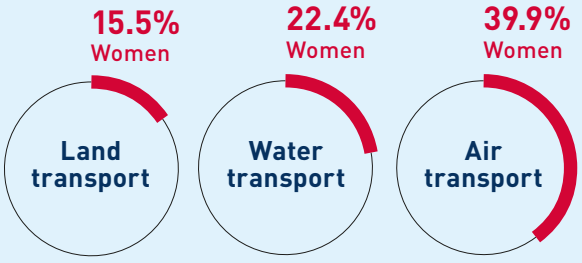
Gender imbalance

Global statistics on gender equality within the air transport sector are scarce; however, anecdotal evidence suggests that aviation still tends to be a male-dominated industry. Statistics for Europe for 2024 show that women make up 42% of employees, although technical positions will likely skew towards men[174]. Despite the first commercial pilot's licence being granted to a woman in 1934[175], ICAO data for 2021 indicates that the share of female licensed personnel in aviation, which includes pilots, air traffic controllers, and maintenance technicians, was around 5.1%. More specifically, at that point, globally, women comprised 4.7% of all pilots, 3.1% of aircraft maintenance engineers, and 21.1% of air traffic controllers[176].

Some countries show signs of a move in the right direction: India (where 14% of airline pilots are women)[177], Ireland and South Africa follow with 9.9% each[178], Canada 7% and Germany 6.9%[179]. In the United States, the number of female commercial pilots (especially among younger age groups) increased by around 52% between 2018 and 2023. As a share of the total, female pilots increased from 5.6% to 8.2% over this period[180]. But perhaps the most promising sign is in the next generation. In a 2014 survey of student pilots, more than 10% were women in 16 countries, with over 23% of student pilots being women in Singapore. Unfortunately, this analysis has not been repeated and as a general note there is a severe lack of gender balance information at a global level[181].

Gender, balanced?

Air transport has more work to do getting women into the business, EU27, 2022[182].



On the manufacturing side of the industry, women tend to have a slightly higher representation, making up 25% of the workforce in the United States (this includes defence manufacturing, whereas most of the statistics in this report are limited to civil aviation). Within this group, women make up 17% of engineering jobs and 31% of executive positions[183]. Similarly, there are large gender gaps in other important line jobs in the aviation and aerospace industry. For example, women comprise only about 26% of air traffic controllers and 18% of flight dispatchers in the US[184]. In contrast, cabin crew staff tend to be predominantly female, with around 74.9% of flight attendant positions being held by women in 2022 in the US[185].

In airline executive roles, the gender gap is as great as in technical positions, with women making up just 12% of the top 100 airline CEOs (versus 7.5% of CEOs in the wider economy); 13% of chief financial officers (vs. 37%); and 4% of chief operating officers (vs. 23%). In human resources, airlines outperform the wider economy, with women constituting 43% of human resources directors (vs. 39%)[186]. The 'Soaring Through the Glass Ceiling' report, compiled in 2019 by six leading stakeholders in the aviation and aerospace industry, found that there are pockets of success, with female CEOs representing 19% of the total number of aerospace and defence CEOs in the US, well ahead of the 5% of female CEOs across all industries in the country[187].

In 2019, IATA launched an industry-wide initiative to increase the number of women in senior and under-represented roles by 25% by 2025. These include flight deck, maintenance and engineering divisions, The 25by2025 campaign is a voluntary commitment by airlines and other aviation-related organisations. In 2023, female employees accounted for 41% of the signatories' total workforce. A campaign-related survey in 2023 found that among the signatories, 31% of senior roles were held by women[188].

Aviation passengers seem to be balanced in gender, with the United Kingdom and the United States reporting around a 50% split[189]. Unfortunately, there are few other statistics available on passenger gender split globally.

Good health and well-being

The United Nations' third SDG, 'good health and wellbeing', is a crucial element of sustainable development. Although not directly linked to improving physical heath, air transport, with its ability to provide speedy and safe transport of people and cargo to places that are often in remote areas of the world, has a part to play.

A prime example of how aviation plays a role in public health is the ability to transport vaccinations. Not only are these vital medical supplies time-sensitive, making other modes of transport unviable over long distances, but their temperatures must also be carefully regulated, something in which cargo airlines are very experienced. Vaccines are some of our most critical and precious shipments, as was demonstrated during the Covid-19 pandemic.

Aviation also has a crucial role to play in pandemic response. When a viral outbreak occurs, it is vital that the air transport sector acts quickly to work with governments and international institutions to ensure that the virus does not travel further. Recent examples of this collaborative effort aside from Covid-19 were the Ebola and Zika outbreaks in West Africa and South America, respectively. Whereas halting all travel from affected regions was deemed necessary by many governments during the Covid-19 pandemic, often this is not the best response. The World Health Organization recommends that connectivity remain in place, although with appropriate health controls on passengers[190].

Providing vital aid

One of the more ambitious of the UN's SDGs is the campaign to achieve 'zero hunger'. To achieve this goal requires the creation of the conditions for food security across the world. This is a long-term challenge, and, in the meantime, some

parts of the world will continue to need support from the international community.

The UN Humanitarian Air Service (UNHAS), managed by the UN World Food Programme (WFP), transports food and urgent relief items to those in need in the world's most remote and challenging locations, in the midst of conflict and disasters, including to survivors of cyclones Idai and Kenneth in Mozambique, drought in Somalia and the ongoing crises in Yemen. Because many of these areas are inaccessible by road – either because of the absence of reliable road infrastructure, precarious security situations or extreme weather conditions – air transport is often the only option. In 2023, UNHAS airlifted 4,800 metric tonnes of vital relief cargo and more than 388,000 humanitarian and development workers to 21 countries, allowing life-saving projects to be implemented and monitored. UNHAS is often the only way in or out of an area of operation[191].

Aviation's unique ability to combine speed with flexibility makes it a vital conduit for an immediate response to natural and man-made emergencies and disasters. In 2009, the non-profit organisation Airlink was established to help coordinate responses to emergencies by the air transport industry. Today, Airlink provides a vital link between more than 30 commercial and charter airlines and 122 international non-profit aid organisations which have been pre-qualified and vetted to ensure the right aid gets to the right people. When disaster strikes, there is no need to form relationships to coordinate a response – they exist already. During the Covid-19 pandemic in 2021, Airlink transported over 5 million items of personal protective equipment (PPE) and within 18 months had transported 10 million. In 2023 alone, Airlink delivered lifesaving and life-sustaining aid to over 13 million people in 52 countries, moving 2,311 tonnes of supplies across 254 shipments. Airlink staff also secured free flights for 1,690 skilled responders, ensuring they could quickly reach areas where their expertise was most needed[192].

Helping to end trafficking

The trafficking of persons remains an issue the world must tackle. Abuse can include forced labour, sexual exploitation and organ removal, and it takes place internationally and domestically, many times using air transport services[193]. The United Nations Office on Drugs and Crime (UNODC) reported 46,850 detected victims of human trafficking in 2020, of which three quarters were women and girls[194].

The aviation industry is taking action to help relevant staff identify the signs of trafficking on-board aircraft and at airports and to report suspicions to law enforcement. IATA and ACI World have issued resolutions to ensure airlines and airports are made aware of the issue and have prescribed actions they can take to reduce the possibility of trafficking[195]. ICAO has worked with the Office of the United Nations High Commissioner for Human Rights to develop guidance material on the training of cabin crew[196]. However, for any training of cabin crew, ground staff, operations centre teams and flight crew to be effective, clear channels of communication with law enforcement are essential. The industry stands ready to help but also needs government authorities to provide effective solutions.

Halting the illegal trade in wildlife has also been an area of joint action between industry, governments, and non-governmental organisations. IATA and ACI World are working alongside other aviation stakeholders through the United for Wildlife (UfW) Transport Taskforce of the Royal Foundation. Airlines and airports around the globe are actively supporting this fight, with 79 airlines being among the stakeholders[197]. Data collected on seizures of wildlife products between 2009 and 2019 backs the importance of the aviation industry for breaking the illegal wildlife trade supply chain from the source to the consumer: over 2,000 seizures were registered with wildlife products and 5.5 million animals seized in 102 countries[198]. The United States Agency for International Development (USAID) ROUTES Partnership played an important role in providing resources and tools to the aviation sector to help combat the illegal wildlife trade, including training materials on how to spot signs of wildlife trafficking[199]. As with the trafficking of persons, the responsibility lies with the appropriate law enforcement agency. The industry can support their work by raising awareness and ensuring appropriate reporting mechanisms are available for staff to report suspicions to law enforcement.



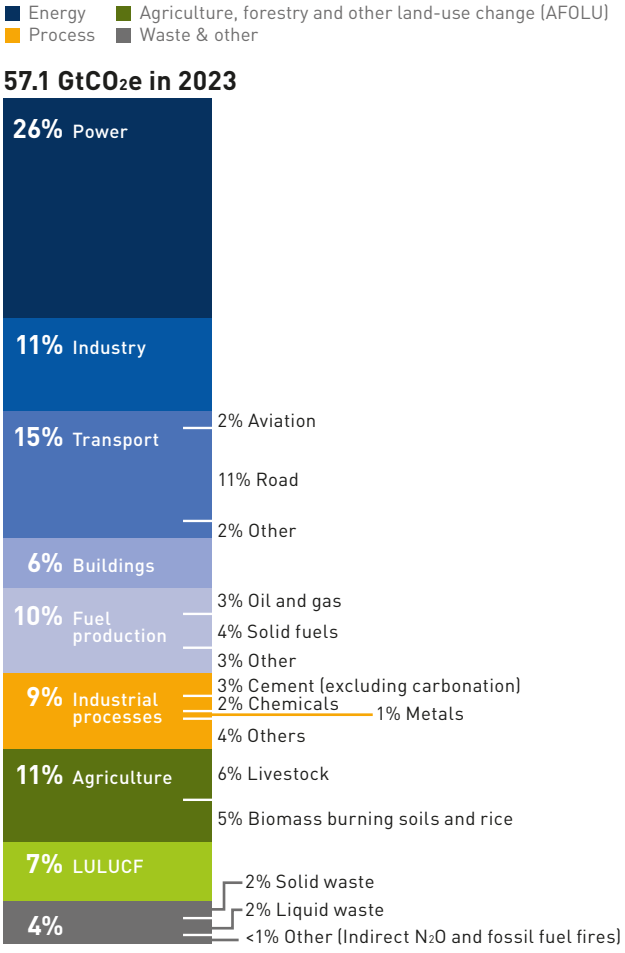
ENVIRONMENTAL RESPONSIBILITY

The economic and social benefits of aviation are clear, with the growth of the sector being important for all countries, developed and developing. However, these benefits also come with an environmental cost. For aviation to grow sustainably, it is vital that the industry balances the advantages of growth in air travel with the responsibility to pursue climate action and to take steps to reduce other environmental impacts such as noise, emissions which affect local air quality, and effects on water courses. This responsibility is something that the global aviation sector takes seriously, and it ties in with a number of the SDGs.

Aviation accounts for 2.05% of all human-induced CO_2 emissions through the burning of 279 million tonnes (348.75 billion litres) [200] of jet fuel, which in 2023 produced 882 million tonnes of CO_2[201]. This is around the same as the power needed to run the servers and transmission cables of the internet (not including the computers accessing the internet)[202].

Aviation's share

Chart shows the 2023 share of aviation CO_2 emissions compared with other parts of the economy[203]. This chart includes all greenhouse gas emissions – it goes beyond the CO_2 emissions (energy and agriculture CO_2) of around 43 gigatonnes (Gt) alone.



Aviation is an efficient means of long-distance (intercity, interregional, and international) transport, operating in many places more efficiently than the alternatives, such as road and even rail. For some travel, there is simply no practical alternative to flying – around 80% of aviation CO_2 emissions are produced from flights greater than 1,500 kilometres. The challenge for aviation is to further reduce emissions while retaining the benefits of a growing air transport sector.

To meet this challenge, the aviation industry agreed a global, sector-wide climate action framework to tackle emissions in 2008 – a world first – then in 2021 committed to achieve net-zero carbon emissions by 2050, supported by accelerated efficiency measures, energy transition and innovation across the aviation sector and in partnership with Governments around the world. This goal was subsequently adopted by ICAO in 2022.

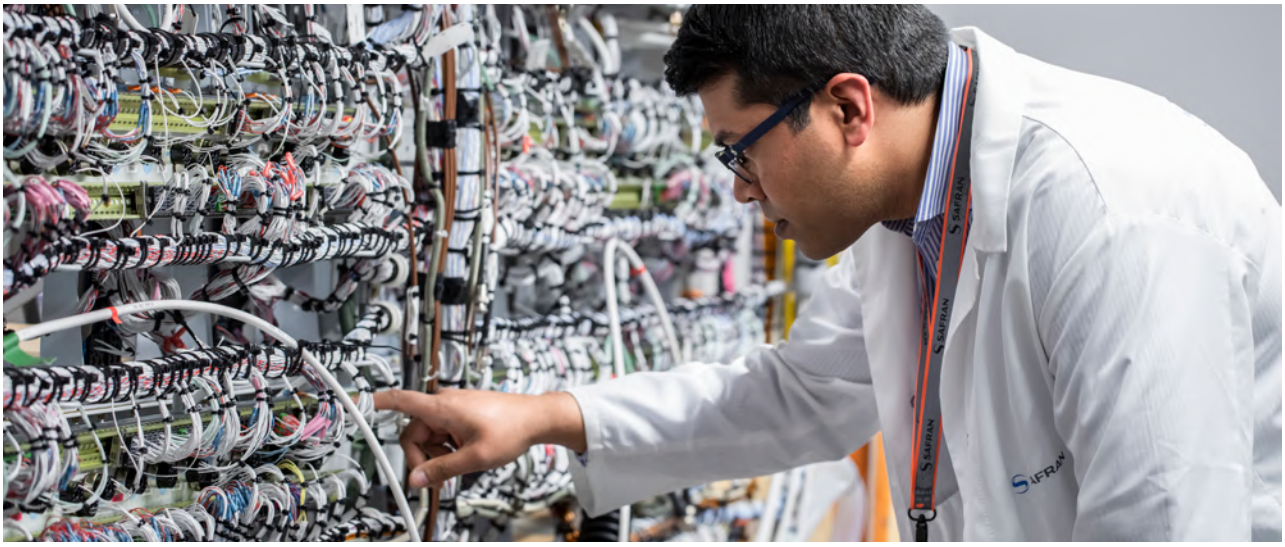
To meet this goal, the industry has put in place a collective strategy that takes account of all means of reducing aviation emissions, in the air and on the ground. The industry has been implementing many of these measures for years and has made significant progress in fuel and CO_2 efficiency. In fact, per passenger, a flight taken today will produce less than half of the CO_2 produced by the same flight in 1990. This has been achieved through technological advancement and improvements in operations and infrastructure.

Technological innovations

Aviation has always had a focus on efficiency. Fuel is one of the main operating costs for airlines – around 32% in 2023[204] – so in this sense, economic and environmental motivations are intertwined. Since the first jets in the 1950s, technology-driven fuel efficiency has improved 80% with the introduction of new models of aircraft and engines. On average, each new generation of aircraft is roughly 15% to 25% more fuel efficient than the previous generation, and aircraft and engine manufacturers spend around $15 billion each year on efficiency-related research and development, representing a major investment towards a more sustainable future for air travel[205]. Around 30% of the current global fleet consists of the latest generation aircraft.

Airlines have continued to improve their fuel efficiency performance. Since the year 2000, industry fuel efficiency has cumulatively improved 37% and CO_2 tonnes per thousand kilometres performed has decreased from 1.83 to 0.86[206]. This improved fuel efficiency has been driven by airlines investing over $1 trillion in 19,360 more efficient new-technology aircraft since 2009 and by improving performance through higher load factors and other operational measures. Passenger load factors now average 82.1% globally[207]. In addition, airlines are investing in future fleet with a current aircraft production backlog of some 15,700 new technology aircraft due to enter the fleet over the next decade, further improving fuel efficiency[208].

Efficiency improvements in technology and operations at a global level have avoided 14.6 billion tonnes of CO_2 since 1990[209]. Thanks to new aircraft and the introduction of cutting-edge technologies and new flight procedures,



US airlines improved their fuel efficiency (on a revenue tonne mile basis) by more than 145% between 1978 and 2022, avoiding over 5.9 billion tonnes of CO_2[210]. In Europe, the average fuel burn per passenger kilometre flown for passenger aircraft, excluding business aviation, decreased by 28% between 2005 and 2019 while passenger kilometres flown by commercial flights rose by 90% over the same period[211]. This is thanks to several factors, including new technology, air traffic management efficiency and operational improvements such as higher load factors.

The last decade has seen the development or introduction of entirely new aircraft types, such as the Airbus A350 XWB and A220 family, the Boeing 787 Dreamliner family and the Comac C919. These were joined by new versions of existing aircraft, such as the Embraer E2, 737MAX, A320neo, A330neo and 747-8. These are powered by next-generation jet engines made by manufacturers such as CFM International, GE Aerospace, Pratt & Whitney, and Rolls-Royce, and all have produced impressive double-digit fuel savings. In addition, in-service aircraft models are subject to continuous performance improvements. These include highly efficient turboprop aircraft, such as the ATR72-600 and DeHavilland Canada's Dash 8 series. The Boeing 777X with a wingspan of 72 metres to further reduce drag, is expected to enter service in 2026.

In addition to the latest propulsion technology, additional technological features have been included to maximise fuel efficiency. Improved aerodynamics, new manufacturing techniques and composite materials play an increasingly prominent role in reducing how much fuel is burned on any given flight.

Manufacturers are increasingly using light-weight materials such as carbon fibre composites to build aircraft components, particularly the wings, which improves fuel efficiency through decreasing weight and enabling advanced aerodynamics. The Boeing 787 and 777X, Airbus A220 and A350XWB aircraft all use these cutting-edge materials and technologies to deliver exceptional gains in environmental performance. Engine manufacturers are also using carbon fibre composites (such as for fan blades), highly advanced processes such as additive layer manufacturing and new materials such as ceramic-matrix composites to develop new engines. Ceramic-matrix composites used in jet engines allow the engines to operate at a higher temperature than conventional engines, resulting in better fuel efficiency. This material is also lighter than traditional metal alloys, and that further reduces fuel use.

Technology on new aircraft can either improve fuel burn through aerodynamic efficiency (mainly airframe), weight reduction (including the use of new materials) or reducing actual combustion use (mainly engine-related). Combined, these elements create a new aircraft with a reduced environmental impact.

From 2020, the world's first CO_2 emissions standard for aircraft was adopted at ICAO. This encourages further industry technological improvements that have so far been purely market driven.

Although in their infancy, established aerospace manufacturers and start-ups alike are investigating the introduction of fully hybrid-electric and hydrogen-powered aircraft technologies which could benefit a range of next generation aircraft platforms, from new urban air mobility applications, up to regional, short and medium-haul aircraft. The quest to maximise range and payload (passengers or freight) while reducing the weight of the batteries and increasing the energy density of stored electricity is a key challenge. As battery technology develops, increased energy storage may make electrically powered commercial flight a reality in the coming decades.

In the longer term, several companies are developing more familiar commercial aircraft concepts. These would be regional jet-sized, short-haul aircraft powered by electricity or hydrogen systems and could potentially be in service by around 2035, although more research is needed before they are ready to begin test flights. The quest to maximise range and payload (passengers or freight) while reducing the weight of the batteries and increasing the energy density of stored electricity is a challenge. There is also a lot of research into hybrid options – combining the performance of liquid sustainable aviation fuel with the efficiency of electric propulsion. This may be an option for mid to long-range flights in future.

WAYPOINT 2050

AN AIR TRANSPORT ACTION GROUP PROJECT

In a two-year project called *Waypoint 2050*, the aviation sector outlined several potential pathways to reach its 2050 goal and how, with the right support from governments, net-zero emissions could potentially be achievable a decade or so later. The analysis shows that the implementation of radical new technologies such as commercial-scale electric, hybrid or hydrogen flight could be possible in the 2035-2040 timescale. This would be accompanied by improvements in operational and infrastructure performance. Importantly, a significant scaling-up of sustainable aviation fuel (SAF) will be needed, in the region of 450-500 million tonnes of SAF each year by 2050.

Waypoint 2050 explored three consolidated scenarios for how air transport can meet its goal. Which of these scenarios plays out over time will be determined by several decisions in the course of the coming decades:

- How will the industry balance investment in sustainable aviation fuel deployment and radical new technologies?
- Can energy providers meet the necessary scale-up of SAF and hydrogen production at the same time?
- Will governments, finance institutions and consumers play the role they need to accelerate the energy transitions?

Whilst the solution will likely be some combination of all the above, the important lesson learnt from the work in this report is that it can be done whilst ensuring that the growth of global connectivity continues. Aviation can meet its ambitious climate goal to achieve net-zero carbon emissions by 2050 at a global level. Different studies have shown there is enough feedstock to produce the necessary SAF and hydrogen is a realistic possibility. Efficiency will continue to improve and modern air transport will remain a key driver of connectivity, business and social connections across the world well after 2050.

www.aviationbenefits.org/W2050

A transition in fuel and jobs: the scale-up of sustainable aviation fuel (SAF)

SAF could be the key to sustainable long-haul air travel, contributing hugely to the industry's emissions-reduction strategy. In order to get the needed quantity of SAF flowing into the system, a significant transition will be needed, requiring jobs and skills to shift from fossil fuel to SAF. According to the *Fuelling Net Zero* report which was produced as part of the *Waypoint 2050* study, the delivery of enough SAF to meet our net-zero carbon goal would require some 5,000 fuel refineries at a cost of some $1.45 trillion over the next 25 years.

However, the successful scaling of SAF production also depends on a skilled workforce capable of supporting the sector's growth: an estimated 13.7 million jobs could be supported as part of this process. For the most part, these aren't 'aviation direct' jobs, but would be included in the 'indirect jobs' included in the supply chain: many SAF plants would also produce other outputs, so some of these positions would serve other sectors and some would be temporary as construction of plants is ramped up.

Developing and upskilling the current workforce, recruiting workers during the process of upscaling for infrastructure development to meet targeted upscale as well as generating new expertise in SAF-related sectors, are critical to overcoming industry bottlenecks, such as:

- Skill gaps: many workers in traditional energy sectors may lack the specialised skills needed for SAF technologies, such as biochemical engineering, feedstock logistics, and advanced fuel processing.
- Training and upskilling: partnerships between governments, universities, vocational schools, and other institutions are essential to equip workers with the technical and operational skills required for SAF production and supply chain management.
- Specialised roles: SAF production involves highly technical roles in areas such as biorefinery operations, e-fuel synthesis, and infrastructure retrofitting. Investment in targeted skill development programmes can help fill these roles.
- Workforce expansion: The SAF industry will create opportunities across feedstock collection, processing, transportation, compliance and policy making, and research, necessitating new training programmes to prepare workers for these emerging fields.

The transition to SAF will create diverse employment opportunities across its value chain, encompassing feedstock collection, infrastructure development, production technologies, regulatory compliance and skill providers:

- **Feedstock sourcing, collection and preprocessing.** As SAF production scales, the need

for efficient and sustainable feedstock sourcing becomes increasingly critical. Roles in this segment include: biomass collection and transport; municipal waste processing; biogenic material separation; feedstock policy implementation; community engagement; research and development of new feedstock streams; and construction, operation and maintenance of feedstock collection centres.

- **Transportation and logistics.** Effective coordination of feedstocks and intermediate products within the SAF supply chain is essential to ensuring a reliable and cost-efficient production system. Roles include logistics planning and execution; and sustainability auditing.
- **Infrastructure for refining.** For short-term infrastructure development – such as extending existing facilities or installing new equipment – producers plan to rely on agencies and contractors on a contractual basis. When it comes to designing and constructing new SAF production plants, particularly at entirely new locations, producers see the need to hire specialised professionals. Some of these roles include: engineers in chemical, biochemical, and mechanical engineering; architects and systems designers; project managers; construction specialists, including structural engineers, electricians, and welders; process optimisation experts to ensure that the new plant operates efficiently and aligns with sustainability goals; technical and maintenance staff; helpers and labourers; operations management; and quality testing specialists. For power-to-liquid fuels, there will be an increased demand for professionals skilled in electricity and power management, as well as handling hydrogen.
- **Jobs in SAF conversion/production technologies.** As SAF production scales up, both existing companies expanding their operations and new companies entering the market will drive job creation in conversion and production technologies.
- **SAF transportation to end user.** As this transformation primarily involves transitioning from petroleum-based fuels to SAF within existing supply chain frameworks, and assuming no significant increase in the number of end users, the overall growth in transportation-related jobs may remain moderate.
- **Jobs in end users.** As the adoption of SAF expands, end-user industries, particularly airlines, are increasingly involved in integrating SAF into their operations. This transition creates new job opportunities across procurement, logistics, quality assurance, regulatory compliance and carbon accounting, and fuel management processes.

To further develop SAF-specific technical skills, vocational training centres and SAF-related institutes play a crucial role. These institutions already support activities such as research participation, advisory roles, organising workshops, and aiding the commercialisation of SAF technologies. However, given the growing demands of the SAF industry, there is a need to expand the capacity of these centres and potentially establish additional institutes. This would help enhance the skillsets of both the existing workforce and new entrants, ensuring they are well-prepared to contribute to the development and scaling of SAF production technologies.

Investing in such specialised training initiatives is essential for bridging the gap between general academic knowledge and the specific technical requirements of the SAF sector.

This is a summary extract from a research paper by Cranfield University.



Sustainable aviation fuel

Sustainable aviation fuel (SAF) provides a cleaner source of energy to power the world's fleet of aircraft, and is one of the key enablers for the aviation industry to reduce its carbon footprint and dependence on fossil-based fuel sources. SAF can reduce emissions by up to 80% across the lifecycle of the fuel, with a 100% reduction possible in the future. The industry's *Waypoint 2050* analysis suggests that SAF will contribute between 53% and 71% of the emissions reductions needed to get to net-zero by 2050.

The chemical and physical characteristics of SAF are almost identical to those of conventional jet fuel. Today, SAF is blended with conventional kerosene in ratios of up to 50% SAF to ensure compatibility with aircraft, engines or fuelling systems. The industry is working towards commercial aircraft being permitted to fly with 100% SAF in the near future.

Once blended, SAF is certified to exactly the same standard as conventional jet fuel by the global fuel standards agency – ASTM International, which has approved seven SAF production pathways, depending on the type of feedstocks used. The most technologically mature process is hydroprocessed esters and fatty acids (HEFA) SAF that uses waste fats, oils, or greases from vegetable and animal sources, as well as algae. An additional method to accelerate SAF production is 'co-processing', which involves the use of sustainable feedstock as a small percentage of input into the refining of conventional fossil-based jet fuel. Co-processing represents a significant opportunity to scale-up SAF production through current infrastructure, while dedicated facilities scale-up.

A number of other pathways are also going through the rigorous assessment process for their viability for use in aviation, for example solar jet fuel (or sun-to-liquid), which uses highly concentrated sunlight to break up water and CO_2 molecules. Each pathway has potential benefits such as feedstock availability and cost, total carbon reduction, or processing complexity. Some SAF pathways may be more suitable than others in certain areas of the world depending on feedstock availability and processing capabilities.

On the demand side, 44 States have instituted SAF policy in a variety of ways. The European Union has the ReFuel EU SAF blend mandate (of 6% SAF in jet fuel uplift from 2030), the United States has a series of supply-side incentives. And a number of other countries are developing SAF policy, mostly as blend mandates. Adding these policy measures together would indicate a need for just over 20 million tonnes of SAF to be delivered in 2030[212] (based on policy expectations at the time of publication).

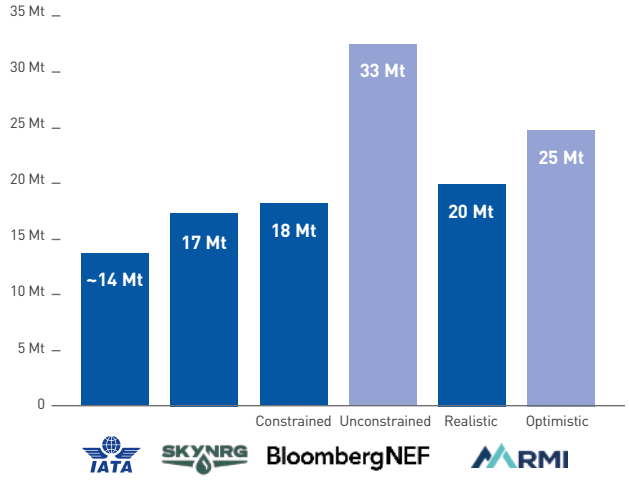
In addition, some 50 airlines accounting for 40% of global air traffic (and jet fuel use) have voluntary commitments to SAF offtake ranging from 5% to 30% of their jet fuel use in 2030[213]. These combined are around 12 million tonnes of SAF[214] and often come on top of the regulatory requirements for blend mandates.

On the supply side, a large number of announcements have been made for SAF production facilities in recent years. In 2023, around 500,000 tonnes of neat SAF was produced and blended with traditional fossil fuel[215]. While this only represents around 0.18% of the current fuel used in aviation globally, as this new source of fuel takes off, we will see this figure rise substantially. In 2023, SAF production was more than double the 300 million litres produced in 2022[216]. SAF production estimates for 2024 are at nearly 1.9 billion litres, accounting for 0.53% of airlines' total fuel consumption in 2024[217]. As at October 2024, there are 140 identified SAF projects underway, by 100+ producers in 31 countries[218].

Various groups are tracking SAF production announcements and providing an estimate of likely production in 2030, with the average being around 20 million tonnes of SAF. A number of these plants may fail to make it to final investment decision or operation, however there are also signs the failure rate in plant development is reducing (particularly for the fairly technologically-mature HEFA process) and a number of yet-to-be-announced plants may still make it to production by 2030.

SAF supply expectations, 2030

Supply-side 2030 SAF production expectations.

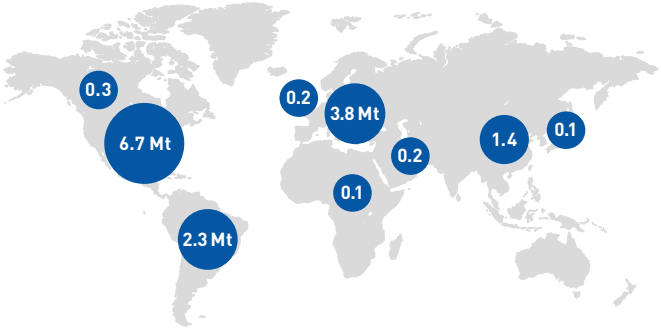


Several estimates of 2030 production: ~17-20Mt of SAF most realistic

* Note that the IATA estimate shown is for 25-30% of all renewable capacity. The BloombergNEF 'unconstrained' and RMI 'optimistic' estimates are for all announced plants – these have not weighted which plants will not make FID and therefore into production.

2030 SAF supply map

Supply-side SAF expectations: 2030 production locations.



Analysis from SkyNRG Market Outlook 2024

Whilst production is scaling-up impressively, there is still much acceleration needed to reach 2030 demand requirements and, more importantly, the significant scale-up required beyond 2030. *Waypoint 2050* analysis shows that around 490 million tonnes of SAF will be needed per year, from a variety of sources[219].

Operational improvements

The operations pillar of the industry's climate strategy deals with how aircraft are run once they are in service to ensure that all flights maximise fuel efficiency (which has the added benefit of often reducing costs to operators). At every step of an aircraft's operation – at the gate, during taxiing, take-off, cruise and landing – there are opportunities to reduce fuel burn and consequently, emissions. Operational efficiency is capable of making immediate and lasting benefits, regardless of propulsion, aircraft performance and fuel technology advances.

Many efficiency gains come from cutting all unnecessary, non-flight-critical weight. Numerous airlines have invested in features such as lightweight seats and cabin trolleys or Kevlar cargo containers, which have the added benefit of being stronger and lighter than conventional aluminium counterparts[220]. It has also become increasingly common for flight crews to be issued with tablet computers in place of paper-based flight manuals, which can weigh up to 20 kilograms[221]. While on their own these savings are not huge, when added together they account for significant CO_2 savings. By installing lighter but stronger seats, one airline reduced annual CO_2 emissions across its fleet by 21,000 tonnes.

Wingtip technology is another operational improvement that has led to major fuel and emissions savings for airlines. Most new aircraft have these features included at the point of production, and many airlines have invested in having their aircraft retrofitted with wingtip technology. These additions to the tips of the wings reduce drag and can reduce fuel consumption by around 4%[222].

Through a process called airport collaborative decision-making, airports, air navigation service providers (ANSPs), and airlines work together to optimise flights by sharing information on potential inefficiencies and delays on the runway and en route, which saves airlines from wasting unnecessary time in the air[223]. By working together to flag delays early, all parties involved in a flight get crucial arrival and departure information at the same time, allowing them to adjust their schedules and resources as the latest information comes to hand. A process known as air traffic flow management allows airlines and airports to work with ANSPs to ensure the available capacity is used efficiently. This works best when multiple nations cooperate regionally. For example, if one airspace sector in a region is congested, its neighbouring sector might be able to take some traffic.

Taxiing is also an opportunity for cutting emissions. Many airlines only use one engine during taxiing. Taking this concept further, new technologies have been developed that power the aircraft entirely with electric motors or external tugs while it taxis to the runway[224].

When parked at airport gates, aircraft must be powered to provide air conditioning and electricity for cabin lighting, heating and air conditioning for passenger well-being, to run pre-flight systems and also to start the engines. Aircraft are equipped with a small generator in the tail called an auxiliary power unit (APU) powered by jet fuel. A large number of airports have now equipped gates with fixed electrical ground power and pre-conditioned air, allowing pilots to switch off the APU, saving fuel, reducing emissions and noise and reducing airline costs while parked at the gate.

An airline's choice of aircraft to operate a certain route can also provide efficiency gains. Turboprop aircraft on some short-haul routes can produce up to 40% less CO_2 than equivalent jets[225].

Jet engines ingest contaminants during taxi, take-off and landing such as dust, soot, insects and pollution: these can cause engines to operate less efficiently and burn more fuel. Every kilogram of fuel saved eliminates 3.15 kilograms of CO_2 emissions[226]. Regular internal engine washing can recover as much as 1% fuel efficiency and improve reliability[227]. Recent innovations in engine washing promise higher fuel efficiency in the future. For example, GE Aerospace has developed a foam wash method that saves three times more fuel than the traditional water wash method. Cleaning GE90-powered aircraft engines with this method has the potential to save more than 130 tonnes of fuel per year and related CO_2 emissions[228]. Another example is Lufthansa Technik's Cyclean engine wash, which reduces the cleaning process to 45 minutes and uses a wastewater collection system, further mitigating negative impacts on the environment[229].

Infrastructure efficiencies

The infrastructure pillar of the climate strategy for aviation emissions relates mainly to improving navigational systems and procedures, ensuring that aircraft are guided through the sky as efficiently as possible. In many regions of the world, mid-20th-century technology still determines the route structures, with aircraft needing to zigzag between ground-based navigation aids throughout their journey. However, this situation is rapidly changing.

By using an array of new satellite-based navigational technologies and procedures collectively referred to as 'performance-based navigation', aircraft are able to follow optimised, more direct routes with greater accuracy and efficiency. Cutting out unnecessary travel time can save fuel, reduce CO_2 emissions and enable more efficient air traffic management to cater for increasing traffic and help reduce congestion and delays.

Modifying how an aircraft climbs to cruising altitude and descends on approach can also reduce emissions. ANSPs are constantly improving operating techniques and airspace to allow more and more continuous climb and descent operations, which enables airlines all over the world to reduce fuel use and associated emissions. Rather than following the traditional 'staggered' or 'stepped' procedure, aircraft are now able to climb out of and approach airports more smoothly, avoiding the need to use additional engine power to level off at multiple altitudes during these phases of flight. Landing using a continuous descent saves on average 150kg of CO_2 and continuous climb around 50kg per flight. A Eurocontrol study indicates that in Europe, the potential emissions savings from optimising continuous climb and descent operations are up to 1.1 million tonnes CO_2 per year (340,000 tonnes of fuel). Nearly all flights in European airspace already perform

a partial continuous climb (to around 10,000 feet) and three quarters perform a full continuous climb. Further potential for improvement is available for landing procedures as fewer than half of all flights perform a partial continuous descent and only a quarter fly a full continuous descent[230], often due to congestion in the busy terminal airspace surrounding airports.

Another procedure that is enabling aircraft to improve efficiency and reduce emissions is called 'free route airspace'. Historically, aircraft have flown along fixed routes, like motorways in the sky traditionally organised around ground-based navigational aids. These route structures, whilst providing predictability and consistency through any section of airspace, can prevent optimised routings based on variable factors such as winds.

Australia's air navigation service provider Airservices Australia, for example, calculates and publishes this so-called Flextrack information for airlines flying into, through and out of Australian airspace, offering them the most prevailing weather patterns and winds to reduce fuel usage and emissions. Flextracks are now being used widely between Australia and airports in Asia and the Middle East. New surveillance technology much like GPS systems will enable it to be used on more crowded routes as well. The move from fixed to free route airspace in Europe enabled around 10 million tonnes of CO_2 emissions to be saved between 2017 and 2021. This is equivalent to around 170,000 round trips between Madrid and Riga. 68% of flight time was flown in free route airspace in 2021[231]. Free route airspace has the potential to reduce these emissions by 10,000 tonnes per day (3,000 tonnes of fuel)[232]. This requires cooperation among the countries over which an aircraft flies, good examples of which are being experienced in Europe.

Improvements to the harmonisation of airspace may allow aircraft to navigate more seamlessly across national borders on the most efficient routes. In some regions, large areas of airspace are permanently reserved for the military, which means civil aircraft must fly around these areas, adding time, fuel burn and emissions. The Civil Air Navigation Services Organisation (CANSO) and its members are working with governments in those regions to provide for access to this airspace on a flexible basis when it is not required for military purposes and to also look at the possibility of reducing the size of such restricted areas to allow for more direct commercial routes. The so-called "flexible use of airspace" means that it can be closed when required by the military but open at all other times.

In Europe, a collaborative project is underway called Single European Sky ATM Research (SESAR), which is part of the vision to transform Europe's aviation infrastructure enabling it to handle future growth while minimising environmental impact with efficient flight routes and optimised trajectories. Once in place, the Single European Sky will be a key enabler for enhancing sustainability, contributing to an effective environmental improvement of the sector and helping it to be more resilient.

The SESAR programme was initially launched in 2008 and the third phase runs until 2031. A total of €5.5 billion is being invested by the European Union, Eurocontrol and the industry, each of which contribute around a third of the total funding. SESAR aims to contribute to CO_2 reductions by reducing fuel burn by between 250-500 kilograms per flight between 2012 and 2035, a relative improvement of 5-10%. This corresponds to between 800-1,600 kilograms of CO_2 emissions per flight[233]. The second phase of the programme delivered 127 solutions that could be deployed in the system to reduce emissions from air transport – in total, an estimated 4% reduction in CO_2 emissions per flight could be achieved with the solutions delivered so far.

A similar modernisation of airspace is underway in the United States. Once fully implemented, the Next Generation Air Transportation System (NextGen), like SESAR, will result in significant emissions reductions. The NextGen project is being undertaken by the US Federal Aviation Administration (FAA) and aims to simplify US ATM by rolling out Performance Based Navigation (PBN), an advanced satellite-enabled form of air navigation, and other satellite-based technologies known as Automatic Dependent Surveillance-Broadcast (ADS-B) that replace radar technology, as well as collaborative air traffic management technologies[234].

Market-based measures

Encouraging progress has been made on the first three pillars of the industry's environmental strategy. However, to achieve the goals of carbon-neutral growth and net-zero carbon by 2050, other measures need to be taken. This is why the industry has called on the world's governments, represented at the International Civil Aviation Organization (ICAO), to put in place a global market-based measure for aviation.

At the 2016 ICAO Assembly, the world's governments agreed to implement the first global carbon emissions mechanism for any single industrial sector. The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) is being implemented in phases, with aircraft operators being tasked with monitoring and reporting emissions since 1 January 2019. Operators based in countries that volunteered to take part in the early phases of CORSIA's offsetting obligations have had to offset the growth in their international aviation CO_2 emissions after 2020. From 2027, participation becomes mandatory for most countries. Based on the 129 volunteer nations confirmed at the time of publishing, nearly 80% of the growth in international aviation CO_2 will be offset through CORSIA[235]. The cost of compliance with CORSIA may be between $1.9 to 6.3 billion for the first phase from 2024 to 2026 (depending on the price of eligible carbon credits)[236].

Market-based measures, and in particular the regulated trading of carbon credits generated outside of the aviation sector, will contribute significantly to achieving net-zero CO_2 emissions. These measures are expected to abate residual emissions that cannot be avoided or reduced by new technologies, SAF or operational improvements. In particular, major emission trading schemes applying to aviation, such as the European Emissions Trading Scheme or the UK Emissions Trading Scheme, have already aligned their caps with net-zero CO_2 emissions commitments.

The specific role of carbon dioxide removals to neutralise aviation's residual emissions – a subtype of carbon credits issued from projects that physically remove CO_2 from the atmosphere – is considered with growing interest for future evolutions of aviation market mechanisms.

Green taxes

The aviation industry agrees that it should pay for its environmental impact, but preferably using a mechanism like CORSIA, where there is a direct link to emissions reductions, which is a more effective way that yields true environmental results. By contrast, environmental or "green" taxes add a cost to each flight; a charge for each passenger carried, each take-off or landing, or for each leg of a flight, but there is also little transparency or accountability over governments' use of the revenues collected, and no quantifiable environmental benefits. The taxes aim to internalise the external cost of air travel, which may mean pricing some passengers out of the market. But in many instances, travellers have no reasonable alternative to air transport.

Such taxes are not a viable solution to reduce CO_2 emissions because they may drain the aviation sector of financial resources and delay investments into fleet renewal and efficiency research and development. In nearly all cases, the money raised by governments from such taxes has not been reinvested in environmental improvement measures – the United Kingdom's Air Passenger Duty is a case in point.

It is also worth noting that aviation is already subject to about $400 million of environment-specific passenger taxes and charges around the world[237] (data from 2019). This does not include the European Union Emissions Trading Scheme (which cost airlines over $727 million (EUR650m) in 2019[238], and is expected to have cost airlines $6.7 billion by 2025[239]).

On the ground

Airports, too, are playing their part in improving infrastructure. They work to reduce their environmental footprint through the sustainable management of waste, water, energy, noise, local air quality and emissions. Airport planning and design also takes into consideration environmental aspects to maximise efficiency with the minimal possible impact on the environment.

The Airport Carbon Accreditation Programme, launched by ACI Europe in 2009 and later expanded to all regions, is the only institutionally-endorsed, global carbon management certification programme for airports. It recognises airports at ascending levels of certification: footprint measurement, carbon management towards a reduced carbon footprint, third party engagement in carbon reduction, absolute emissions reductions aligned with objectives of the Paris Agreement and net-zero balance on scopes one and two[240]. At the time of writing, there were 592 airports in 89 countries, covering 52.6% of global air passenger traffic, accredited to the Airport Carbon Accreditation Programme. More than 549,000 tonnes of CO_2 were reduced between 2021 and 2022, equivalent to the CO_2 emitted by the production of more than 81 million cotton t-shirts[241].

Airport energy-efficiency gains have been made via a number of initiatives, such as LED lighting, electrical ground support equipment and renewable energy sources such as wind, hydro and solar. Athens International Airport was one of the pioneers in harnessing the abundant sun in its location, through its investment in photovoltaic power plants. A further phase of the project, which should be completed by 2025, will ensure 100% self-generated electricity production for the airport[242]. Cochin International Airport, the eighth busiest airport in India, became the world's first airport fully powered by solar energy in 2015, and Galapagos Airport on the Ecuadorian island Isla Baltra uses only renewable energy sources – both wind and solar generated.

Airports have also been increasing their rate of waste recycling and diversion from landfill and even using waste to produce energy. In addition, airports have started to introduce the concept of circular economy into environmental programmes. For example, Schiphol entered into a partnership with Engie and Philips to replace the lighting fixtures in its terminal introducing a different business model where the airport pays for light performance while Philips remains the owner of the fittings and installations and is responsible for the system's performance and service life. The circular economy concept can also be applied to the design and development of new infrastructure projects, for instance, using materials which can last longer and be disassembled and assembled in different ways, serving different purposes to extend its life cycle.

Airports also play an important role in collaborative projects involving various stakeholders operating at their sites. These include the provision of fixed electrical ground power and preconditioned air to aircraft and the installation of charging points for electric vehicles used by ground handlers or passengers. Collaboration is also key to the success of sustainable aviation fuels (SAF) and airports can play a role in supporting the commercial deployment of SAF on site at airports.

Dealing with consumer waste

The industry recognises the importance of reducing, reusing, and recycling waste generated by both in-flight operations and on the ground at airports. Passengers are increasingly worried about the impact of single-use plastics on the marine environment, there is increased focus on minimising food waste and the industry is concerned that the regulatory system inhibits their ability to respond to these challenges. Whilst airports are putting in place best-practice recycling and waste minimisation strategies, in line with other large ground-based facilities, aviation has the unique element of on-board cabin and catering waste.

A study commissioned by IATA in 2024 indicates that the sector generated 3.6 million tonnes of cabin waste in 2023 and with passenger growth rates, this waste volume could double by 2040[243]. On a short-haul flight, every passenger produces an average of 762 grams of waste. This number increases to almost 1.18 kilograms on long-haul flights[244]. Untouched food and drinks contribute to 34% of cabin waste, while paper and plastic contribute 66%. Waste removal costs airlines about $6 billion per year[245].

IATA and ACI are working to support the simplification and harmonisation of cabin waste regulations and promote technical solutions that will reduce industry costs and contribute to the circular economy.

Often the rules are different for domestic and international flights when it comes to recycling catering waste. A number of countries with economically important agricultural sectors such as Australia, Canada, the European Union, New Zealand and the USA, have imposed strict controls on catering waste from international flights based on animal health concerns.

These controls often preclude the reuse and recycling of any materials removed from an international flight due to the perceived risk of transferring animal diseases. This is despite the in-flight catering sector operating under very strict hygiene and ingredient source controls and studies have shown that most of these regulations have not been adopted based on the actual risk involved[246].

For domestic and other flights not subject to such regulations, recycling is often possible and practiced, as crew collect used service items. One of the key areas of focus for many businesses and consumers is the reduction and eventual elimination of single-use plastics. The IATA passenger insights survey conducted in November 2023 showed that more than three quarters of passengers would feel better about flying if it did not involve any single-use plastics, and that they would be happy to support fewer food and beverage options so that airlines could achieve this[247]. Single-use plastic products are widely used in aviation and offer a wide variety of benefits including being safe, hygienic and light-weight. Although many single-use plastic products can be removed or replaced easily (straws, stirrers, cutlery), others are more problematic. Single-use plastic regulations often fail to recognise that alternatives to plastics in aviation must meet strict safety and hygiene requirements. In addition, alternative products will need to comply with aviation security and safety restrictions and ensure there is no displaced pollution. For example, replacing plastic water bottles with glass would increase weight and therefore fuel use (and CO_2 emissions). Some plastics, if recycled properly, will have a lower lifecycle impact than other materials such as paper or aluminium.

Whilst airlines are supportive of a move to more sustainable inflight products, it is essential that the sector follows a cohesive and phased implementation plan that can meet national waste reduction targets but also recognise the characteristics of the airline industry. For international airlines, the surge in plastic bans presents an additional challenge, with over 127 countries regulating the use of plastic bags, and 91 have introduced additional restrictions on the manufacture, import, and distribution of single-use plastics[248]. In May 2021, the 27 EU member states also implemented bans and restrictions, and China followed in 2023. Airlines now face the challenge of asymmetric legislation with certain products banned on the outbound and others on the return leg. The same lack of consistency applies to product labelling. For example, the EU has introduced rules that plastic cups should have a specific printed marking. Currently, the Canadian government is considering the development of labelling rules for plastic packaging and single-use plastics, and it is unclear if they will be aligned with the EU or any other national scheme. The United Nations could help harmonise standards internationally, for instance through the United Nations Environment Program (UNEP), which has convened an intergovernmental negotiating committee (INC) to develop an international legally binding agreement on plastic pollution by the end of 2024. In the meantime, at least 40 airlines have nevertheless implemented plastic product reduction and replacement programmes[249].

End-of-service

A passenger aircraft will typically remain in service for 20-25 years. During that time, it will fly on average over 40 million kilometres – over 1,000 times around the world – with some long-haul aircraft at several airlines flying over 100 million kilometres[250]. Once it reaches the end of its useful life, up to 90% of currently retiring aircraft by weight can be recovered via the reuse of spares, recycling or energy recovery. This ensures environmentally-sound management of the aircraft's end of life, but also takes advantage of the many high-quality components and materials. The industry is optimistic that current recycle rates can be maintained as technology advances, as long as composites recycling technologies are developed at scale to address composite-based fuselage and cabin interior waste.

All airframe and engine manufacturers support the responsible management of aircraft and engines after their end of service. These companies, through organisations such as the Aircraft Fleet Recycling Association (AFRA)[251], collaborate to promote responsible environmental management in the disassembly and recycling of aircraft and accredit companies to best practice standards requiring rigorous on-site auditing.

It is anticipated that in the next 20 years, some 15,000 aircraft will be retired[252]. More than 500 aircraft are disassembled each year. This trend was disrupted as a result of the Covid-19 pandemic and only around 420 aircraft were officially retired in 2021, which represents the lowest level since 2007. Between 40-50% of the weight of all dismantled aircraft is returned to the parts distribution pipeline. The remaining unserviceable material is mainly repurposed, recycled and returned to the supply chain as raw materials[253].

Manufacturers are ensuring that new aircraft are designed not only for a long, safe and efficient life but also for end-of-service opportunities. Newer materials, such as composites, are increasingly being recycled for commercial applications in electronics and auto parts. With innovative technology and economic solutions continuing to emerge, maintaining current recycle rates is anticipated. Interior components containing flame retardants required for passenger safety present a technology challenge to recycling. This will continue as a focus of research and development by civil aerospace manufacturers.

Noise

Modern jet aircraft are roughly 75% quieter than the first models, and each new generation continues this downward trend. It is estimated that the noise footprint of each new generation of aircraft is at least 15% smaller than previous models – with some new generation aircraft showing a 75% smaller footprint than the model they replace. Meanwhile, the number of flights has grown dramatically and the sensitivity of communities located near airports to perceived aviation-related noise has also increased.

Statistics in the US show that between 1975 and 2023, the number of residents exposed to significant aircraft noise levels fell by 94%, while passenger departures rose 365%[254]. In Europe, average noise levels around airports are still close to what they were in 2005 despite growth in traffic[255]. This trend is being replicated around the world. Despite this progress, aviation noise impacts remain an issue of concern for many people in communities located near airports.

Addressing these concerns requires effort from many industry stakeholders. Manufacturers continue to explore

and develop new technologies aimed at reducing noise emitted by future generation aircraft, enabling more advanced operational noise-mitigation procedures, and facilitating adoption of other beneficial technologies which may also otherwise impact noise. Airports and air traffic controllers are working to provide operational noise mitigation measures, and airports continue to work with local governments to more appropriately zone areas around airports. Land-use planning is crucial for minimising the number of people exposed to aircraft noise. Effective land-use planning can discourage or prevent inappropriate new residential, health or educational developments, and encourage developments that are not sensitive to aircraft noise, such as light industry or storage areas.

Counter-intuitively, in some cases, efforts to improve airspace efficiency can also lead to a higher number of noise complaints, even where the numbers of people exposed to noise have reduced. The implementation of performance-based navigation has, in some cases, led to an increased perception of noise by communities where flight paths have changed and are now flown very accurately by all aircraft on those routes (compared to historically aircraft being spread more geographically across different communities). In cases like these, it is important for governments and the industry to engage with communities on noise issues and to determine how new technologies and airspace changes, land-use planning, or other methods such as insulating houses, can be used to address concerns.

Aviation is not the only source of noise in the transport sector; in many cases, noise impacts on communities stem far more regularly from the road and rail sectors. A report by the European Environment Agency shows that road traffic is responsible for the vast majority of noise in Europe, exposing over 106 million people to levels above 55 decibel (dB). Rail is the second-highest cause of noise, with nearly 17 million people exposed, and aviation noise comes in third, with just over 2 million people affected[256].

Climate adaptation

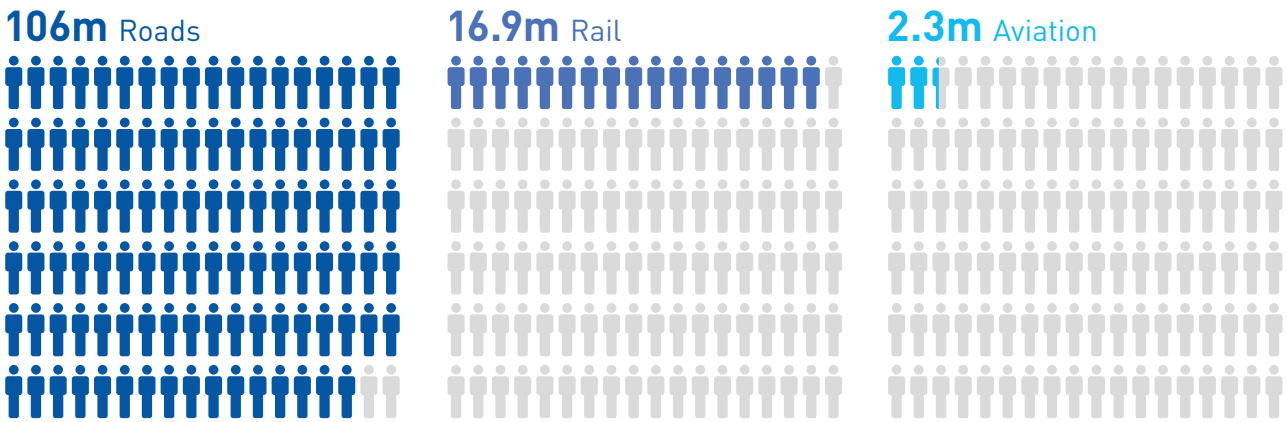
The aviation industry is prioritising fuel efficiency to reduce its impact on climate change. However, a changing climate also impacts flights and ground operations at airports and will continue to do so. Aviation is a resilient industry, used to dealing with operational challenges, from extreme weather events to closure of airspace due to Covid-19 or volcanic ash. Some future climate impacts could be dealt with through existing practices of normal daily network planning and operations, particularly in the short-term, while others will require more systematic planning and changes. Assessing risks at early stages, understanding knock-on effects of anticipated impacts, working in collaboration with aviation and non-aviation stakeholders and planning to increase overall resilience are general recommendations. Identifying opportunities to combine mitigation with adaptation measures are also relevant to ensure resilience of projects. For example, as airports invest in renewable energy generation onsite to reduce CO_2 emissions, considerations on resilience to more adverse weather conditions are advisable.

Physical changes to the climate could potentially have long-term impacts across the aviation sector. For example:

- Weather changes, including increased storminess (resulting in more diversions or flight cancellations); more turbulence; increased snowfall and snow or frost in places that have not traditionally experienced it; or a trend towards hotter weather, which can impact the take-off performance characteristics of aircraft; and operations in more polluted air, which can impact engine durability and maintenance requirements.
- Infrastructure impacts, including rising sea levels, which may affect airport and other ground infrastructure, and increased rainfall, flooding and storm surges, which can also flood ground infrastructure, such as airports and air traffic control facilities. A 2018 ACI resolution encouraged airports to conduct risk assessments and take into consideration the potential impact of climate change as they develop their master plans[258].

Planes, trains and automobiles

Population exposed to noise above 55dB in Europe, 2022 (in millions)[257].



» Market dynamics, including the less-understood consequences of possible alterations in destination choices by travellers as a result of changing weather patterns. Increasing temperatures may make some destinations less attractive during summer months if they start getting too hot, and other destinations may increase in popularity.

Contrails

The aviation industry is also focused on another of its climate impacts which has less scientific clarity or mature solutions: the causes and consequences of other aviation emissions besides CO_2, and their atmospheric effects. Among those non-CO_2 impacts, condensation trails, or 'contrails', (the familiar white lines in the sky that are, in essence, human-made clouds) could have the most significant warming effect.

Some persistent contrails occurring during the day have a cooling effect by reducing the solar radiation reaching the Earth's surface, much like naturally occurring clouds. Those occurring at night have a warming effect by trapping heat in the atmosphere, rather than allowing it to escape.

The latest scientific consensus is that persistent contrails have, on balance, a warming impact, with a radiative effect potentially in the same order of magnitude as aviation's CO_2 emissions. Although the quantification of this impact currently has low confidence levels and more research is needed to fully understand the overall climate impact, mitigation options are already being trialled and tested (such as flying around the areas of atmosphere where persistent, warming contrails are likely to form).

Despite some complexities in several aspects of the underlying science, the sector is engaged across a range of research and operational initiatives to identify how best to avoid warming contrails as part of a wider climate impact mitigation effort. Large-scale trails – both modelled and in real-world operations – are strongly supported to identify how these mitigation efforts could eventually play a role in daily flight operations[259].



REGIONAL AND GROUP ANALYSIS



- Africa
- Asia-Pacific
- Europe
- Latin America and the Caribbean
- Middle East
- North America
- APEC economies
- European Union
- ASEAN member states
- Small island states
- Developing countries
- OECD countries
- Least-developed countries
- Landlocked developing countries

AFRICA[260]

Air transport supported 8.1 million jobs and contributed $75 billion to GDP in Africa. This is equivalent to one in every 61 jobs across the continent or 1.6% of all employment and 2.6% of all GDP in African countries in 2023.

Every person directly employed in the aviation sector supported another 22 jobs elsewhere in Africa. Similarly, $5.30 of economic activity was supported elsewhere in Africa for every $1 of gross value added (GVA) directly created by the air transport sector.

The aviation sector in Africa directly employed around 360,000 people in 2023. A sub-sectoral analysis of these workers suggests that:

- **200,000 (56% of the total)** were employed by airlines or handling agents as, for example, flight crew, check-in staff, maintenance crew, or head office staff;
- **53,000 (15%)** had jobs with airport operators in, for example, airport management, maintenance, and security;
- **75,000 (21%)** worked on-site in airports at, for example, retail outlets, restaurants, hotels and government agencies;
- **17,000 (5%)** were employed in the manufacture of civil aircraft (including systems, components, airframes, and engines); and
- **13,000 (4%)** worked for air navigation service providers in, for example, air traffic control and engineering.

Airlines, airport operators, retailers and other on-site businesses at airports and air navigation service providers and civil aircraft manufacturers also contribute to GDP in Africa. In 2023, the operations of these businesses directly generated a $12 billion contribution to GDP, about the equivalent to the entire GDP of Namibia or 89% of Malawi's GDP.

The aviation sector's spending with suppliers is estimated to have supported a further 1.2 million jobs and a $13 billion gross value-added contribution to GDP. In addition, wage payments to staff – by the aviation sector and businesses in the aviation sector's supply chain – supported 1.5 million more jobs and a $8.3 billion gross value added contribution to GDP.

The aviation sector also facilitates a substantial amount of tourism in Africa. This stimulates still more economic activity, as tourists spend their money with restaurants, hotels, retailers, tour operators, and other providers of consumer goods and services. In 2023, spending by foreign visitors who flew to African countries supported an estimated 5 million jobs and a $42 billion contribution to GDP.

In total, accounting for the sector's direct impact, its supply chain impact, its wage expenditure impact, and the impact of tourism made possible by air transport, the aviation sector supported 8.1 million jobs and a $75 billion contribution to GDP in Africa in 2023.

Over the next two decades, the aviation sector's direct contribution to Africa's GDP is forecast to grow by an estimated 4.9% annually. The number of people directly employed in the sector is also forecast to grow, rising by 4.4% annually from 360,000 to 840,000 between 2023 and 2043. This increase will, in turn, drive growth in the economic output and jobs that are supported by the air transport industry over the next 20 years. Oxford Economics forecasts that by 2043 the impact of air transport and the tourism it facilitates in Africa will have grown to support 16 million jobs (93% more than in 2023) and a $190 billion contribution to GDP (a 158% increase).



2.9%
share of global passenger traffic

1.4 m
flights[263]
3 million flight movements at airports[264]

110 m
passengers[261]
221.1 million passenger movements at airports[262]

196
airlines[266]

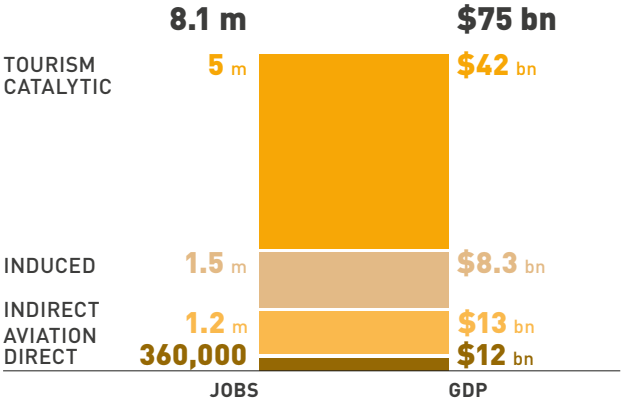
1.2 m
tonnes of cargo[267]

383
commercial airports[265]

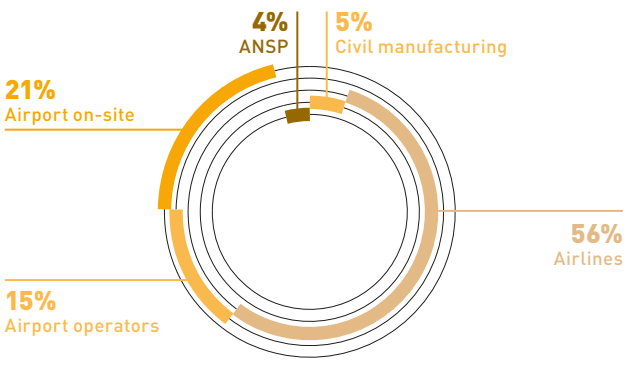
36
air navigation service providers[268]

73%
average regional load factor[269]

Total jobs and GDP generated by air transport in Africa, 2023



Direct jobs generated by air transport in Africa, 2023



ASIA-PACIFIC[270]

Air transport supported 42 million jobs and contributed $890 billion to GDP in the Asia-Pacific region. This is equivalent to one in every 45 jobs across the region or 2.2% of all employment and 2.5% of all GDP in Asia-Pacific countries in 2023.

Every person directly employed in the aviation sector supported another nine jobs elsewhere in the Asia-Pacific region. Similarly, $3.70 of economic activity was supported elsewhere in Asia-Pacific for every $1 of gross value-added directly created by the air transport sector.

The aviation sector in the Asia-Pacific region directly employed 4.3 million people in 2023. A sub-sectoral analysis of these workers suggests that:

- **1.3 million (31% of the total)** were employed by airlines or handling agents as, for example, flight crew, check-in staff, maintenance crew, or head office staff;
- **260,000 (6%)** had jobs with airport operators in, for example, airport management, maintenance, and security;
- **1.9 million (43%)** worked on-site in airports at, for example, retail outlets, restaurants, hotels and government agencies;
- **790,000 (18%)** were employed in the manufacture of civil aircraft (including systems, components, airframes, and engines); and
- **77,000 (2%)** worked for air navigation service providers in, for example, air traffic control and engineering.

Airlines, airport operators, retailers and other on-site businesses at airports and air navigation service providers and civil aircraft manufacturers also contribute to GDP in Asia-Pacific countries. In 2023, the operations of these businesses directly generated a $190 billion contribution to GDP, equivalent to three quarters of the entire GDP of New Zealand.

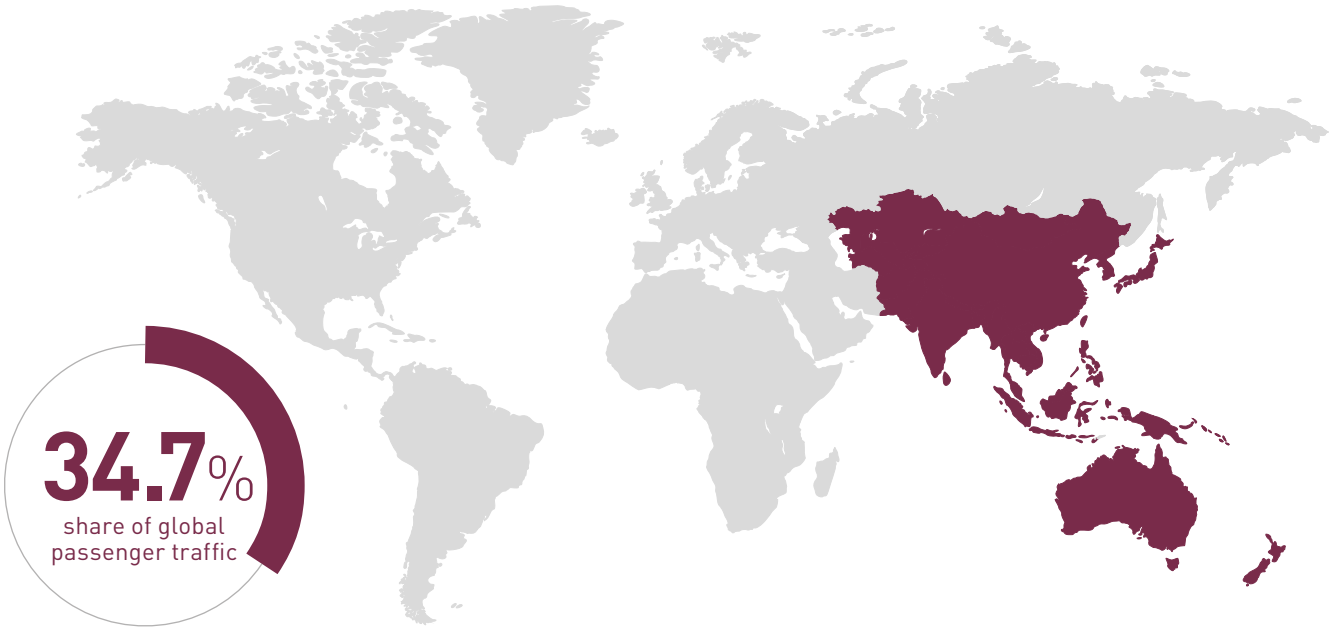
The aviation sector's spending with suppliers is estimated to have supported a further 9.7 million jobs and a $270 billion gross value added contribution to GDP. In addition, wage payments to staff – by the aviation sector and businesses in the aviation sector's supply chain – supported 7.9 million more jobs and a $180 billion gross value added contribution to GDP.

The aviation sector also facilitates a substantial amount of tourism in the Asia-Pacific region. This stimulates still more economic activity, as tourists spend their money with restaurants, hotels, retailers, tour operators, and other providers of consumer goods and services. In 2023, spending by foreign visitors who flew to Asia-Pacific countries supported an estimated 20 million jobs and a $250 billion contribution to GDP.

In total, accounting for the sector's direct impact, its supply chain impact, its wage expenditure impact, and the impact of tourism made possible by air transport, the aviation sector supported 42 million jobs and a $890 billion contribution to GDP in the Asia-Pacific region in 2023.

Over the next two decades, the aviation sector's direct contribution to the Asia-Pacific's GDP is forecast to grow by an estimated 5.1% annually. The number of people directly employed in the sector is also forecast to grow, rising 1.7% annually from 4.3 million to 6.1 million between 2023 and 2043. Oxford Economics forecasts that by 2043 the impact of air transport and the tourism it facilitates in Asia-Pacific countries will have grown to support 62 million jobs (47.1% more than in 2023) and a $2.3 trillion contribution to GDP (a 157% increase).

Note: the snapshot in this edition of Aviation: Benefits Beyond Borders is for 2023 data, at a time when some parts of Asia-Pacific had not fully recovered from the Covid-19 shutdown in traffic. This should be taken into account when viewing this data.



11.4 m
flights
25.2 million aircraft movements at airports

1.4 bn
passengers
3 billion passenger movements at airports

316
airlines

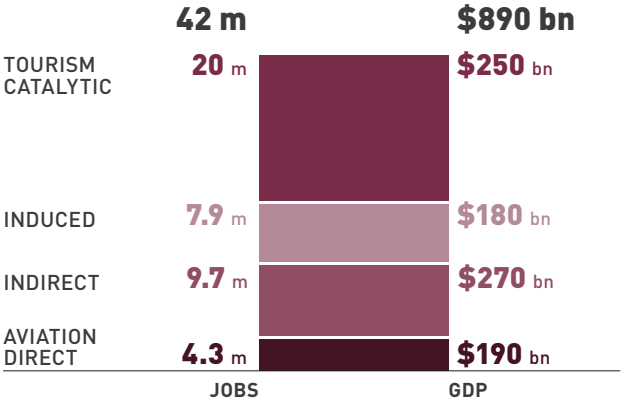
20.5 m
tonnes of cargo

1,187
commercial airports

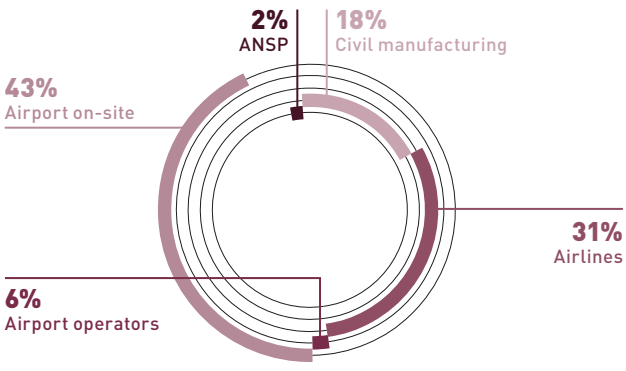
35
air navigation service providers

81%
average regional load factor

Total jobs and GDP generated by air transport in Asia-Pacific, 2023



Direct jobs generated by air transport in Asia-Pacific, 2023



EUROPE[271]

Air transport supported 15 million jobs and contributed $1.2 trillion to GDP in Europe. This is equivalent to one in every 25 jobs across the continent and 4% of all employment and 4.6% of all GDP in European countries in 2023.

Every person directly employed in the aviation sector supported another four jobs elsewhere in Europe. Similarly, $3.30 of economic activity was supported elsewhere in Europe for every $1 of gross value added directly created by the air transport sector.

The aviation sector in Europe directly employed an estimated 2.9 million people in 2023. A sub-sectoral analysis of these workers suggests that:

- **490,000 (17% of the total)** were employed by airlines or handling agents as, for example, flight crew, check-in staff, maintenance crew, or head office staff;
- **180,000 (6%)** had jobs with airport operators in, for example, airport management, maintenance, and security;
- **1.8 million (63%)** worked on-site in airports at, for example, retail outlets, restaurants, hotels and government agencies;
- **360,000 (12%)** were employed in the manufacture of civil aircraft (including systems, components, airframes, and engines); and
- **56,000 (2%)** worked for air navigation service providers in, for example, air traffic control and engineering.

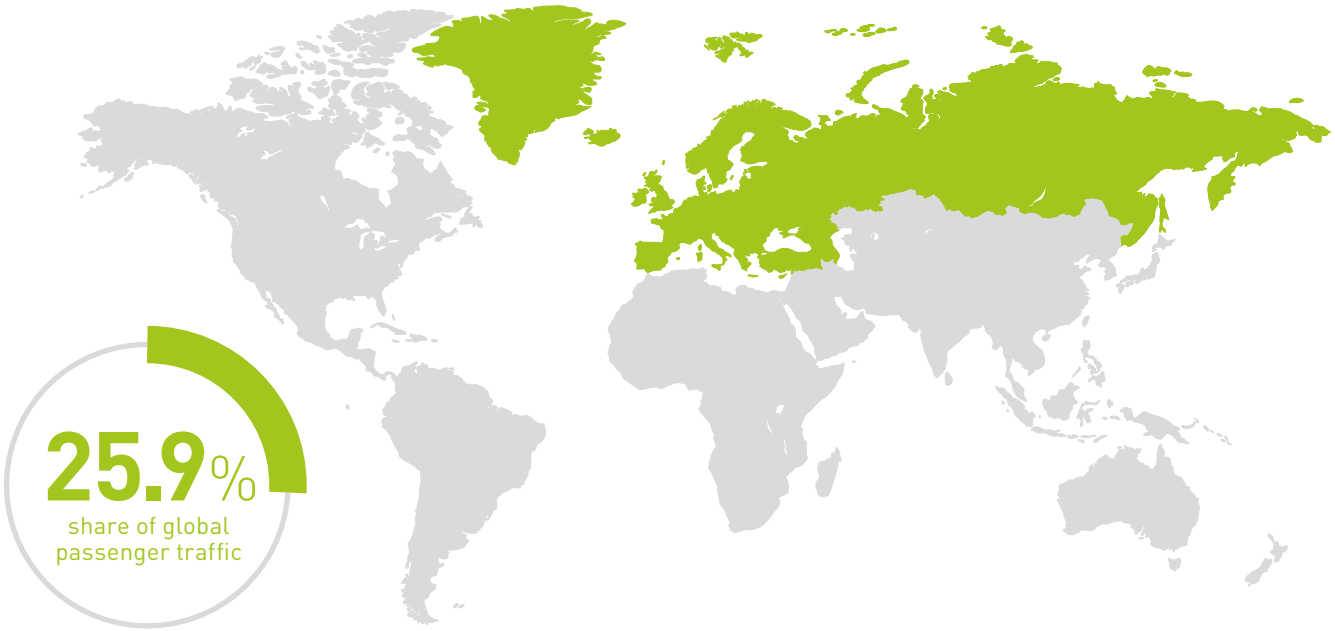
Airlines, airport operators, retailers and other on-site businesses at airports and air navigation service providers and civil aircraft manufacturers also contribute to GDP in Europe. In 2023, the operations of these businesses directly generated a $283 billion contribution to GDP, equivalent to the entire GDP of Portugal.

The aviation sector's spending with suppliers is estimated to have supported a further 4.2 million jobs and a $330 billion gross value added contribution to GDP. In addition, wage payments to staff – by the aviation sector and businesses in the aviation sector's supply chain – supported another 2.9 million jobs and a $230 billion gross value added contribution to GDP.

The aviation sector also facilitates a substantial amount of tourism in Europe. This stimulates still more economic activity, as tourists spend their money with restaurants, hotels, retailers, tour operators, and other providers of consumer goods and services. In 2023, spending by foreign visitors who flew to European countries supported an estimated 5.3 million jobs and a $370 billion contribution to GDP.

In total, accounting for the sector's direct impact, its supply chain impact, its wage expenditure impact, and the impact of tourism made possible by air transport, the aviation sector supported an estimated 15 million jobs and a $1.2 trillion contribution to GDP in Europe in 2023.

Over the next two decades, the aviation sector's direct contribution to Europe's GDP is forecast to grow by an estimated 2.5% annually. The number of people directly employed in the sector is also forecast to grow, rising by 1.2% annually from 2.9 million to 3.7 million between 2023 and 2043. Oxford Economics forecasts that by 2043, the impact of air transport and the tourism it facilitates in Europe will have grown to support 21 million jobs (39% more than in 2023) and a $2.1 trillion contribution to GDP (a 77% increase).



7.9 m
flights
23 million aircraft movements at airports

988 m
passengers
2.3 billion passenger movements at airports

309
airlines

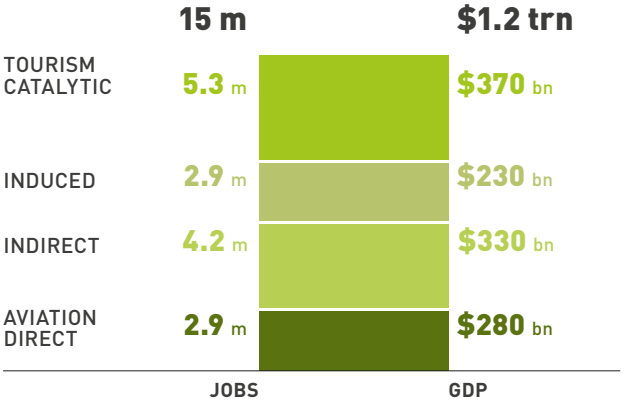
10.4 m
tonnes of cargo

766
commercial airports

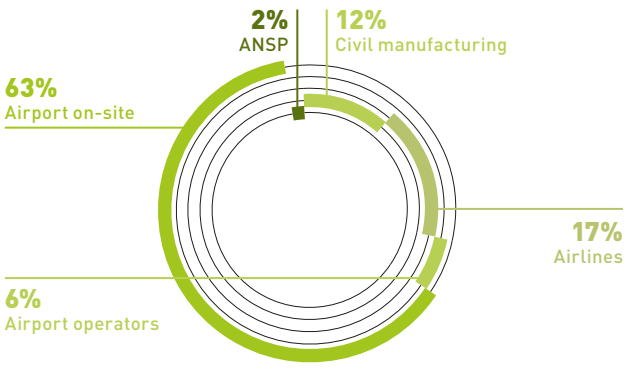
44
air navigation service providers

85%
average regional load factor

Total jobs and GDP generated by air transport in Europe, 2023



Direct jobs generated by air transport in Europe, 2023



LATIN AMERICA AND THE CARIBBEAN[272]

Air transport supported 8.3 million jobs and contributed $240 billion to GDP in Latin America and the Caribbean. This is equivalent to one in every 35 jobs across the region or 2.9% of all employment and 3.6% of all GDP in Latin American and Caribbean countries in 2023.

Every person directly employed in the aviation sector supported another 10 jobs elsewhere in Latin America and the Caribbean. Similarly, $3.00 of economic activity was supported elsewhere in Latin America and the Caribbean for every $1 of gross value added directly created by the air transport sector.

The aviation sector in Latin America and the Caribbean directly employed an estimated 790,000 people in 2023. A sub-sectoral analysis of these workers suggests that:

- **220,000 (28% of the total)** were employed by airlines or handling agents as, for example, flight crew, check-in staff, maintenance crew, or head office staff;
- **33,000 (4%)** had jobs with airport operators in, for example, airport management, maintenance, and security;
- **440,000 (56%)** worked on-site in airports at, for example, retail outlets, restaurants, hotels and government agencies;
- **61,000 (8%)** were employed in the manufacture of civil aircraft (including systems, components, airframes, and engines); and
- **27,000 (3%)** worked for air navigation service providers in, for example, air traffic control and engineering.

Airlines, airport operators, retailers and other on-site businesses at airports and air navigation service providers and civil aircraft manufacturers also contribute to GDP in Latin America and the Caribbean. In 2023, the operations of these businesses directly generated a $60 billion contribution to GDP, equivalent to around 77% of Uruguay's GDP.

The aviation sector's spending with suppliers is estimated to have supported a further 2 million jobs and a $52 billion gross value added contribution to GDP. In addition, wage payments to staff – by the aviation sector and businesses in the aviation sector's supply chain – supported 1.7 million more jobs and a $39 billion gross value added contribution to GDP.

The aviation sector also facilitates a substantial amount of tourism in Latin America and the Caribbean. This stimulates still more economic activity, as tourists spend their money with restaurants, hotels, retailers, tour operators, and other providers of consumer goods and services. In 2023, spending by foreign visitors who flew to Latin America and the Caribbean supported an estimated 3.8 million jobs and a $85 billion contribution to GDP.

In total, accounting for the sector's direct impact, its supply chain impact, its wage expenditure impact, and the impact of tourism made possible by air transport, the aviation sector supported an estimated 8.3 million jobs and a $240 billion contribution to GDP in Latin America and the Caribbean in 2023.

Over the next two decades, the aviation sector's direct contribution to Latin America and the Caribbean's GDP is forecast to grow by an estimated 3.2% annually. The number of people directly employed in the sector is also forecast to grow, rising by 2.3% annually from 790,000 to 1.2 million between 2023 and 2043. Oxford Economics forecasts that by 2043 the impact of air transport and the tourism it facilitates in Latin America and the Caribbean will have grown to support 15 million jobs (76% more than in 2023) and a $500 billion contribution to GDP (a 114% increase).



3.0 m
flights
8.2 million aircraft movements at airports

317 m
passengers
732.4 million passenger movements at airports

135
airlines

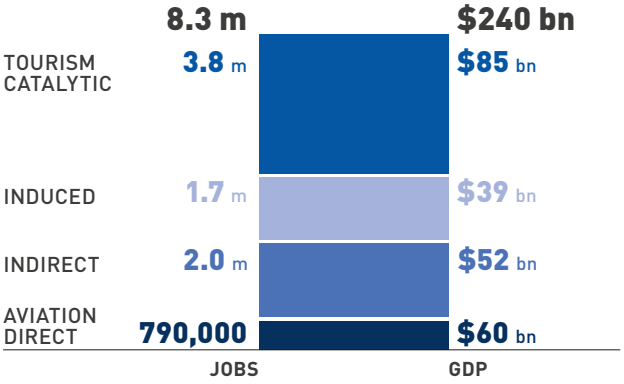
2.6 m
tonnes of cargo

527
commercial airports

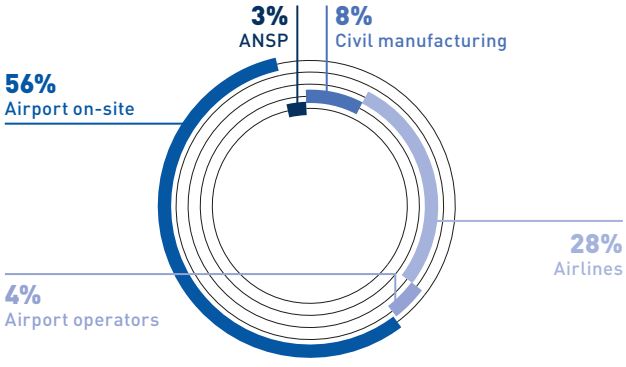
31
air navigation service providers

83%
average regional load factor

Total jobs and GDP generated by air transport in Latin America and the Caribbean, 2023



Direct jobs generated by air transport in Latin America and the Caribbean, 2023



MIDDLE EAST[273]

Air transport supported 4 million jobs and contributed $290 billion to GDP in the Middle East. This is equivalent to one in every 20 jobs across the region or 5% of all employment and 4.3% of all GDP in Middle Eastern countries in 2023.

Every person directly employed in the aviation sector supported another six jobs elsewhere in the Middle East. Similarly, $3.60 of economic activity was supported elsewhere in the Middle East for every $1 of gross value added directly created by the air transport sector.

The aviation sector in the Middle East directly employed an estimated 580,000 people in 2023. A sub-sectoral analysis of these workers suggests that:

- **220,000 (38% of the total)** were employed by airlines or handling agents as, for example, flight crew, check-in staff, maintenance crew, or head office staff;
- **32,000 (6%)** had jobs with airport operators in, for example, airport management, maintenance, and security;
- **310,000 (54%)** worked on-site in airports at, for example, retail outlets, restaurants, and government agencies;
- **7,500 (1%)** were employed in the manufacture of civil aircraft (including systems, components, airframes, and engines); and
- **6,600 (1%)** worked for air navigation service providers in, for example, air traffic control and engineering.

Airlines, airport operators, retailers and other on-site businesses at airports and air navigation service providers and civil aircraft manufacturers also contribute to GDP in the Middle East. In 2023, the operations of these businesses directly generated a $63.8 billion contribution to GDP, equivalent to 89% of the entire GDP of Yemen.

The aviation sector's spending with suppliers is estimated to have supported a further 790,000 jobs and a $76 billion gross value added contribution to GDP. In addition, wage payments to staff – by the aviation sector and businesses in the aviation sector's supply chain – supported 470,000 more jobs and a $43 billion gross value added contribution to GDP.

The aviation sector also facilitates a substantial amount of tourism in the Middle East. This stimulates still more economic activity, as tourists spend their money with restaurants, hotels, retailers, tour operators, and other providers of consumer goods and services. In 2023, spending by foreign visitors who flew to Middle Eastern countries supported an estimated 2.2 million jobs and a $110 billion contribution to GDP.

In total, accounting for the sector's direct impact, its supply chain impact, its wage expenditure impact, and the impact of tourism made possible by air transport, the aviation sector supported an estimated 4 million jobs and a $290 billion contribution to GDP in the Middle East in 2023. Some parts of the region benefit at even greater levels, with Oxford Economics reporting that some 27% of Dubai's GDP in 2023 came from aviation-related activity[274].

Over the next two decades, the aviation sector's direct contribution to the Middle East's GDP is forecast to grow by an estimated 4.5% annually. The number of people directly employed in the sector is also forecast to grow, rising by 2.4% annually from 580,000 to 930,000 between 2023 and 2043. Oxford Economics forecasts that by 2043 the impact of air transport and the tourism it facilitates in Middle Eastern countries will have grown to support 9.4 million jobs (134% more than in 2023) and a $730 billion contribution to GDP (a 151% increase).



4.6%
share of global passenger traffic

1.2 m
flights
3 million aircraft movements at airports

142 m
passengers
407.8 million passenger movements at airports

58
airlines

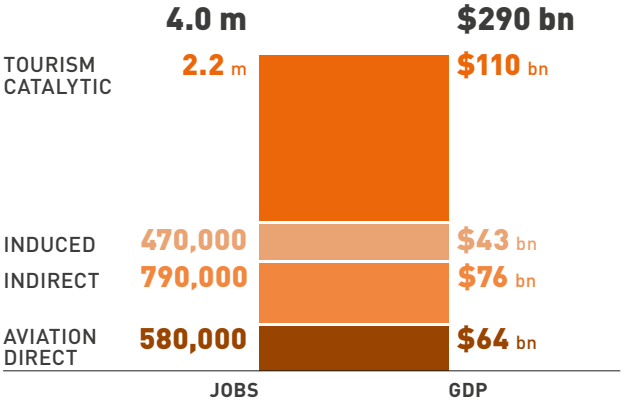
6.6 m
tonnes of cargo

128
commercial airports

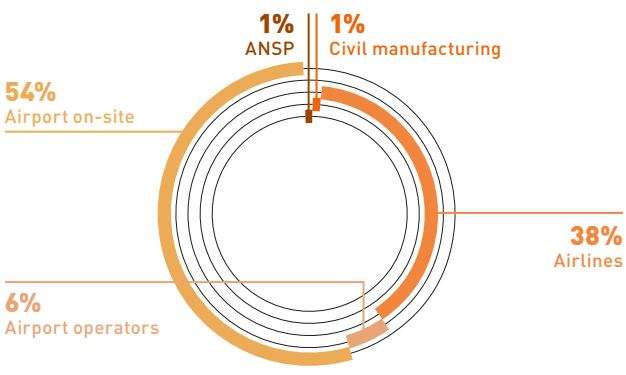
14
air navigation service providers

78%
average regional load factor

Total jobs and GDP generated by air transport in the Middle East, 2023



Direct jobs generated by air transport in the Middle East, 2023



NORTH AMERICA[275]

Air transport supported 8.4 million jobs and contributed $1.4 trillion to GDP in North America. This is equivalent to one in every 21 jobs across the continent or 4.7% of all employment and 4.7% of all GDP in the United States and Canada in 2023.

Every person directly employed in the aviation sector supported another two jobs elsewhere in North America. Similarly, $2.00 of economic activity was supported elsewhere in North America for every $1 of gross value added directly created by the air transport sector.

The aviation sector in North America directly employed an estimated 2.5 million people in 2023. A sub-sectoral analysis of these workers suggests that:

- **630,000 (25% of the total)** were employed by airlines or handling agents as, for example, flight crew, check-in staff, maintenance crew, or head office staff;
- **54,000 (2%)** had jobs with airport operators in, for example, airport management, maintenance, and security;
- **1.3 million (52%)** worked on-site in airports at, for example, retail outlets, restaurants, hotels and government agencies;
- **510,000 (20%)** were employed in the manufacture of civil aircraft (including systems, components, airframes, and engines); and
- **35,000 (1%)** worked for air navigation service providers in, for example, air traffic control and engineering.

Airlines, airport operators, retailers and other on-site businesses at airports and air navigation service providers and civil aircraft manufacturers also contribute to GDP in North America. In 2023, the operations of these businesses directly generated a $460 billion contribution to GDP, equivalent to the entire GDP of Minnesota.

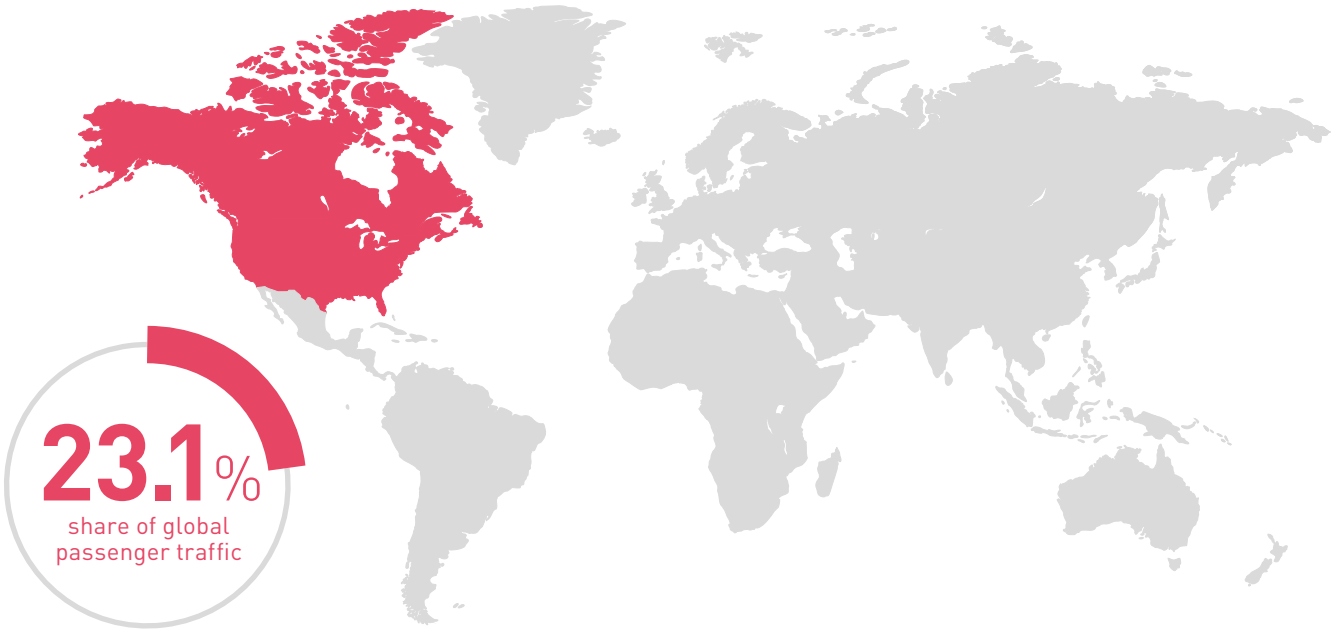
The aviation sector's spending with suppliers is estimated to have supported a further 2.3 million jobs and a $410 billion gross value added contribution to GDP. In addition, wage payments to staff – by the aviation sector and businesses in the aviation sector's supply chain – supported 2.6 million more jobs and a $410 billion gross value added contribution to GDP.

The aviation sector also facilitates a substantial amount of tourism in North America. This stimulates still more economic activity, as tourists spend their money with restaurants, hotels, retailers, tour operators, and other providers of consumer goods and services. In 2023, spending by foreign visitors who flew to North American countries supported an estimated 920,000 jobs and a $110 billion contribution to GDP.

In total, accounting for the sector's direct impact, its supply chain impact, its wage expenditure impact, and the impact of tourism made possible by air transport, the aviation sector supported an estimated 8.4 million jobs and a $1.4 trillion contribution to GDP in North America in 2023.

Over the next two decades, the aviation sector's direct contribution to North America's GDP is forecast to grow by an estimated 3.1% annually. The number of people directly employed in the sector is also forecast to grow, rising by 1.8% annually from 2.5 million to 3.7 million between 2023 and 2043. Oxford Economics forecasts that by 2043 the impact of air transport and the tourism it facilitates in North America will have grown to support 13 million jobs (51% more than in 2023) and a $2.6 trillion contribution to GDP (an 87% increase).

Note: In the United States, the FAA collects economic impact data with which these numbers are aligned. The FAA assessment further evaluates the much wider economic activity that is supported by air transport, including general aviation and the domestic tourism markets, which this report does not include. Accordingly, with these wider catalytic impacts included, the total number of jobs supported by civil aviation in the US alone is around 9.4 million, with a contribution to GDP of $1.8 trillion (in 2022)[276].



9.6 m
flights
33.6 million aircraft movements at airports

773 m
passengers
2 billion passenger movements at airports

124
airlines

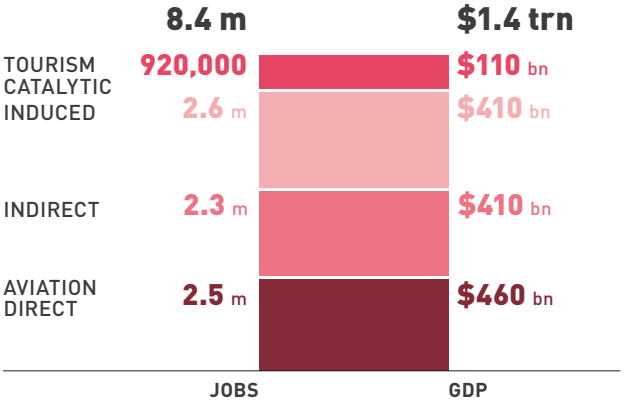
20.1 m
tonnes of cargo

909
commercial airports

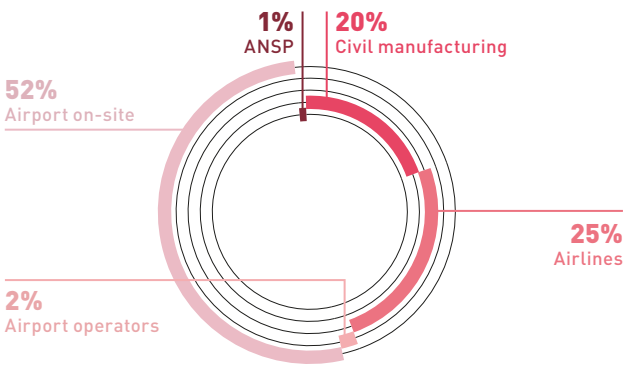
2
air navigation service providers

83%
average regional load factor

Total jobs and GDP generated by air transport in North America, 2023



Direct jobs generated by air transport in North America, 2023



APEC ECONOMIES[277]

Air transport supported 43 million jobs and $2.3 trillion in GDP across Asia-Pacific Economic Cooperation (APEC) economies. This is equivalent to one in every 35 jobs across the bloc or 2.8% of all employment and 3.6% of all GDP in the APEC countries in 2023.

Every person directly employed in the aviation sector supported another five jobs elsewhere in the APEC economies. Similarly, $2.40 of economic activity was supported elsewhere in the APEC economies for every $1 of gross value added directly created by the air transport sector.

The aviation sector in APEC economies directly employed 6.8 million people in 2023 in the following sub-sectors:

- **Airlines: 1.9 million** (29% of the total)
- **Airport operators: 290,000** (4%)
- **Other on-airport: 3.2 million** (47%)
- **Civil aerospace: 1.3 m** (19%)
- **Air navigation service providers: 98,000** (1%)

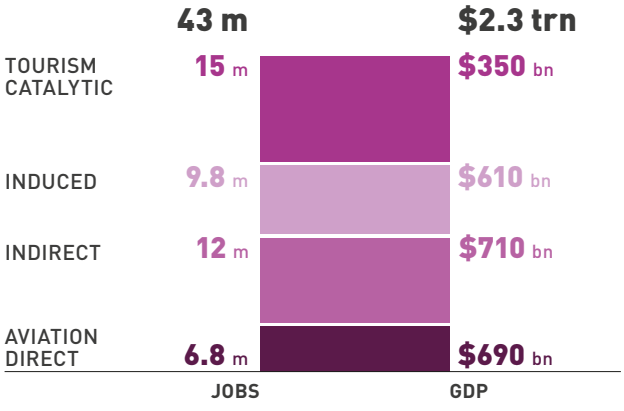
Airlines, airport operators, retailers and other on-site businesses at airports and air navigation service providers and civil aircraft manufacturers also contribute to GDP in APEC economies. In 2023, the operations of these businesses directly generated a $690 billion contribution to GDP, more than the entire GDP of Argentina, or around 91% of Taiwan's GDP.

The aviation sector's spending with suppliers is estimated to have supported a further 12 million jobs and a $710 billion gross value added contribution to GDP. In addition, wage payments to staff – by the aviation sector and businesses in the aviation sector's supply chain – supported 9.8 million more jobs and a $610 billion gross value added contribution to GDP.

In total, accounting for the sector's direct impact, its supply chain impact, its wage expenditure impact, and the impact of tourism made possible by air transport, the aviation sector supported an estimated 43 million jobs and a $2.3 trillion contribution to GDP in APEC economies in 2023.

Over the next two decades, the aviation sector's direct contribution to the APEC bloc's GDP is forecast to grow by an estimated 3.7% annually. The number of people directly employed in the sector is also forecast to grow, rising by 1.7% annually from 6.8 million to 9.5 million between 2023 and 2043. Oxford Economics forecasts that by 2043 the impact of air transport and the tourism it facilitates in APEC economies will have grown to support 64 million jobs (50% more than in 2023) and a $5 trillion contribution to GDP (a 112% increase).

Total jobs and GDP generated by air transport in the APEC economies, 2023



2.2 bn passengers[279]

21.0 m flights

57.7% share of global passenger traffic

397 airlines

2,016 airports

EUROPEAN UNION[279]

Air transport supported 9.2 million jobs and $830 billion (€760[280] billion) in GDP across countries in the European Union. This is equivalent to one in every 23 jobs across member countries or 4.4% of all employment and 4.5% of all GDP in the European Union countries in 2023.

Every person directly employed in the aviation sector supported another four jobs elsewhere in the European Union. Similarly, $3.30 (€3.02) of economic activity was supported elsewhere in the European Union for every $1 (€0.91) of gross value added directly created by the air transport sector.

The aviation sector in the European Union directly employed around 2 million people in 2023 in the following sub-sectors:

- **Airlines: 310,000** (16% of the total)
- **Airport operators: 120,000** (6%)
- **Other on-airport: 1.2 million** (63%)
- **Civil aerospace: 260,000** (14%)
- **Air navigation service providers: 36,000** (2%)

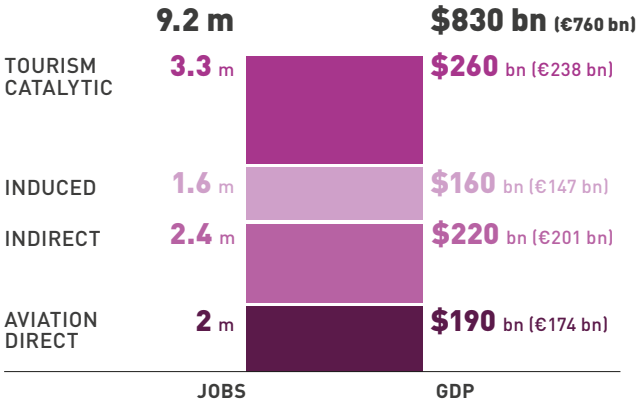
Airlines, airport operators, retailers and other on-site businesses at airports and air navigation service providers and civil aircraft manufacturers also contribute to GDP in the European Union. In 2023, the operations of these businesses directly generated a $190 billion (€175 billion) contribution to GDP, equivalent to around 90% of Hungary's GDP.

The aviation sector's spending with suppliers is estimated to have supported a further 2.4 million jobs and a $220 billion (€205 billion) gross value added contribution to GDP.
In addition, wage payments to staff – by the aviation sector and businesses in the aviation sector's supply chain – supported 1.6 million more jobs and a $160 billion (€150 billion) gross value added contribution to GDP.

In total, accounting for the sector's direct impact, its supply chain impact, its wage expenditure impact, and the impact of tourism made possible by air transport, the aviation sector supported an estimated 9.2 million jobs and a $830 billion (€770 billion) contribution to GDP in the European Union in 2023.

Over the next two decades, the aviation sector's direct contribution to the EU's GDP is forecast to grow by an estimated 2.4% annually. The number of people directly employed in the sector is also forecast to grow, rising by 1.1% annually from 2 million to 2.5 million between 2023 and 2043. Oxford Economics forecasts that by 2043, the impact of air transport and the tourism it facilitates in the European Union will have grown to support 14 million jobs (48% more than in 2023) and a $1.5 trillion (€1.4trn) contribution to GDP (79% increase).

Total jobs and GDP generated by air transport in the EU27 economies, 2023



644 m passengers

4.9 m flights

16.9% share of global passenger traffic

187 airlines

384 airports

ASEAN MEMBER STATES[281]

Air transport supported 17 million jobs and $210 billion in GDP in ASEAN member states. This is equivalent to one in every 19 jobs across the bloc or 5.2% of all employment and 5.5% of all GDP in these countries in 2023.

Every person directly employed in the aviation sector supported another 18 jobs elsewhere in the ASEAN states. Similarly, $3.70 of economic activity was supported elsewhere in the ASEAN region for every $1 of gross value added directly created by the air transport sector.

The aviation sector in the ASEAN bloc directly employed an estimated 880,000 people in 2023 in the following sub-sectors:

- **Airlines: 380,000** (43% of the total)
- **Airport operators: 42,000** (5%)
- **Other on-airport: 400,000** (45%)
- **Civil aerospace: 44,000** (5%)
- **Air navigation service providers: 17,000** (2%)

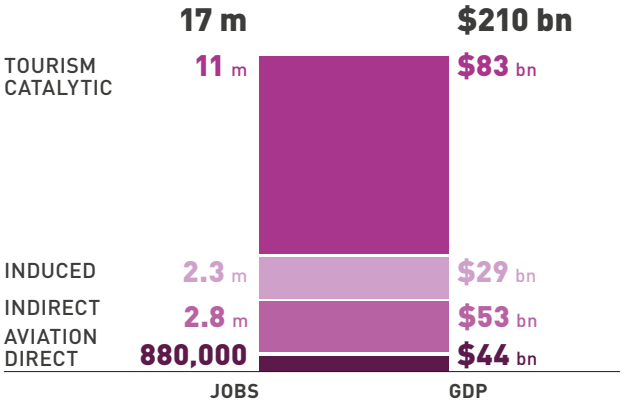
Airlines, airport operators, retailers and other on-site businesses at airports and air navigation service providers and civil aircraft manufacturers also contribute to GDP in ASEAN. In 2023, the operations of these businesses directly generated a $44 billion contribution to GDP, equivalent in size to 71% of Myanmar's GDP.

The aviation sector's spending with suppliers is estimated to have supported a further 2.8 million jobs and a $53 billion gross value added contribution to GDP. In addition, wage payments to staff – by the aviation sector and businesses in the aviation sector's supply chain – supported 2.3 million more jobs and another $29 billion gross value added contribution to GDP.

In total, accounting for the sector's direct impact, its supply chain impact, its wage expenditure impact, and the impact of tourism made possible by air transport, the aviation sector supported an estimated 17 million jobs and a $210 billion contribution to GDP in ASEAN in 2023.

Over the next two decades, the aviation sector's direct contribution to the ASEAN bloc's GDP is forecast to grow by an estimated 5.3% annually. The number of people directly employed in the sector is also forecast to grow, rising by 0.9% from 880,000 to 1.1 million between 2023 and 2043. This increase will, in turn, drive growth in the economic output and jobs that are supported by the air transport industry over the next 20 years. Oxford Economics forecasts that by 2043 the impact of air transport and the tourism it facilitates in ASEAN will have grown to support 28 million jobs (65% more than in 2023) and a $630 billion contribution to GDP (a 202% increase).

Total jobs and GDP generated by air transport in ASEAN, 2023



299 m passengers

2.3 m flights

7.8% share of global passenger traffic

76 airlines

307 airports

SMALL ISLAND STATES[282]

Air transport supported 2 million jobs and $46 billion in GDP in small island states. This is equivalent to one in every 11 jobs across the grouping or 8.7% of all employment and 12.8% of all GDP in these countries in 2023.

Every person directly employed in the aviation sector supported another 37 jobs elsewhere in the small island states. Similarly, $29.70 of economic activity was supported elsewhere in the small island states for every $1 of gross value added directly created by the air transport sector.

The aviation sector in small island states directly employed an estimated 54,000 people in 2023 in the following sub-sectors:

- **Airlines: 21,000** (38% of the total)
- **Airport operators: 4,900** (9%)
- **Other on-airport: 25,000** (47%)
- **Air navigation service providers: 3,000** (6%)

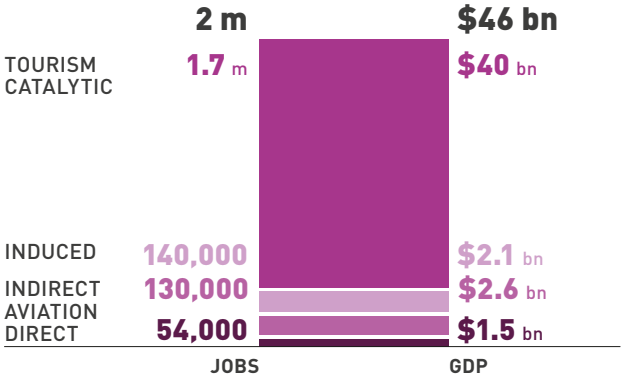
Airlines, airport operators, retailers and other on-site businesses at airports and air navigation service providers and civil aircraft manufacturers also contribute to GDP in small island states. In 2023, the operations of these businesses directly generated a $1.5 billion contribution to GDP, equivalent to 82% of Antigua and Barbuda's GDP.

The aviation sector's spending with suppliers is estimated to have supported a further 130,000 jobs and a $2.6 billion gross value added contribution to GDP. In addition, wage payments to staff – by the aviation sector and businesses in the aviation sector's supply chain – supported 140,000 more jobs and another $2.1 billion gross value added contribution to GDP.

In total, accounting for the sector's direct impact, its supply chain impact, its wage expenditure impact, and the impact of tourism made possible by air transport, the aviation sector supported an estimated 2 million jobs and a $46 billion contribution to GDP in small island states in 2023.

Over the next two decades, the aviation sector's direct contribution to small island states' GDP is expected to grow by an estimated 4.8% annually. The number of people directly employed in the sector is also forecast to grow, rising by 5.0% from 54,000 to 140,000. Oxford Economics forecasts that by 2043 the impact of air transport and the tourism it facilitates in small island states will have grown to support 4.1 million jobs (99% more than in 2023) and a $120 billion contribution to GDP (a 164% increase).

Total jobs and GDP generated by air transport in small island state economies, 2023



38 m passengers

545,000 flights

0.9% share of global passenger traffic

53 airlines

791 airports

DEVELOPING COUNTRIES[283]

Air transport supported nearly 61 million jobs and $1.3 trillion in GDP in developing countries. This is equivalent to one in every 44 jobs across the group of countries or 2.3% of all employment and 2.8% of all GDP in developing countries in 2023.

Every person directly employed in the aviation sector supported another 10 jobs elsewhere in developing countries. Similarly, $3.70 of economic activity was supported elsewhere in developing countries for every $1 of gross value added directly created by the air transport sector.

The aviation sector in developing countries directly employed an estimated 5.5 million people in 2023 in the following sub-sectors:

- **Airlines: 1.9 million** (33% of the total)
- **Airport operators: 370,000** (7%)
- **Other on-airport: 2.4 million** (42%)
- **Civil aerospace: 850,000** (15%)
- **Air navigation service providers: 120,000** (2%)

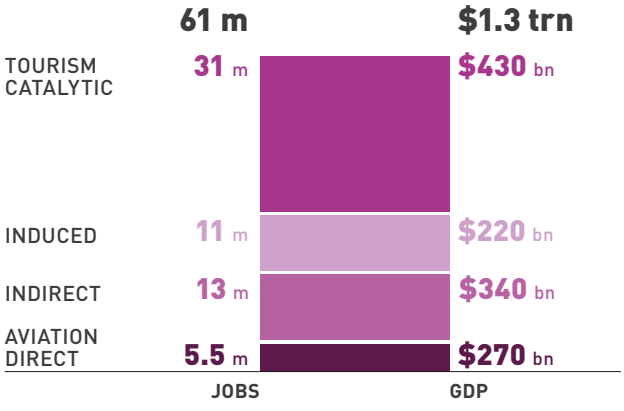
Airlines, airport operators, retailers and other on-site businesses at airports and air navigation service providers and civil aircraft manufacturers also contribute to GDP in developing countries. In 2023, the operations of these businesses directly generated a $270 billion contribution to GDP, equivalent to 80% of the entire GDP of Chile.

The aviation sector's spending with suppliers is estimated to have supported a further 13 million jobs and a nearly $340 billion gross value added contribution to GDP. In addition, wage payments to staff – by the aviation sector and businesses in the aviation sector's supply chain – supported another 11 million jobs and a further $220 billion gross value added contribution to GDP.

In total, accounting for the sector's direct impact, its supply chain impact, its wage expenditure impact, and the impact of tourism made possible by air transport, the aviation sector supported an estimated 61 million jobs and a $1.3 trillion contribution to GDP in developing countries in 2023.

Over the next two decades, the aviation sector's direct contribution to developing countries' GDP is expected to grow by an estimated 4.4% annually. The number of people directly employed in the sector is also forecast to grow, rising by 1.6% annually from 5.5 million to 7.7 million between 2023 and 2043. Oxford Economics forecasts that by 2043 the impact of air transport and the tourism it facilitates in developing countries will have grown to support 97 million jobs (60% more than in 2023) and a $3.1 trillion contribution to GDP (a 150% increase).

Total jobs and GDP generated by air transport in developing economies, 2023



1.8 bn passengers

15.5 m flights

46.6% share of global passenger traffic

633 airlines

1,982 airports

OECD COUNTRIES[284]

Air transport supported 29 million jobs and $2.9 trillion in GDP in OECD countries. This is equivalent to one in every 23 jobs across these countries or 4.3% of all employment and 4.6% of all GDP in OECD countries in 2023.

Every person directly employed in the aviation sector supported another four jobs elsewhere in OECD countries. Similarly, $2.60 of economic activity was supported elsewhere in OECD countries for every $1 of gross value added directly created by the air transport sector.

The aviation sector in OECD countries directly employed 6.3 million people in 2023 in the following sub-sectors:

- **Airlines: 1.3 million** (21% of the total)
- **Airport operators: 240,000** (4%)
- **Other on-airport: 3.7 million** (58%)
- **Civil aerospace: 920,000** (15%)
- **Air navigation service providers: 99,000** (2%)

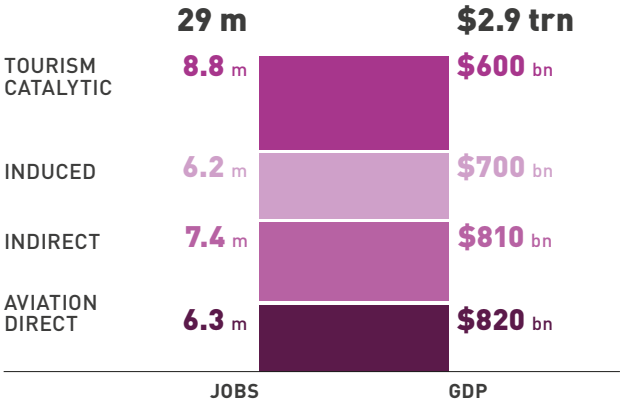
Airlines, airport operators, retailers and other on-site businesses at airports and air navigation service providers and civil aircraft manufacturers also contribute to GDP in OECD countries. In 2023, the operations of these businesses directly generated an $820 billion contribution to GDP, equivalent to the entire GDP of Poland.

The aviation sector's spending with suppliers is estimated to have supported a further 7.4 million jobs and a $810 billion gross value added contribution to GDP. In addition, wage payments to staff – by the aviation sector and businesses in the aviation sector's supply chain – supported 6.2 million more jobs and a $700 billion gross value added contribution to GDP.

In total, accounting for the sector's direct impact, its supply chain impact, its wage expenditure impact, and the impact of tourism made possible by air transport, the aviation sector supported an estimated 29 million jobs and a $2.9 trillion contribution to GDP in OECD countries in 2023.

Over the next two decades, the aviation sector's direct contribution to OECD countries' GDP is forecast to grow by an estimated 3.1% annually. The number of people directly employed in the sector is also forecast to grow, rising by 1.8% from 6.3 million to 8.9 million between 2023 and 2043. Oxford Economics forecasts that by 2043 the impact of air transport and the tourism it facilitates in OECD countries will have grown to support 44 million jobs (53% more than in 2023) and a $5.5 trillion contribution to GDP (an 88% increase).

Total jobs and GDP generated by air transport in the OECD countries, 2023



2.1 bn passengers

19.9 m flights

56.6% share of global passenger traffic

417 airlines

1,885 airports

LEAST-DEVELOPED COUNTRIES[285]

Air transport supported 6 million jobs and $26 billion in GDP across LDCs. This is equivalent to one in every 68 jobs across these countries or 1.5% of all employment and 1.7% of all GDP in LDCs in 2023.

Every person directly employed in the aviation sector supported another 43 jobs elsewhere in LDCs. Similarly, $3.80 of economic activity was supported elsewhere in LDCs for every $1 of gross value added directly created by the air transport sector.

The aviation sector in LDCs directly employed an estimated 140,000 people in 2023 in the following sub-sectors:

- **Airlines: 83,000** (61% of the total)
- **Airport operators: 18,000** (13%)
- **Other on-airport: 31,000** (23%)
- **Air navigation service providers: 4,100** (3%)

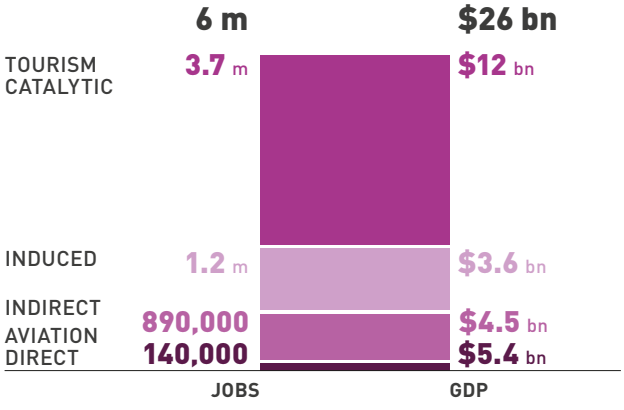
Airlines, airport operators, retailers and other on-site businesses at airports and air navigation service providers and civil aircraft manufacturers also contribute to GDP in LDCs. In 2023, the operations of these businesses directly generated a $5.4 billion contribution to GDP, equivalent to 83% of South Sudan's GDP.

The aviation sector's spending with suppliers is estimated to have supported a further 890,000 jobs and a $4.5 billion gross value added contribution to GDP. In addition, wage payments to staff – by the aviation sector and businesses in the aviation sector's supply chain – supported 1.2 million more jobs and a $3.6 billion gross value added contribution to GDP

In total, accounting for the sector's direct impact, its supply chain impact, its wage expenditure impact, and the impact of tourism made possible by air transport, the aviation sector supported 6 million jobs and a $26 billion contribution to GDP in LDCs in 2023.

Over the next two decades, the aviation sector's direct contribution to LDCs' GDP is forecast to grow by an estimated 6.3% annually. The number of people directly employed in the sector is also forecast to grow, rising by 4.0% from 140,000 to 300,000. Oxford Economics forecasts that by 2043 the impact of air transport and the tourism it facilitates in LDCs will have grown to support 10 million jobs (71% more than in 2023) and a $70 billion contribution to GDP (a 170% increase).

Total jobs and GDP generated by air transport in the LDCs, 2023



46 m passengers

713,000 flights

1.2% share of global passenger traffic

108 airlines

301 airports

LANDLOCKED DEVELOPING COUNTRIES[286]

Air transport supported 2.9 million jobs and $24 billion in GDP across LLDCs. This is equivalent to one in every 75 jobs across these countries or 1.3% of all employment and 2.1% of all GDP in LLDCs in 2023.

Every person directly employed in the aviation sector supported another 17 jobs elsewhere in LLDCs. Similarly, $4.10 of economic activity was supported elsewhere in LLDCs for every $1 of gross value added directly created by the air transport sector.

The aviation sector in LLDCs directly employed an estimated 160,000 people in 2023 in the following sub-sectors:

- **Airlines: 80,000** (50% of the total)
- **Airport operators: 15,000** (10%)
- **Other on-airport: 52,000** (33%)
- **Civil aerospace: 4,800** (3%)
- **Air navigation service providers: 6,800** (4%)

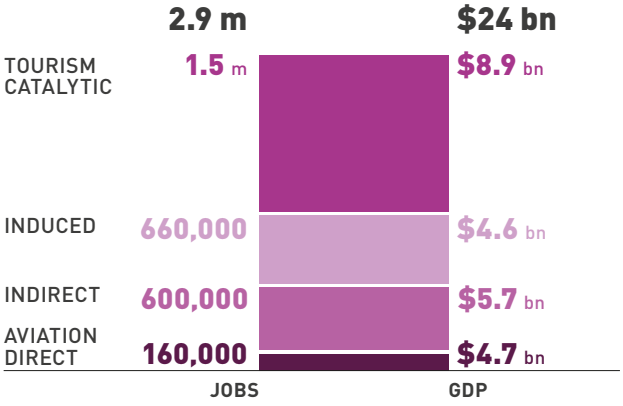
Airlines, airport operators, retailers and other on-site businesses at airports and air navigation service providers and civil aircraft manufacturers also contribute to GDP in LLDCs. In 2023, the operations of these businesses directly generated a $4.7 billion contribution to GDP, equivalent to the entire GDP of Eswatini.

The aviation sector's spending with suppliers is estimated to have supported a further 600,000 jobs and a $5.7 billion gross value added contribution to GDP. In addition, wage payments to staff – by the aviation sector and businesses in the aviation sector's supply chain – supported 660,000 more jobs and a $4.6 billion gross value added contribution to GDP.

In total, accounting for the sector's direct impact, its supply chain impact, its wage expenditure impact, and the impact of tourism made possible by air transport, the aviation sector supported an estimated 2.9 million jobs and a $24 billion contribution to GDP in LLDCs in 2023.

Over the next two decades, the aviation sector's direct contribution to LLDCs' GDP is forecast to grow by an estimated 2.6% annually. The number of people directly employed in the sector is also forecast to grow, rising by 0.4% annually from 160,000 to 170,000. This increase will, in turn, drive growth in the economic output and jobs that are supported by the air transport industry over the next 20 years. Oxford Economics forecasts that by 2043 the impact of air transport and the tourism it facilitates in LLDCs will have grown to support 4.5 million jobs (56% more than in 2023) and a $45 billion contribution to GDP (an 88% increase).

Total jobs and GDP generated by air transport in the LLDCs, 2023



52 m passengers

612,000 flights

1.4% share of global passenger traffic

88 airlines

194 airports


BOEING
NO SMOKING
FLAMMABLE



NATIONAL ANALYSIS

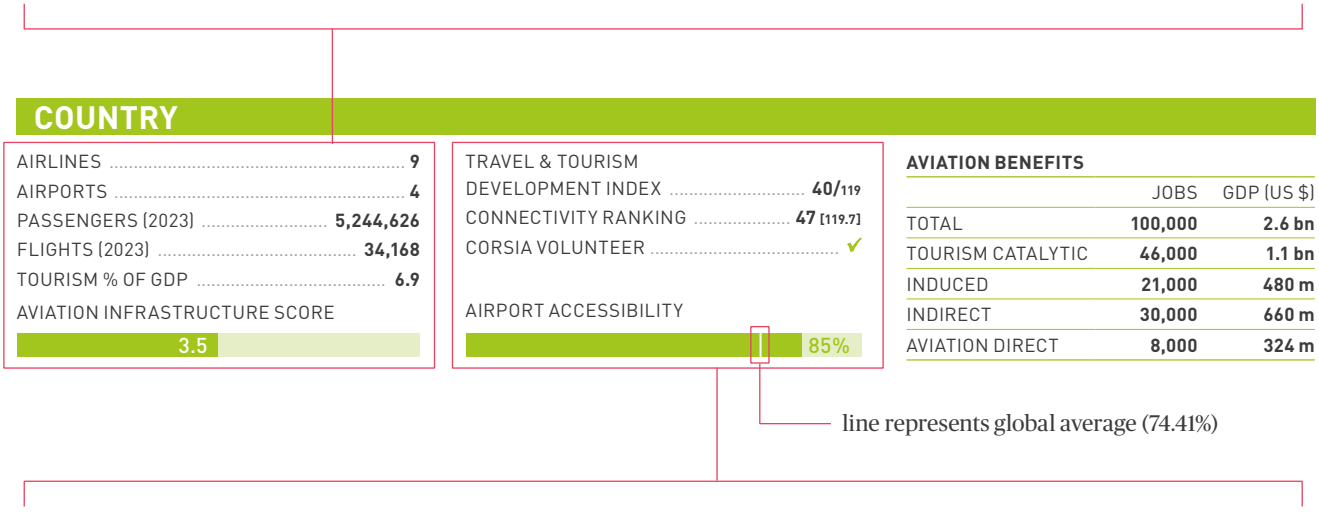


A country-by-country look at aviation's benefits

HOW TO USE THIS SECTION

The Oxford Economics analysis has been supplemented with other analysis:

- **Airlines:** commercial airlines based in the country[287].
- **Airports:** with scheduled commercial flights in the country[288].
- **Passengers 2023:** number of passengers departing airports in the country (does not include connecting passengers)[289].
- **Flights 2023:** number of flights operated from airports in the country[290].
- **Tourism % of GDP:** 2023 figures from the World Travel & Tourism Council[291], including direct, indirect and induced contributions of the tourism sector[292].
- **Air transport infrastructure score:** 1-7 score from the World Economic Forum Travel and Tourism Development Index 2024[293], based on the quality of the aviation infrastructure, using indicators such as air connectivity and capacity. Higher is better.



- **Travel and tourism development:** World Economic Forum Travel and Tourism Development Index 2024[294]. Rankings for 119 economies, with 1 being the highest.
- **Connectivity ranking:** ICAO Air Transport Bureau 2023 analysis ranking each country based on the number of countries and territories that can be easily reached from it by air, with a weighted average of the number of countries or territories that can be reached directly or with one or two stops in square brackets ([ ])[295].
- **CORSIA volunteer:** countries that have volunteered for the first phases of ICAO's CORSIA and will participate from 2025 (correct at the time of publication)[296].
- **Airport accessibility:** ICAO iStars Database's percentage of a country's population within 100 kilometres of either an international airport or a domestic airport with at least one regular connection to an international airport, the global average for all countries being 74.41%[297].

National figures for employment and GDP supported by aviation, with analysis provided by Oxford Economics for those countries where reliable data are available and estimations are possible at the national level. Estimates are conducted based on national statistics, industry financial statements, industry surveys and indicators such as airport employment, airport passenger traffic and airline passenger numbers. For Israel, Russia and Ukraine, 2018 data for jobs and GDP has been used. The GDP estimates have been converted to "real" 2023 $ values, thereby taking inflation changes into consideration to illustrate their values in 2023.

The country figures shown will not necessarily equal the regional totals expressed elsewhere in the report. In part, this is because individual country figures are computed using country-specific multipliers, whereas regional figures are computed using region-specific multipliers. The former are smaller than the latter because of the effects of 'leakage': spending that occurs outside the country or region as a result of imports. A country will have more leakage than a region, since some imports will occur only within the region to which the country belongs.

Countries not included in this section have insufficient data available for a reliable, country-specific analysis.

ALGERIA

AIRLINES 4
AIRPORTS 32
PASSENGERS (2023) 6,288,916
FLIGHTS (2023) 69,075
TOURISM % OF GDP 5.8

AVIATION INFRASTRUCTURE SCORE

2.7

TRAVEL & TOURISM DEVELOPMENT INDEX 98/119
CONNECTIVITY RANKING ..... 56 [114.8]

AIRPORT ACCESSIBILITY

91%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	59,000	2.1 bn
TOURISM CATALYTIC	5,000	93 m
INDUCED	12,000	470 m
INDIRECT	23,000	1 bn
AVIATION DIRECT	19,000	475 m

ARGENTINA

AIRLINES 7
AIRPORTS 41
PASSENGERS (2023) 21,578,884
FLIGHTS (2023) 167,217
TOURISM % OF GDP 8.8

AVIATION INFRASTRUCTURE SCORE

3.2

TRAVEL & TOURISM DEVELOPMENT INDEX 49/119
CONNECTIVITY RANKING ..... 84 [104.8]

AIRPORT ACCESSIBILITY

81%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	150,000	9.1 bn
TOURISM CATALYTIC	42,000	1.8 bn
INDUCED	45,000	2.6 bn
INDIRECT	35,000	2.3 bn
AVIATION DIRECT	25,000	2.5 bn

AUSTRALIA

AIRLINES 23
AIRPORTS 169
PASSENGERS (2023) 74,397,243
FLIGHTS (2023) 703,405
TOURISM % OF GDP 9.8

AVIATION INFRASTRUCTURE SCORE

5.2

TRAVEL & TOURISM DEVELOPMENT INDEX 5/119
CONNECTIVITY RANKING ..... 39 [124.2]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

90%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	600,000	68 bn
TOURISM CATALYTIC	210,000	25 bn
INDUCED	120,000	15 bn
INDIRECT	110,000	15 bn
AVIATION DIRECT	163,000	13.1 bn

AUSTRIA

AIRLINES 5
AIRPORTS 6
PASSENGERS (2023) 13,622,785
FLIGHTS (2023) 124,693
TOURISM % OF GDP 10.6

AVIATION INFRASTRUCTURE SCORE

4.5

TRAVEL & TOURISM DEVELOPMENT INDEX 15/119
CONNECTIVITY RANKING ..... 18 [137]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

100%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	240,000	26 bn
TOURISM CATALYTIC	110,000	12 bn
INDUCED	34,000	3.8 bn
INDIRECT	48,000	5.2 bn
AVIATION DIRECT	47,000	5.6 bn

BANGLADESH

AIRLINES 7
AIRPORTS 8
PASSENGERS (2023) 8,232,253
FLIGHTS (2023) 73,639
TOURISM % OF GDP 2.3

AVIATION INFRASTRUCTURE SCORE

3.1

TRAVEL & TOURISM DEVELOPMENT INDEX 109/119
CONNECTIVITY RANKING ..... 87 [103.8]

AIRPORT ACCESSIBILITY

90%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	470,000	5.3 bn
TOURISM CATALYTIC	86,000	380 m
INDUCED	200,000	1.1 bn
INDIRECT	160,000	1.3 bn
AVIATION DIRECT	29,000	2.5 bn

BELGIUM

AIRLINES 5
AIRPORTS 5
PASSENGERS (2023) 14,363,282
FLIGHTS (2023) 108,929
TOURISM % OF GDP 5.5

AVIATION INFRASTRUCTURE SCORE

4.4

TRAVEL & TOURISM DEVELOPMENT INDEX 23/119
CONNECTIVITY RANKING ..... 15 [144.2]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

100%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	170,000	20 bn
TOURISM CATALYTIC	43,000	4.4 bn
INDUCED	38,000	4.9 bn
INDIRECT	53,000	6.9 bn
AVIATION DIRECT	39,000	4.3 bn

BELIZE

AIRLINES ..... N/A
AIRPORTS 13
PASSENGERS (2023) 1,329,116
FLIGHTS (2023) 95,546
TOURISM % OF GDP 30.8

AVIATION INFRASTRUCTURE SCORE

N/A

TRAVEL & TOURISM DEVELOPMENT INDEX ..... N/A
CONNECTIVITY RANKING ..... 164 [72.6]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

98%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	39,000	550 m
TOURISM CATALYTIC	32,000	380 m
INDUCED	2,000	35 m
INDIRECT	1,700	32 m
AVIATION DIRECT	3,700	96 m

BRAZIL

AIRLINES 11
AIRPORTS 144
PASSENGERS (2023) 87,729,246
FLIGHTS (2023) 836,354
TOURISM % OF GDP 7.7

AVIATION INFRASTRUCTURE SCORE

3.9

TRAVEL & TOURISM DEVELOPMENT INDEX 26/119
CONNECTIVITY RANKING ..... 49 [119.5]

AIRPORT ACCESSIBILITY

73%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	1.9 m	46 bn
TOURISM CATALYTIC	310,000	6.6 bn
INDUCED	610,000	14 bn
INDIRECT	750,000	16 bn
AVIATION DIRECT	247,000	10.3 bn

BULGARIA

AIRLINES 9
AIRPORTS 4
PASSENGERS (2023) 5,244,626
FLIGHTS (2023) 34,168
TOURISM % OF GDP 6.9

AVIATION INFRASTRUCTURE SCORE

3.5

TRAVEL & TOURISM DEVELOPMENT INDEX 40/119
CONNECTIVITY RANKING ..... 47 [119.7]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

85%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	100,000	2.6 bn
TOURISM CATALYTIC	46,000	1.1 bn
INDUCED	21,000	480 m
INDIRECT	30,000	660 m
AVIATION DIRECT	7,600	324 m

CANADA

AIRLINES 47
AIRPORTS 244
PASSENGERS (2023) 64,018,909
FLIGHTS (2023) 856,981
TOURISM % OF GDP 6.0

AVIATION INFRASTRUCTURE SCORE

5.4

TRAVEL & TOURISM DEVELOPMENT INDEX 11/119
CONNECTIVITY RANKING ..... 11 [150.5]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

92%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	810,000	82 bn
TOURISM CATALYTIC	180,000	14 bn
INDUCED	150,000	18 bn
INDIRECT	210,000	27 bn
AVIATION DIRECT	265,000	23 bn

CHILE

AIRLINES 6
AIRPORTS 20
PASSENGERS (2023) 18,201,180
FLIGHTS (2023) 126,740
TOURISM % OF GDP 9.7

AVIATION INFRASTRUCTURE SCORE

3.5

TRAVEL & TOURISM DEVELOPMENT INDEX 31/119
CONNECTIVITY RANKING ..... 78 [107.5]

AIRPORT ACCESSIBILITY

83%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	210,000	7.9 bn
TOURISM CATALYTIC	35,000	1.2 bn
INDUCED	54,000	1.9 bn
INDIRECT	66,000	2.6 bn
AVIATION DIRECT	57,000	2.1 bn

CHINA

AIRLINES 61
AIRPORTS 236
PASSENGERS (2023) 599,578,329
FLIGHTS (2023) 4,984,360
TOURISM % OF GDP 7.3

AVIATION INFRASTRUCTURE SCORE

5.3

TRAVEL & TOURISM DEVELOPMENT INDEX 8/119
CONNECTIVITY RANKING ..... 13 [146.8]

AIRPORT ACCESSIBILITY

73%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	10 m	250 bn
TOURISM CATALYTIC	1.2 m	20 bn
INDUCED	3.1 m	75 bn
INDIRECT	3.9 m	110 bn
AVIATION DIRECT	2.1 m	53.7 bn

HONG KONG SAR

AIRLINES 6
AIRPORTS 2
PASSENGERS (2023) 15,793,601
FLIGHTS (2023) 98,732
TOURISM % OF GDP 9.8

AVIATION INFRASTRUCTURE SCORE

N/A

TRAVEL & TOURISM DEVELOPMENT INDEX ..... N/A
CONNECTIVITY RANKING ..... 30 [129.9]

AIRPORT ACCESSIBILITY

N/A

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	320,000	38 bn
TOURISM CATALYTIC	75,000	5.3 bn
INDUCED	62,000	9.9 bn
INDIRECT	87,000	8.4 bn
AVIATION DIRECT	99,000	14 bn

CHINESE TAIPEI

AIRLINES 7
AIRPORTS 12
PASSENGERS (2023) 21,896,159
FLIGHTS (2023) 172,126
TOURISM % OF GDP ..... N/A

AVIATION INFRASTRUCTURE SCORE

N/A

TRAVEL & TOURISM DEVELOPMENT INDEX ..... N/A
CONNECTIVITY RANKING ..... 49 [119.5]

AIRPORT ACCESSIBILITY

N/A

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	500,000	30 bn
TOURISM CATALYTIC	230,000	9.4 bn
INDUCED	70,000	4.7 bn
INDIRECT	130,000	8.4 bn
AVIATION DIRECT	70,000	7.5 bn

COLOMBIA

AIRLINES 13
AIRPORTS 48
PASSENGERS (2023) 36,424,390
FLIGHTS (2023) 330,769
TOURISM % OF GDP 4.7

AVIATION INFRASTRUCTURE SCORE

3.7

TRAVEL & TOURISM DEVELOPMENT INDEX 50/119
CONNECTIVITY RANKING ..... 62 [113]

AIRPORT ACCESSIBILITY

91%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	920,000	15 bn
TOURISM CATALYTIC	600,000	7.6 bn
INDUCED	100,000	1.9 bn
INDIRECT	140,000	3 bn
AVIATION DIRECT	87,000	3 bn

COSTA RICA

AIRLINES 2
AIRPORTS 16
PASSENGERS (2023) 3,966,308
FLIGHTS (2023) 65,177
TOURISM % OF GDP 9.3

AVIATION INFRASTRUCTURE SCORE

3.5

TRAVEL & TOURISM DEVELOPMENT INDEX 51/119
CONNECTIVITY RANKING ..... 88 [103.4]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

100%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	160,000	5.2 bn
TOURISM CATALYTIC	120,000	4 bn
INDUCED	16,000	440 m
INDIRECT	11,000	380 m
AVIATION DIRECT	13,000	362 m

CÔTE D'IVOIRE

AIRLINES 2
AIRPORTS 6
PASSENGERS (2023) 1,024,189
FLIGHTS (2023) 11,812
TOURISM % OF GDP 5.9

AVIATION INFRASTRUCTURE SCORE

2.5

TRAVEL & TOURISM DEVELOPMENT INDEX 114/119
CONNECTIVITY RANKING ..... 54 [115.2]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

46%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	120,000	980 m
TOURISM CATALYTIC	44,000	230 m
INDUCED	32,000	170 m
INDIRECT	38,000	290 m
AVIATION DIRECT	6,100	277 m

CROATIA

AIRLINES 2
AIRPORTS 9
PASSENGERS (2023) 5,498,375
FLIGHTS (2023) 49,499
TOURISM % OF GDP 25.8

AVIATION INFRASTRUCTURE SCORE

3.7

TRAVEL & TOURISM DEVELOPMENT INDEX 46/119
CONNECTIVITY RANKING ..... 44 [121.6]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

100%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	82,000	3.6 bn
TOURISM CATALYTIC	34,000	1.6 bn
INDUCED	15,000	620 m
INDIRECT	19,000	680 m
AVIATION DIRECT	13,000	727 m

CYPRUS

AIRLINES 2
AIRPORTS 3
PASSENGERS (2023) 7,736,702
FLIGHTS (2023) 47,698
TOURISM % OF GDP 12.9

AVIATION INFRASTRUCTURE SCORE

5.0

TRAVEL & TOURISM DEVELOPMENT INDEX 30/119
CONNECTIVITY RANKING ..... 61 [113.8]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

100%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	70,000	4.9 bn
TOURISM CATALYTIC	50,000	3.5 bn
INDUCED	5,400	430 m
INDIRECT	4,800	430 m
AVIATION DIRECT	10,000	586 m

CZECHIA

AIRLINES 2
AIRPORTS 5
PASSENGERS (2023) 6,621,441
FLIGHTS (2023) 45,576
TOURISM % OF GDP 5.5

AVIATION INFRASTRUCTURE SCORE

3.7

TRAVEL & TOURISM DEVELOPMENT INDEX 33/119
CONNECTIVITY RANKING ..... 32 [129.5]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

99%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	120,000	7.1 bn
TOURISM CATALYTIC	19,000	840 m
INDUCED	26,000	1.7 bn
INDIRECT	45,000	2.9 bn
AVIATION DIRECT	30,000	1.7 bn

DENMARK

AIRLINES 8
AIRPORTS 11
PASSENGERS (2023) 14,078,922
FLIGHTS (2023) 137,778
TOURISM % OF GDP 6.5

AVIATION INFRASTRUCTURE SCORE

4.8

TRAVEL & TOURISM DEVELOPMENT INDEX 17/119
CONNECTIVITY RANKING ..... 25 [132.7]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

100%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	130,000	18 bn
TOURISM CATALYTIC	43,000	5.4 bn
INDUCED	26,000	3.7 bn
INDIRECT	31,000	4.9 bn
AVIATION DIRECT	28,000	3.9 bn

DOMINICAN REPUBLIC

AIRLINES 5
AIRPORTS 7
PASSENGERS (2023) 8,904,799
FLIGHTS (2023) 61,597
TOURISM % OF GDP 15.3

AVIATION INFRASTRUCTURE SCORE

4.3

TRAVEL & TOURISM DEVELOPMENT INDEX 64/119
CONNECTIVITY RANKING ..... 48 [132.7]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

100%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	550,000	13 bn
TOURISM CATALYTIC	510,000	12 bn
INDUCED	12,000	270 m
INDIRECT	10,000	270 m
AVIATION DIRECT	14,000	342 m

ECUADOR

AIRLINES 4
AIRPORTS 11
PASSENGERS (2023) 6,067,663
FLIGHTS (2023) 51,840
TOURISM % OF GDP 4.6

AVIATION INFRASTRUCTURE SCORE

4.6

TRAVEL & TOURISM DEVELOPMENT INDEX 80/119
CONNECTIVITY RANKING ..... 124 [88.8]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

82%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	330,000	4.6 bn
TOURISM CATALYTIC	210,000	2.8 bn
INDUCED	55,000	650 m
INDIRECT	46,000	790 m
AVIATION DIRECT	20,000	400 m

EGYPT

AIRLINES 12
AIRPORTS 13
PASSENGERS (2023) 19,984,262
FLIGHTS (2023) 154,558
TOURISM % OF GDP 8.0

AVIATION INFRASTRUCTURE SCORE

4.6

TRAVEL & TOURISM DEVELOPMENT INDEX 61/119
CONNECTIVITY RANKING ..... 7 [153.3]

AIRPORT ACCESSIBILITY

88%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	1.4 m	21 bn
TOURISM CATALYTIC	1.2 m	15 bn
INDUCED	75,000	1 bn
INDIRECT	89,000	1.6 bn
AVIATION DIRECT	56,000	3.5 bn

EL SALVADOR

AIRLINES 2
AIRPORTS 1
PASSENGERS (2023) 1,932,796
FLIGHTS (2023) 20,349
TOURISM % OF GDP 14.5

AVIATION INFRASTRUCTURE SCORE

3.0

TRAVEL & TOURISM DEVELOPMENT INDEX 97/119
CONNECTIVITY RANKING ..... 133 [85.8]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

95%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	120,000	1.5 bn
TOURISM CATALYTIC	97,000	1.2 bn
INDUCED	8,900	98 m
INDIRECT	6,000	79 m
AVIATION DIRECT	5,300	103 m

ETHIOPIA

AIRLINES 5
AIRPORTS 21
PASSENGERS (2023) 4,599,131
FLIGHTS (2023) 90,117
TOURISM % OF GDP 5.5

AVIATION INFRASTRUCTURE SCORE

N/A

TRAVEL & TOURISM DEVELOPMENT INDEX ..... N/A
CONNECTIVITY RANKING ..... 24 [133]

AIRPORT ACCESSIBILITY

64%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	530,000	2 bn
TOURISM CATALYTIC	370,000	1.5 bn
INDUCED	100,000	230 m
INDIRECT	40,000	130 m
AVIATION DIRECT	20,000	90 m

FIJI

AIRLINES 3
AIRPORTS 11
PASSENGERS (2023) 1,356,039
FLIGHTS (2023) 23,195
TOURISM % OF GDP 35.0

AVIATION INFRASTRUCTURE SCORE

N/A

TRAVEL & TOURISM DEVELOPMENT INDEX ..... N/A
CONNECTIVITY RANKING ..... 122 [89.2]

AIRPORT ACCESSIBILITY

99%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	51,000	1.2 bn
TOURISM CATALYTIC	40,000	1bn
INDUCED	3,400	59 m
INDIRECT	4,300	75 m
AVIATION DIRECT	4,100	63 m

FINLAND

AIRLINES 3
AIRPORTS 19
PASSENGERS (2023) 6,772,990
FLIGHTS (2023) 84,008
TOURISM % OF GDP 7.1

AVIATION INFRASTRUCTURE SCORE

4.3

TRAVEL & TOURISM DEVELOPMENT INDEX 20/119
CONNECTIVITY RANKING ..... 84 [126.7]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

92%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	71,000	7.5 bn
TOURISM CATALYTIC	7,900	800 m
INDUCED	17,000	2.1 bn
INDIRECT	23,000	2.6 bn
AVIATION DIRECT	24,000	2 bn

FRANCE

AIRLINES 15
AIRPORTS 55
PASSENGERS (2023) 81,161,852
FLIGHTS (2023) 629,523
TOURISM % OF GDP 8.8

AVIATION INFRASTRUCTURE SCORE

5.5

TRAVEL & TOURISM DEVELOPMENT INDEX 4/119
CONNECTIVITY RANKING ..... 2 [166.9]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

98%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	1.3 m	140 bn
TOURISM CATALYTIC	260,000	24 bn
INDUCED	280,000	32 bn
INDIRECT	430,000	46 bn
AVIATION DIRECT	378,000	42.4 bn

GERMANY

AIRLINES 17
AIRPORTS 30
PASSENGERS (2023) 76,816,042
FLIGHTS (2023) 708,880
TOURISM % OF GDP 11.0

AVIATION INFRASTRUCTURE SCORE

5.4

TRAVEL & TOURISM DEVELOPMENT INDEX 6/119
CONNECTIVITY RANKING ..... 6 [158.2]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

100%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	1.5 m	140 bn
TOURISM CATALYTIC	210,000	17 bn
INDUCED	340,000	35 bn
INDIRECT	510,000	53 bn
AVIATION DIRECT	387,000	37 bn

GREECE

AIRLINES 7
AIRPORTS 39
PASSENGERS (2023) 33,696,294
FLIGHTS (2023) 264,118
TOURISM % OF GDP 20.8

AVIATION INFRASTRUCTURE SCORE

5.5

TRAVEL & TOURISM DEVELOPMENT INDEX 21/119
CONNECTIVITY RANKING ..... 21 [135.9]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

100%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	490,000	30 bn
TOURISM CATALYTIC	370,000	21 bn
INDUCED	29,000	1.9 bn
INDIRECT	50,000	3.4 bn
AVIATION DIRECT	37,000	3.5 bn

GUATEMALA

AIRLINES 4
AIRPORTS 4
PASSENGERS (2023) 2,231,683
FLIGHTS (2023) 23,860
TOURISM % OF GDP 5.4

AVIATION INFRASTRUCTURE SCORE

2.5

TRAVEL & TOURISM DEVELOPMENT INDEX 100/119
CONNECTIVITY RANKING ..... 159 [74.5]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

79%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	62,000	740 m
TOURISM CATALYTIC	45,000	500 m
INDUCED	7,400	95 m
INDIRECT	3,800	61 m
AVIATION DIRECT	5,300	83 m

HONDURAS

AIRLINES 4
AIRPORTS 7
PASSENGERS (2023) 1,695,920
FLIGHTS (2023) 32,399
TOURISM % OF GDP 10.5

AVIATION INFRASTRUCTURE SCORE

2.5

TRAVEL & TOURISM DEVELOPMENT INDEX 111/119
CONNECTIVITY RANKING ..... 135 [84.1]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

87%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	89,000	670 m
TOURISM CATALYTIC	53,000	380 m
INDUCED	18,000	130 m
INDIRECT	12,000	79 m
AVIATION DIRECT	7,600	77 m

HUNGARY

AIRLINES 3
AIRPORTS 2
PASSENGERS (2023) 7,720,304
FLIGHTS (2023) 46,511
TOURISM % OF GDP 7.4

AVIATION INFRASTRUCTURE SCORE

3.7

TRAVEL & TOURISM DEVELOPMENT INDEX 37/119
CONNECTIVITY RANKING ..... 46 [119.9]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

89%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	110,000	6.1 bn
TOURISM CATALYTIC	25,000	950 m
INDUCED	29,000	1.4 bn
INDIRECT	38,000	1.9 bn
AVIATION DIRECT	18,000	1.8 bn

ICELAND

AIRLINES 6
AIRPORTS 13
PASSENGERS (2023) 3,628,470
FLIGHTS (2023) 35,838
TOURISM % OF GDP 22.7

AVIATION INFRASTRUCTURE SCORE

4.7

TRAVEL & TOURISM DEVELOPMENT INDEX 32/119
CONNECTIVITY RANKING ..... 51 [117.2]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

95%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	55,000	7.8 bn
TOURISM CATALYTIC	21,000	3.3 bn
INDUCED	5,400	940 m
INDIRECT	12,000	1.6 bn
AVIATION DIRECT	17,000	1.9 bn

INDIA

AIRLINES 14
AIRPORTS 99
PASSENGERS (2023) 159,142,408
FLIGHTS (2023) 1,255,600
TOURISM % OF GDP 6.5

AVIATION INFRASTRUCTURE SCORE

4.6

TRAVEL & TOURISM DEVELOPMENT INDEX 39/119
CONNECTIVITY RANKING ..... 17 [137.8]

AIRPORT ACCESSIBILITY

57%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	7.7 m	54 bn
TOURISM CATALYTIC	5 m	27 bn
INDUCED	1.1 m	9 bn
INDIRECT	1.2 m	12 bn
AVIATION DIRECT	370,000	5.6 bn

INDONESIA

AIRLINES 24
AIRPORTS 127
PASSENGERS (2023) 82,807,235
FLIGHTS (2023) 723,306
TOURISM % OF GDP 4.8

AVIATION INFRASTRUCTURE SCORE

4.3

TRAVEL & TOURISM DEVELOPMENT INDEX 22/119
CONNECTIVITY RANKING ..... 81 [106.5]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

79%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	6 m	63 bn
TOURISM CATALYTIC	3.3 m	18 bn
INDUCED	940,000	7.6 bn
INDIRECT	1.4 m	18 bn
AVIATION DIRECT	337,000	19 bn

IRAQ

AIRLINES 3
AIRPORTS 6
PASSENGERS (2023) 3,788,467
FLIGHTS (2023) 36,513
TOURISM % OF GDP 5.4

AVIATION INFRASTRUCTURE SCORE

N/A

TRAVEL & TOURISM DEVELOPMENT INDEX ..... -
CONNECTIVITY RANKING ..... 71 [110.3]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

78%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	260,000	4.9 bn
TOURISM CATALYTIC	96,000	1.5 bn
INDUCED	52,000	1.1 bn
INDIRECT	90,000	2 bn
AVIATION DIRECT	18,000	292 m

IRELAND

AIRLINES 6
AIRPORTS 6
PASSENGERS (2023) 19,355,927
FLIGHTS (2023) 134,341
TOURISM % OF GDP 3.8

AVIATION INFRASTRUCTURE SCORE

5.0

TRAVEL & TOURISM DEVELOPMENT INDEX 24/119
CONNECTIVITY RANKING ..... 42 [122.7]

AIRPORT ACCESSIBILITY

100%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	130,000	20 bn
TOURISM CATALYTIC	34,000	5 bn
INDUCED	22,000	4.8 bn
INDIRECT	27,000	4.8 bn
AVIATION DIRECT	44,000	5.6 bn

ISRAEL (2018)

AIRLINES 5
AIRPORTS 6
PASSENGERS (2023) 11,857,169
FLIGHTS (2023) 69,987
TOURISM % OF GDP 4.5

AVIATION INFRASTRUCTURE SCORE

4.6

TRAVEL & TOURISM DEVELOPMENT INDEX 48/119
CONNECTIVITY RANKING ..... 19 [136.2]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

100%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	260,000	31 bn
TOURISM CATALYTIC	95,000	9.8 bn
INDUCED	65,000	6.8 bn
INDIRECT	45,000	4.8 bn
AVIATION DIRECT	59,000	9.6 bn

ITALY

AIRLINES 7
AIRPORTS 39
PASSENGERS (2023) 100,148,795
FLIGHTS (2023) 668,001
TOURISM % OF GDP 10.5

AVIATION INFRASTRUCTURE SCORE

5.2

TRAVEL & TOURISM DEVELOPMENT INDEX 9/119
CONNECTIVITY RANKING ..... 10 [151.4]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

99%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	1.1 m	100 bn
TOURISM CATALYTIC	360,000	28 bn
INDUCED	160,000	18 bn
INDIRECT	330,000	32 bn
AVIATION DIRECT	262,000	26.7 bn

JAPAN

AIRLINES 23
AIRPORTS 79
PASSENGERS (2023) 142,950,564
FLIGHTS (2023) 1,057,515
TOURISM % OF GDP 7.1

AVIATION INFRASTRUCTURE SCORE

5.3

TRAVEL & TOURISM DEVELOPMENT INDEX 3/119
CONNECTIVITY RANKING ..... 30 [129.9]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

99%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	2 m	120 bn
TOURISM CATALYTIC	880,000	47 bn
INDUCED	290,000	18 bn
INDIRECT	470,000	31 bn
AVIATION DIRECT	360,000	20 bn

KAZAKHSTAN

AIRLINES 10
AIRPORTS 19
PASSENGERS (2023) 7,902,281
FLIGHTS (2023) 90,081
TOURISM % OF GDP 2.9
AVIATION INFRASTRUCTURE SCORE
N/A

TRAVEL & TOURISM DEVELOPMENT INDEX 52/119
CONNECTIVITY RANKING ..... 78 [107.5]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY
67%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	190,000	6.4 bn
TOURISM CATALYTIC	15,000	360 m
INDUCED	74,000	2 bn
INDIRECT	58,000	2 bn
AVIATION DIRECT	45,000	2.1 bn

KENYA

AIRLINES 27
AIRPORTS 29
PASSENGERS (2023) 5,832,705
FLIGHTS (2023) 186,028
TOURISM % OF GDP 7.0
AVIATION INFRASTRUCTURE SCORE
3.2

TRAVEL & TOURISM DEVELOPMENT INDEX 77/119
CONNECTIVITY RANKING ..... 36 [125.2]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY
70%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	460,000	3.3 bn
TOURISM CATALYTIC	240,000	1.2 bn
INDUCED	92,000	410 m
INDIRECT	100,000	530 m
AVIATION DIRECT	21,000	1.2 bn

LAOS

AIRLINES 3
AIRPORTS 10
PASSENGERS (2023) 1,369,961
FLIGHTS (2023) 17,916
TOURISM % OF GDP 6.5
AVIATION INFRASTRUCTURE SCORE
2.4

TRAVEL & TOURISM DEVELOPMENT INDEX 91/119
CONNECTIVITY RANKING ..... 172 [68.8]

AIRPORT ACCESSIBILITY
87%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	40,000	250 m
TOURISM CATALYTIC	23,000	82 m
INDUCED	8,600	57 m
INDIRECT	4,600	59 m
AVIATION DIRECT	4,000	54 m

LATVIA

AIRLINES 3
AIRPORTS 2
PASSENGERS (2023) 2,635,495
FLIGHTS (2023) 27,209
TOURISM % OF GDP 7.5
AVIATION INFRASTRUCTURE SCORE
3.1

TRAVEL & TOURISM DEVELOPMENT INDEX 65/119
CONNECTIVITY RANKING ..... 57 [114.5]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY
77%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	37,000	1.9 bn
TOURISM CATALYTIC	11,000	460 m
INDUCED	6,400	370 m
INDIRECT	11,000	620 m
AVIATION DIRECT	8,600	452 m

LUXEMBOURG

AIRLINES 2
AIRPORTS 1
PASSENGERS (2023) 2,434,765
FLIGHTS (2023) 25,979
TOURISM % OF GDP 8.5
AVIATION INFRASTRUCTURE SCORE
3.7

TRAVEL & TOURISM DEVELOPMENT INDEX 28/119
CONNECTIVITY RANKING ..... 63 [112.8]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY
100%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	35,000	7 bn
TOURISM CATALYTIC	15,000	3.2 bn
INDUCED	4,500	900 m
INDIRECT	6,800	1.3 bn
AVIATION DIRECT	8,500	1.7 bn

MALAYSIA

AIRLINES 10
AIRPORTS 34
PASSENGERS (2023) 35,802,231
FLIGHTS (2023) 331,646
TOURISM % OF GDP 8.6
AVIATION INFRASTRUCTURE SCORE
4.2

TRAVEL & TOURISM DEVELOPMENT INDEX 35/119
CONNECTIVITY RANKING ..... 66 [112.2]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY
98%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	660,000	14 bn
TOURISM CATALYTIC	310,000	4.7 bn
INDUCED	99,000	2.6 bn
INDIRECT	150,000	4.9 bn
AVIATION DIRECT	100,000	2.2 bn

MALDIVES

AIRLINES 5
AIRPORTS 14
PASSENGERS (2023) 4,053,969
FLIGHTS (2023) 54,630
TOURISM % OF GDP 58.9

AVIATION INFRASTRUCTURE SCORE

N/A

TRAVEL & TOURISM DEVELOPMENT INDEX ..... N/A
CONNECTIVITY RANKING ..... 97 [98.5]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

100%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	210,000	4.7 bn
TOURISM CATALYTIC	200,000	4.2 bn
INDUCED	3,100	95 m
INDIRECT	5,200	190 m
AVIATION DIRECT	4,900	222 m

MALTA

AIRLINES 19
AIRPORTS 1
PASSENGERS (2023) 4,064,176
FLIGHTS (2023) 24,263
TOURISM % OF GDP 13.6

AVIATION INFRASTRUCTURE SCORE

4.4

TRAVEL & TOURISM DEVELOPMENT INDEX 34/119
CONNECTIVITY RANKING ..... 76 [108.2]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

100%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	67,000	4.1 bn
TOURISM CATALYTIC	43,000	2.2 bn
INDUCED	9,200	590 m
INDIRECT	6,900	490 m
AVIATION DIRECT	8,100	841 m

MEXICO

AIRLINES 16
AIRPORTS 61
PASSENGERS (2023) 80,620,397
FLIGHTS (2023) 652,882
TOURISM % OF GDP 14.4

AVIATION INFRASTRUCTURE SCORE

4.4

TRAVEL & TOURISM DEVELOPMENT INDEX 38/119
CONNECTIVITY RANKING ..... 50 [118.7]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

92%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	1.8 m	88 bn
TOURISM CATALYTIC	550,000	20 bn
INDUCED	440,000	14 bn
INDIRECT	590,000	22 bn
AVIATION DIRECT	203,000	33.3 bn

MOROCCO

AIRLINES 4
AIRPORTS 18
PASSENGERS (2023) 12,585,988
FLIGHTS (2023) 100,589
TOURISM % OF GDP 12.2

AVIATION INFRASTRUCTURE SCORE

3.7

TRAVEL & TOURISM DEVELOPMENT INDEX 82/119
CONNECTIVITY RANKING ..... 26 [132.4]

AIRPORT ACCESSIBILITY

92%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	860,000	11 bn
TOURISM CATALYTIC	680,000	8.5 bn
INDUCED	64,000	700 m
INDIRECT	72,000	860 m
AVIATION DIRECT	38,000	1.1 bn

NEPAL

AIRLINES 8
AIRPORTS 17
PASSENGERS (2023) 6,531,139
FLIGHTS (2023) 102,554
TOURISM % OF GDP 6.1

AVIATION INFRASTRUCTURE SCORE

2.7

TRAVEL & TOURISM DEVELOPMENT INDEX 105/119
CONNECTIVITY RANKING ..... 127 [88.1]

AIRPORT ACCESSIBILITY

97%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	380,000	1 bn
TOURISM CATALYTIC	260,000	540 m
INDUCED	34,000	75 m
INDIRECT	74,000	150 m
AVIATION DIRECT	12,000	257 m

NETHERLANDS

AIRLINES 7
AIRPORTS 5
PASSENGERS (2023) 24,453,865
FLIGHTS (2023) 244,564
TOURISM % OF GDP 9.6

AVIATION INFRASTRUCTURE SCORE

5.4

TRAVEL & TOURISM DEVELOPMENT INDEX 16/119
CONNECTIVITY RANKING ..... 8 [151.9]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

100%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	400,000	40 bn
TOURISM CATALYTIC	100,000	7.1 bn
INDUCED	79,000	9 bn
INDIRECT	110,000	13 bn
AVIATION DIRECT	111,000	10.5 bn

NEW ZEALAND

AIRLINES 5
AIRPORTS 26
PASSENGERS (2023) 16,075,650
FLIGHTS (2023) 212,123
TOURISM % OF GDP 15.0

AVIATION INFRASTRUCTURE SCORE

4.0

TRAVEL & TOURISM DEVELOPMENT INDEX 25/119
CONNECTIVITY RANKING ..... 74 [108.6]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

100%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	180,000	14 bn
TOURISM CATALYTIC	75,000	6 bn
INDUCED	32,000	2.8 bn
INDIRECT	24,000	2.4 bn
AVIATION DIRECT	46,000	3 bn

NICARAGUA

AIRLINES 1
AIRPORTS 8
PASSENGERS (2023) 781,381
FLIGHTS (2023) 9,102
TOURISM % OF GDP 9.9

AVIATION INFRASTRUCTURE SCORE

2.2

TRAVEL & TOURISM DEVELOPMENT INDEX 108/119
CONNECTIVITY RANKING ..... 167 [71.5]

AIRPORT ACCESSIBILITY

73%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	95,000	510 m
TOURISM CATALYTIC	75,000	400 m
INDUCED	11,000	58 m
INDIRECT	6,400	38 m
AVIATION DIRECT	1,900	12.8 m

NIGERIA

AIRLINES 16
AIRPORTS 21
PASSENGERS (2023) 9,018,883
FLIGHTS (2023) 111,949
TOURISM % OF GDP 3.7

AVIATION INFRASTRUCTURE SCORE

2.9

TRAVEL & TOURISM DEVELOPMENT INDEX 112/119
CONNECTIVITY RANKING ..... 38 [125]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

69%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	220,000	2.5 bn
TOURISM CATALYTIC	67,000	450 m
INDUCED	43,000	340 m
INDIRECT	67,000	1 bn
AVIATION DIRECT	40,000	702 m

NORWAY

AIRLINES 4
AIRPORTS 48
PASSENGERS (2023) 20,890,970
FLIGHTS (2023) 298,189
TOURISM % OF GDP 6.9

AVIATION INFRASTRUCTURE SCORE

N/A

TRAVEL & TOURISM DEVELOPMENT INDEX ..... N/A
CONNECTIVITY RANKING ..... 35 [125.7]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

99%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	160,000	22 bn
TOURISM CATALYTIC	29,000	3.1 bn
INDUCED	32,000	5.2 bn
INDIRECT	45,000	8 bn
AVIATION DIRECT	54,000	6.2 bn

PAKISTAN

AIRLINES 6
AIRPORTS 19
PASSENGERS (2023) 11,881,408
FLIGHTS (2023) 67,007
TOURISM % OF GDP 5.8

AVIATION INFRASTRUCTURE SCORE

3.3

TRAVEL & TOURISM DEVELOPMENT INDEX 101/119
CONNECTIVITY RANKING ..... 73 [108.8]

AIRPORT ACCESSIBILITY

74%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	680,000	56 bn
TOURISM CATALYTIC	230,000	950 m
INDUCED	140,000	890 m
INDIRECT	260,000	1.7 bn
AVIATION DIRECT	57,000	2.1 bn

PANAMA

AIRLINES 4
AIRPORTS 17
PASSENGERS (2023) 2,896,070
FLIGHTS (2023) 68,864
TOURISM % OF GDP 15.2

AVIATION INFRASTRUCTURE SCORE

4.3

TRAVEL & TOURISM DEVELOPMENT INDEX 63/119
CONNECTIVITY RANKING ..... 52 [116.1]

AIRPORT ACCESSIBILITY

83%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	190,000	6.8 bn
TOURISM CATALYTIC	150,000	4.9 bn
INDUCED	10,000	350 m
INDIRECT	15,000	540 m
AVIATION DIRECT	23,000	1 bn

PERU

AIRLINES 7
AIRPORTS 25
PASSENGERS (2023) 16,948,819
FLIGHTS (2023) 131,897
TOURISM % OF GDP 6.8

AVIATION INFRASTRUCTURE SCORE

3.3

TRAVEL & TOURISM DEVELOPMENT INDEX 62/119
CONNECTIVITY RANKING ..... 89 [103.1]

AIRPORT ACCESSIBILITY

62%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	360,000	6.2 bn
TOURISM CATALYTIC	160,000	2.7 bn
INDUCED	87,000	1 bn
INDIRECT	86,000	1.6 bn
AVIATION DIRECT	36,000	943 m

PHILIPPINES

AIRLINES 11
AIRPORTS 47
PASSENGERS (2023) 41,285,594
FLIGHTS (2023) 300,939
TOURISM % OF GDP 17.9

AVIATION INFRASTRUCTURE SCORE

3.6

TRAVEL & TOURISM DEVELOPMENT INDEX 69/119
CONNECTIVITY RANKING ..... 55 [114.9]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

94%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	1.9 m	20 bn
TOURISM CATALYTIC	1.3 m	11 bn
INDUCED	260,000	2.5 bn
INDIRECT	330,000	3.4 bn
AVIATION DIRECT	76,000	3.3 bn

POLAND

AIRLINES 6
AIRPORTS 14
PASSENGERS (2023) 21,489,311
FLIGHTS (2023) 169,928
TOURISM % OF GDP 4.1

AVIATION INFRASTRUCTURE SCORE

3.7

TRAVEL & TOURISM DEVELOPMENT INDEX 27/119
CONNECTIVITY RANKING ..... 20 [136.1]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

95%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	290,000	15 bn
TOURISM CATALYTIC	38,000	1.5 bn
INDUCED	81,000	4.1 bn
INDIRECT	120,000	6 bn
AVIATION DIRECT	55,000	3.6 bn

PORTUGAL

AIRLINES 7
AIRPORTS 19
PASSENGERS (2023) 30,528,516
FLIGHTS (2023) 234,573
TOURISM % OF GDP 19.6

AVIATION INFRASTRUCTURE SCORE

5.3

TRAVEL & TOURISM DEVELOPMENT INDEX 12/119
CONNECTIVITY RANKING ..... 27 [131.4]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

84%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	330,000	20 bn
TOURISM CATALYTIC	160,000	8.2 bn
INDUCED	47,000	3.2 bn
INDIRECT	74,000	4.3 bn
AVIATION DIRECT	51,000	4.6 bn

REPUBLIC OF KOREA

AIRLINES 11
AIRPORTS 15
PASSENGERS (2023) 56,916,397
FLIGHTS (2023) 344,626
TOURISM % OF GDP 3.8

AVIATION INFRASTRUCTURE SCORE

4.7

TRAVEL & TOURISM DEVELOPMENT INDEX 14/119
CONNECTIVITY RANKING ..... 22 [135.6]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

100%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	1.2 m	78 bn
TOURISM CATALYTIC	440,000	21 bn
INDUCED	260,000	14 bn
INDIRECT	390,000	24 bn
AVIATION DIRECT	108,000	19 bn

ROMANIA

AIRLINES 8
AIRPORTS 14
PASSENGERS (2023) 12,016,229
FLIGHTS (2023) 83,399
TOURISM % OF GDP 5.6

AVIATION INFRASTRUCTURE SCORE

3.4

TRAVEL & TOURISM DEVELOPMENT INDEX 43/119
CONNECTIVITY RANKING ..... 60 [113.9]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

95%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	160,000	6 bn
TOURISM CATALYTIC	44,000	1.5 bn
INDUCED	41,000	1.6 bn
INDIRECT	49,000	1.9 bn
AVIATION DIRECT	28,000	966 m

RUSSIA (2018)

AIRLINES 41
AIRPORTS 169
PASSENGERS (2023) 76,191,641
FLIGHTS (2023) 675,437
TOURISM % OF GDP 4.1
AVIATION INFRASTRUCTURE SCORE
N/A

TRAVEL & TOURISM DEVELOPMENT INDEX ..... N/A
CONNECTIVITY RANKING ..... 33 [127.1]

AIRPORT ACCESSIBILITY
69%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	1.6 m	51 bn
TOURISM CATALYTIC	270,000	6.2 bn
INDUCED	390,000	10 bn
INDIRECT	670,000	17 bn
AVIATION DIRECT	301,000	17.9 bn

RWANDA

AIRLINES 1
AIRPORTS 2
PASSENGERS (2023) 473,251
FLIGHTS (2023) 9,636
TOURISM % OF GDP 10.2
AVIATION INFRASTRUCTURE SCORE
2.4

TRAVEL & TOURISM DEVELOPMENT INDEX 93/119
CONNECTIVITY RANKING ..... 91 [101.5]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY
100%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	42,000	160 m
TOURISM CATALYTIC	29,000	120 m
INDUCED	6,800	15 m
INDIRECT	3,400	12 m
AVIATION DIRECT	2,900	8.9 m

SAUDI ARABIA

AIRLINES 4
AIRPORTS 27
PASSENGERS (2023) 52,797,191
FLIGHTS (2023) 356,162
TOURISM % OF GDP 11.5
AVIATION INFRASTRUCTURE SCORE
5.0

TRAVEL & TOURISM DEVELOPMENT INDEX 41/119
CONNECTIVITY RANKING ..... 14 [146]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY
64%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	1.4 m	91 bn
TOURISM CATALYTIC	1.1 m	53 bn
INDUCED	48,000	6 bn
INDIRECT	120,000	17 bn
AVIATION DIRECT	141,000	14.3 bn

SERBIA

AIRLINES 1
AIRPORTS 3
PASSENGERS (2023) 4,938,477
FLIGHTS (2023) 47,815
TOURISM % OF GDP 6.4
AVIATION INFRASTRUCTURE SCORE
3.4

TRAVEL & TOURISM DEVELOPMENT INDEX 68/119
CONNECTIVITY RANKING ..... 37 [125.1]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY
88%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	45,000	1.3 bn
TOURISM CATALYTIC	18,000	530 m
INDUCED	9,600	260 m
INDIRECT	12,000	330 m
AVIATION DIRECT	6,100	160 m

SINGAPORE

AIRLINES 3
AIRPORTS 2
PASSENGERS (2023) 20,390,038
FLIGHTS (2023) 154,036
TOURISM % OF GDP 11.1
AVIATION INFRASTRUCTURE SCORE
5.9

TRAVEL & TOURISM DEVELOPMENT INDEX 13/119
CONNECTIVITY RANKING ..... 23 [139.9]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY
100%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	530,000	55 bn
TOURISM CATALYTIC	210,000	17 bn
INDUCED	77,000	7.8 bn
INDIRECT	120,000	17 bn
AVIATION DIRECT	119,000	13.6 bn

SOUTH AFRICA

AIRLINES 13
AIRPORTS 26
PASSENGERS (2023) 17,982,317
FLIGHTS (2023) 186,671
TOURISM % OF GDP 7.0
AVIATION INFRASTRUCTURE SCORE
3.7

TRAVEL & TOURISM DEVELOPMENT INDEX 55/119
CONNECTIVITY RANKING ..... 28 [131]

AIRPORT ACCESSIBILITY
81%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	260,000	5.7 bn
TOURISM CATALYTIC	71,000	1.5 bn
INDUCED	71,000	1.5 bn
INDIRECT	75,000	1.8 bn
AVIATION DIRECT	46,000	921 m

SPAIN

AIRLINES 21
AIRPORTS 45
PASSENGERS (2023) 131,428,908
FLIGHTS (2023) 951,527
TOURISM % OF GDP 14.5

AVIATION INFRASTRUCTURE SCORE

6.1

TRAVEL & TOURISM DEVELOPMENT INDEX 2/119
CONNECTIVITY RANKING ..... 12 [148]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

95%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	2 m	170 bn
TOURISM CATALYTIC	1.2 m	100 bn
INDUCED	230,000	19 bn
INDIRECT	300,000	24 bn
AVIATION DIRECT	305,000	26.8 bn

SRI LANKA

AIRLINES 2
AIRPORTS 12
PASSENGERS (2023) 3,028,154
FLIGHTS (2023) 27,268
TOURISM % OF GDP 7.8

AVIATION INFRASTRUCTURE SCORE

3.1

TRAVEL & TOURISM DEVELOPMENT INDEX 76/119
CONNECTIVITY RANKING ..... 70 [110.8]

AIRPORT ACCESSIBILITY

76%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	390,000	3.7 bn
TOURISM CATALYTIC	340,000	2.9 bn
INDUCED	37,000	510 m
INDIRECT	12,000	190 m
AVIATION DIRECT	5,000	118 m

SWEDEN

AIRLINES 9
AIRPORTS 38
PASSENGERS (2023) 16,221,070
FLIGHTS (2023) 166,456
TOURISM % OF GDP 7.1

AVIATION INFRASTRUCTURE SCORE

4.2

TRAVEL & TOURISM DEVELOPMENT INDEX 19/119
CONNECTIVITY RANKING ..... 31 [129.8]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

99%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	140,000	16 bn
TOURISM CATALYTIC	25,000	2.8 bn
INDUCED	32,000	4 bn
INDIRECT	44,000	5.4 bn
AVIATION DIRECT	40,000	3.7 bn

SWITZERLAND

AIRLINES 5
AIRPORTS 7
PASSENGERS (2023) 22,743,353
FLIGHTS (2023) 202,736
TOURISM % OF GDP 7.1

AVIATION INFRASTRUCTURE SCORE

5.5

TRAVEL & TOURISM DEVELOPMENT INDEX 10/119
CONNECTIVITY RANKING ..... 16 [143.2]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

100%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	290,000	47 bn
TOURISM CATALYTIC	89,000	13 bn
INDUCED	59,000	8.9 bn
INDIRECT	77,000	14 bn
AVIATION DIRECT	66,000	11.8 bn

TANZANIA

AIRLINES 8
AIRPORTS 22
PASSENGERS (2023) 3,613,625
FLIGHTS (2023) 135,472
TOURISM % OF GDP 9.5

AVIATION INFRASTRUCTURE SCORE

2.9

TRAVEL & TOURISM DEVELOPMENT INDEX 81/119
CONNECTIVITY RANKING ..... 77 [1107.8]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

N/A

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	710,000	3.8 bn
TOURISM CATALYTIC	610,000	3.4 bn
INDUCED	44,000	120 m
INDIRECT	36,000	150 m
AVIATION DIRECT	17,000	131 m

THAILAND

AIRLINES 9
AIRPORTS 33
PASSENGERS (2023) 56,283,162
FLIGHTS (2023) 380,319
TOURISM % OF GDP 10.4

AVIATION INFRASTRUCTURE SCORE

4.9

TRAVEL & TOURISM DEVELOPMENT INDEX 47/119
CONNECTIVITY RANKING ..... 27 [131.4]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

88%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	3.8 m	35 bn
TOURISM CATALYTIC	3.2 m	22 bn
INDUCED	260,000	3.6 bn
INDIRECT	290,000	5.9 bn
AVIATION DIRECT	133,000	3.5 bn

TÜRKIYE

AIRLINES 11
AIRPORTS 52
PASSENGERS (2023) 76,926,828
FLIGHTS (2023) 638,503
TOURISM % OF GDP 12.0

AVIATION INFRASTRUCTURE SCORE

5.5

TRAVEL & TOURISM DEVELOPMENT INDEX 29/119
CONNECTIVITY RANKING ..... 3 [166.4]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

91%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	2 m	82 bn
TOURISM CATALYTIC	1.2 m	50 bn
INDUCED	200,000	6.4 bn
INDIRECT	340,000	12 bn
AVIATION DIRECT	247,000	14.3 bn

UKRAINE (2018)

AIRLINES 3
AIRPORTS 13
PASSENGERS (2023) 312
FLIGHTS (2023) 60
TOURISM % OF GDP 4.0

AVIATION INFRASTRUCTURE SCORE

N/A

TRAVEL & TOURISM DEVELOPMENT INDEX ..... N/A
CONNECTIVITY RANKING ..... 195 [39.8]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

71%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	140,000	2.4 bn
TOURISM CATALYTIC	37,000	510 m
INDUCED	52,000	730 m
INDIRECT	31,000	440 m
AVIATION DIRECT	24,000	770 m

UNITED ARAB EMIRATES

AIRLINES 7
AIRPORTS 10
PASSENGERS (2023) 34,906,819
FLIGHTS (2023) 313,068
TOURISM % OF GDP 11.7

AVIATION INFRASTRUCTURE SCORE

6.5

TRAVEL & TOURISM DEVELOPMENT INDEX 18/119
CONNECTIVITY RANKING ..... 4 [162.8]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

83%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	990,000	92 bn
TOURISM CATALYTIC	300,000	22 bn
INDUCED	180,000	16 bn
INDIRECT	310,000	28 bn
AVIATION DIRECT	207,000	26.6 bn

UNITED KINGDOM

AIRLINES 23
AIRPORTS 63
PASSENGERS (2023) 128,604,965
FLIGHTS (2023) 951,869
TOURISM % OF GDP 9.0

AVIATION INFRASTRUCTURE SCORE

5.9

TRAVEL & TOURISM DEVELOPMENT INDEX 7/119
CONNECTIVITY RANKING ..... 5 [162.6]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

100%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	1.6 m	160 bn
TOURISM CATALYTIC	440,000	38 bn
INDUCED	360,000	39 bn
INDIRECT	460,000	43 bn
AVIATION DIRECT	378,000	40.2 bn

UNITED STATES

AIRLINES 76
AIRPORTS 696
PASSENGERS (2023) 715,099,201
FLIGHTS (2023) 8,708,235
TOURISM % OF GDP 8.6

AVIATION INFRASTRUCTURE SCORE

6.2

TRAVEL & TOURISM DEVELOPMENT INDEX 1/119
CONNECTIVITY RANKING ..... 1 [167.1]
CORSIA VOLUNTEER ..... ✓

AIRPORT ACCESSIBILITY

96%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	7.6 m	1.3 trn
TOURISM CATALYTIC	730,000	96 bn
INDUCED	2.5 m	390 bn
INDIRECT	2.1 m	380 bn
AVIATION DIRECT	2.3 m	433.3 bn

Note: In the United States, the FAA collects economic impact data with which these numbers are aligned. The FAA assessment further evaluates the much wider economic activity that is supported by air transport, including general aviation and the domestic tourism markets, which this report does not include. Accordingly, with these wider catalytic impacts included, the total number of jobs supported by civil aviation in the US alone is around 9.4 million, with a contribution to GDP of $1.8 trillion (in 2022)[298].

UZBEKISTAN

AIRLINES **9**
AIRPORTS **10**
PASSENGERS (2023) **4,852,235**
FLIGHTS (2023) **31,333**
TOURISM % OF GDP **5.2**

AVIATION INFRASTRUCTURE SCORE

3.1

TRAVEL & TOURISM DEVELOPMENT INDEX **78**/119
CONNECTIVITY RANKING ..... **45** [121.4]

AIRPORT ACCESSIBILITY

70%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	**130,000**	**800 m**
TOURISM CATALYTIC	**54,000**	**280 m**
INDUCED	**28,000**	**180 m**
INDIRECT	**33,000**	**240 m**
AVIATION DIRECT	**12,000**	**97 m**

VIET NAM

AIRLINES **6**
AIRPORTS **22**
PASSENGERS (2023) **54,875,796**
FLIGHTS (2023) **349,673**
TOURISM % OF GDP **6.8**

AVIATION INFRASTRUCTURE SCORE

4.0

TRAVEL & TOURISM DEVELOPMENT INDEX **59**/119
CONNECTIVITY RANKING ..... **43** [122]

AIRPORT ACCESSIBILITY

86%

AVIATION BENEFITS

	JOBS	GDP (US $)
TOTAL	**2.5 m**	**18 bn**
TOURISM CATALYTIC	**1.5 m**	**7.8 bn**
INDUCED	**540,000**	**4.3 bn**
INDIRECT	**350,000**	**3.6 bn**
AVIATION DIRECT	**100,000**	**1.9 bn**


MONTER BRAS AVANT
DESCENDRE BRAS AVANT
DESCENDRE
ROTATION

A GROWTH INDUSTRY



An assessment of the next
20 years of aviation

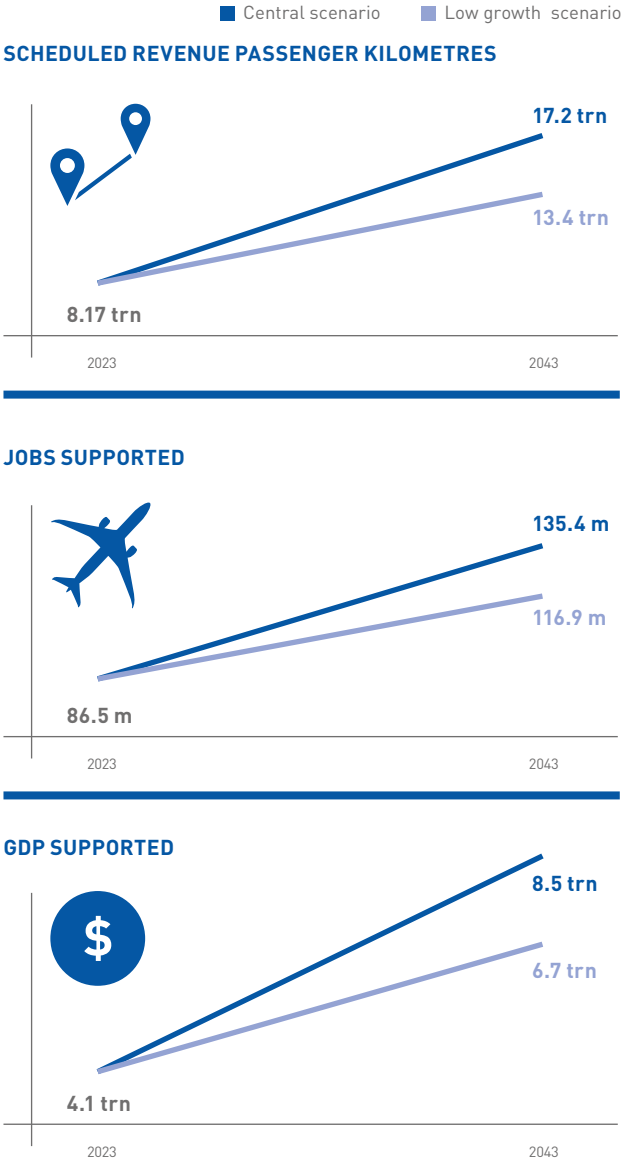
Analysis suggests that demand for air transport will increase by an annual average of 3.9% over the next 20 years. The 20-year outlook presented in this report is based on air transport growing at this predicted rate.

Looking ahead 20 years however, is fraught with uncertainty. Future political turmoil, unexpected economic instability and shocks such as conflict or global health emergencies (as witnessed with Covid-19) could throw these predictions off course. To account for unforeseen fluctuations in activity, Oxford Economics also undertook a sensitivity analysis.

Oxford Economics has provided two scenarios for consideration on how aviation connectivity (and associated support for economic and employment trends) will evolve in the next 20 years.

Onwards and upwards

Growing support for connectivity, employment and economic activity, 2023–2043[299]



A THE CENTRAL SCENARIO

17.2 trillion
Revenue passenger kilometres 2043

135.4 million
Jobs supported 2043

$8.5 trillion
Economic impact 2043

Analysis based on recognised industry forecasts suggests that demand for air transport will increase by an average of 3.9% per annum over the next 20 years[300]. That implies that demand for air travel will increase by a factor of 1.8 over the period, a continuation of longer-term historical trends, but at a lower rate to the recent (pre-Covid 19) growth profile of the sector.

If this growth path is achieved, then in 2043 the air transport industry will support

- 16.4 million direct jobs and $2.1 trillion of GDP to the world economy;
- A further 48.3 million jobs and $3.9 trillion in GDP, generated through the indirect and induced channels; and
- 135 million jobs and $8.5 trillion in GDP once the impacts of global tourism are taken into account[301].

Enabling factors for this scenario to take place include:

- Near-term economic optimism improves.
- Increased business investment supporting long-term supply growth.
- Trade between nations continues to grow.
- Flight freedoms are not restricted and are even improved.
- Technological progress continues to reinforce the downward trend in air fares.

B

THE LOW GROWTH SCENARIO

13.4 trillion

Revenue passenger kilometres 2043

116.9 million

Jobs supported 2043

$6.7 trillion

Economic impact 2043

Should moves towards a more protectionist and fragmented world continue, there will likely be an impact on air traffic growth, particularly international travel and air freight. Oxford Economics produced a forecast that explores the impact of this scenario. The result is a reduction in the growth of aviation activity, with an average annual growth rate in revenue passenger kilometres of 2.6% for the next 20 years.

If this more pessimistic scenario materialises, then in 2043 air transport will support 18.5 million fewer jobs and $1.8 trillion less to GDP[302].

Such a scenario could materialise following some or all of these events:

- Significant reluctance to travel or a shift in propensity to travel due to health-related concerns by passengers, or travel restrictions put in place for lengthy periods of time by governments
- a significant shift in global trade policy and multilateral, regional and bilateral agreements, with retaliatory tariffs established in response
- a trade slowdown that undermines the global recovery
- no further liberalisation in air markets and even more restrictive policies
- a slowdown in migration due to a tightening of immigration policies
- a limiting of the ability of monetary authorities to combat downturns in demand by relaxing monetary policy
- debt accumulation to weigh on consumer spending and business investment

C

THE RAPID GROWTH SCENARIO

There is another option – that air traffic growth returns to the levels seen in the pre-Covid period with 5% annual growth over the next 20 years: for around 21.3 trillion RPKs in 2043. This scenario would see an additional 17.8 million jobs and $1.8 trillion GDP added, providing a 2043 total of 153.2 million jobs and $10.3 trillion in GDP supported by aviation.



Sustainable growth

After the shock caused by the Covid-19 pandemic that hit the global air transport sector particularly hard, the aviation industry is expected to grow significantly in the next two decades.

The months during which air transport was limited or even completely stopped in many parts of the world during the Covid-19 crisis made us even more aware of the importance of aviation for trade links and supply chains, the provision of goods in a globalised world and the role aviation plays on a social and personal level with the unique connectivity it provides.

The aviation industry is confident that rebuilding the sector and future growth can be achieved in an environmentally-sustainable way.

The industry's *Waypoint 2050* report demonstrates that there are viable options for the decarbonisation of air transport with the industry at a global level able to meet net-zero emissions by 2050. This assumes the right level of support from governments, the finance sector, the energy industry and research institutions. The industry itself will need to redouble efforts as well: both industry and governments now have net-zero carbon by 2050 as a goal. That objective will not be cheap, with estimates ranging from $1.5 trillion - $5 trillion in capital needed to make the net-zero transition in aviation.

There are a range of measures that can help drive aviation towards the technology, energy system and operational measures that are required to meet these ambitions. Many of these are incredibly challenging, but all are achievable with the right policy environment and the necessary focus of resources.

This will take the form of evolutionary developments of conventional aircraft architectures and revolutionary shifts with new types of airframe and engines and possible moves to electric, hybrid-electric and / or hydrogen powered aviation in the 2035-2040 timeframe for short-haul and small aircraft.

For long-haul operations, a complete switch to sustainable aviation fuel will be required – with up to 500 million tonnes of SAF needed per year by 2050. Studies have shown that this is technically feasible, using sustainable sources, but it is a significant challenge for the industry as well as energy providers. Government assistance and the right policy environment will be necessary to underpin this energy transition to ensure that the growth in passenger and cargo connectivity can be achieved whilst the industry also works to reduce its climate impact.

Further details on the industry's long-term climate action can be found in the *Waypoint 2050* report: www.aviationbenefits.org



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[1] Chicago Convention, Annex 11: http://ataglink.org/3C6wfsZ

[2] Chicago Convention Annex 8: https://ataglink.org/4faCLh6

[3] Chicago Convention Annex 16: https://ataglink.org/4hqPkX3

[4] Chicago Convention: Annex 9: https://ataglink.org/3ClwFf6

[5] Chicago Convention Annex 1: https://ataglink.org/4ehJuVc

[6] See Essay "Global travel for all", by Dr. Marc Dierikx, published in *Aviation: Benefits Beyond Borders*, 2014.

[7] IATA *Global Outlook for Air Transport* June 2024 report: http://ataglink.org/4f7Y6b0

[8] Population estimate for 1950: 2.5 billion. Population in November 2022: 8 billion. United Nations website: https://ataglink.org/3Ad8dMF

[9] ATAG analysis using combined ICAO, IATA data.

[10] IATA Statistics.

[11] IATA Statistics.

[12] Air Transport Association of America, *Air Transportation, 8th Edition, Little Known Facts, 1946:* https://ataglink.org/3UAnjCz

[13] Oxford Economics, from the US Bureau of Labor Statistics

[14] Air Transport Association of America, *Air Transportation, 8th Edition, Little Known Facts, 1946* (2.12 passenger fatalities per 100 million passenger miles)

[15] Number of accidents: IATA Safety (1 fatal accident on board with 72 fatalities). RPK: (8.17 trillion): IATA Statistics

[16] Business Class, *The history of flights from the UK to Australia: how time flies, 24 October 2017:* https://ataglink.org/4f9oqkU

[17] RAC, *Perth to London Direct:* https://ataglink.org/4fpnLeW

[18] Air Transport Association of America, *Air transportation, today and tomorrow, 1945:* https://ataglink.org/4hu1mPo

[19] Based on the top 10 airports by total passengers, 2023 (see table on p14).

[20] Air Transport Association of America, *Air Transportation, 8th Edition, Little Known Facts, 1946.*

[21] FAA *Aerospace Forecasts,* 2024.

[22] Air Transport Association of America, *Air Transportation, 8th Edition, Little Known Facts, 1946.*

[23] Estimate for 2023 from IATA, *Global Outlook for Air Transport June 2024.*

[24] Airlines for *America State of US Aviation, September 2024:* www.airlines.org/impact/

[25] Oxford Economics analysis.

[26] Oxford Economics analysis.

[27] Airports Council International (ACI) World figures, 2022 estimate. Most of those employed by airport operators work on-site at airports, but a small number may work off-site. To avoid double counting, the airport operator employees are subtracted from the overall on-airport employees figure. Also, on a country-by-country basis, the figures for airport operators may include activities that other countries do not. For example, airport operators in the United Kingdom are obliged to provide security services at their facilities, whereas in the United States that service is provided by the government (and, therefore, those employees appear in the 'other on-airport' category). In New Zealand, airport operators provide the rescue fire service, whereas in Australia that service is provided by the ANSP. A number of countries have one company fulfilling both airport and ANSP functions. This is a conservative approach that likely underestimates overall employment.

[28] ACI World *Economics Survey* and Oxford Economics research.

[29] Oxford Economics.

[30] Oxford Economics and aerospace industry associations research.

[31] Oxford Economics figures derived from Civil Air Navigation Services Organisation (CANSO). To avoid double counting, 40% of ANSP employees are subtracted from 'other on-airport' employment, a conservative estimate of the ratio of ANSP employment on-airport (in control towers, etc.) vs. off-airport (head office, research and training centres and some en route control centres).

[32] Oxford Economics.

[33] Oxford Economics.

[34] Previous studies have indicated this additional benefit could mean aviation supports as much as 8% of global GDP.

[35] Oxford Economics – this is for aviation's direct contribution (airlines, airport operators, ANSPs, airport on-site and civil manufacturing), based on a World Bank list of global economies.

[36] Oxford Economics.

[37] OAG, counting all regularly scheduled commercial routes.

[38] OAG. A 'route' is a flight between one airport and another, bi-directionally. Therefore, LHR-GVA and GVA-LHR are both counted. City pairs are routes between different cities, counted only once. Therefore, all flights between all London airports and Geneva in both directions are counted as one city pair.

[39] ICAO and IATA Sustainability & Economics. Includes all scheduled and charter airline traffic. Does not include business aviation or non-scheduled traffic. Passengers often refers to people who have flown multiple times in a given year, so those listed as passengers are not individual people which have flown.

[40] ACI World.

[41] OAG.

[42] ACI World.

[43] IATA Statistics.

[44] IATA Sustainability & Economics.

[45] IATA Sustainability & Economics.

[46] Cirium's Fleets Analyzer data for the in-service commercial airline fleet as at 31.12.2023.

[47] OAG. Includes airports with at least one scheduled flight per week.

[48] CIA *The World Fact Book:* https://ataglink.org/3NSHJmJ. Data is for 2024.

[49] ATAG and Civil Air Navigation Services Organisation (CANSO) analysis of air navigation service providers covering upper airspace and terminal control, but not aerodrome-specific service providers. Note that the definition of an ANSP is evolving, with Aireon and ESSP (both of which have not been counted) having been certified by EASA due to their role in providing data services. UTM U-space providers are providing air navigation services to vehicles in the airspace.

[50] Cirium's Fleets Analyzer data as at 31.12.2023.

[51] Cirium's Fleets Analyzer data as at 31.12.2023.

[52] The value of world merchandise trade in 2023 was $24 trillion, according to World Trade Organization (WTO) statistics: https://ataglink.org/3YMNCYH

[53] IATA Sustainability & Economics (2019).

[54] IATA Statistics. Airports count cargo in a different way and handled some 114.8 million tonnes in 2023, according to ACI World statistics.

[55] IATA Sustainability & Economics

[56] IATA Sustainability & Economics

[57] World Travel & Tourism Council (WTTC) analysis for 2023.

[58] IATA Sustainability & Economics.

[59] International Energy Agency (IEA), *World Energy Outlook 2023:* https://ataglink.org/3C6KQVj

[60] IATA Sustainability & Economics.

[61] IATA Sustainability & Economics. Note: this is a preliminary calculation.

[62] UN Environment Programme *Emissions Gap Report 2024,* October 2024: https://ataglink.org/3AlW9IW

[63] IATA analysis.

[64] IATA Sustainability & Economics.

[65] IATA, press release: https://ataglink.org/4huPtbV

[66] IATA, press release: https://ataglink.org/3C9Axju

[67] IATA Sustainability & Economics.

[68] ATAG / BlueSky analysis using IATA Statistics data.

[69] ATAG / BlueSky analysis using IATA Statistics data.

[70] ATAG analysis.

[71] McKinsey analysis, *Addressing continued turbulence: The commercial-aerospace supply chain,* April 2024: https://ataglink.org/3AoUeDm

[72] IATA Statistics.

[73] There are no reliable global figures published for other modes of transport. The European Union used to publish occupancy by other forms of public transport but discontinued this several years ago. At that time, trains tended to be on average 35–40% full (with vastly higher occupancy for commuter routes at peak hours). However, commuter trains tend to operate on a very different business model, so air travel is more comparable with high-speed and long-distance rail. In China, studies have shown that long-haul rail services can have as low as 20% occupancy (Yao et al., *Study on High-Speed Rail Pricing Strategy*, 2013). Even then, passengers on long-distance trains often embark or disembark at intermediate stations, which can skew the results. European coach trips tend to be around 60% full, and personal cars across Europe (and in many other 'developed' countries) average 1.45 passengers per vehicle (around 30% occupancy). This figure is declining. European Environment Agency and EuroStat data.

[74] ACI World Airport Traffic Database, 2024.

[75] ACI World Airport Traffic Database, 2024.

[76] ACI World Airport Traffic Database, 2024.

[77] OAG: https://ataglink.org/3YwJzyl

[78] 82 countries with 2023 values. Israel, Russia and Ukraine are included with 2018 values due to ongoing conflicts causing anomalous 2023 values.

[79] IATA Sustainability & Economics.

[80] IATA Statistics.

[81] IATA Statistics.

[82] IATA Sustainability and Economics and WTO data.

[83] WTTC analysis for 2023.

[84] Oxford Economics.

[85] IATA Sustainability & Economics based on OAG.

[86] CANSO and ATAG analysis

[87] Cirium's Fleets Analyzer data as at 31.12.2023.

[88] Oxford Economics.

[89] ACI analysis.

[90] Cirium's Fleets Analyzer data, for the in-service commercial airline fleet as at 31.12.2023.

[91] IATA Sustainability & Economics based on DDS.

[92] IATA Sustainability & Economics based on OAG.

[93] IATA Statistics.

[94] Oxford Economics analysis.

[95] Oxford Economics.

[96] ACI Europe and Intervistas, *Economic Impact of European Airports*, 2015: https://ataglink.org/40nvplU. In Europe, the direct employment generated by increased traffic was studied in different bands of airport size, and it was found that, for airports with fewer than one million passengers, each increase of 1,000 passenger movements increases direct employment on-airport by 1.2 jobs. The employment generated by each additional 1,000 traffic units for small airports is greater than that for large airports. Furthermore, connecting passengers have a marginally smaller (3%) direct employment impact than origin/destination passengers. This may reflect the fact that connecting passengers do not consume certain services at airports, such as car parking, car rental and other ground transportation. Passengers flying on low-cost carriers (LCCs), have a smaller direct employment impact (20% less) than other types of traffic. This may be due to the lower staffing levels at LCCs, reduced auxiliary services (such as in-flight catering and airport lounges), and reduced LCC passenger spending on commercial offerings. It should be noted that these ratios do not attempt to find relationships between passenger numbers and the impact on total employment - in particular the impact upon catalytic impact. For example, connecting passengers may require a lower proportion of direct workers, but if connecting passengers support the operation of routes that would otherwise not be viable, this leads to an increase in traffic, which would not be factored into this ratio. Similarly, although LCC passengers also require fewer direct workers, LCC traffic has been for many airports and areas the major provider of growth in recent years. In such cases, this traffic has contributed to the catalytic impact of airports, which is again not captured in the ratios. Airports generally count each passenger twice (on arrival and departure), whereas most passenger/traffic numbers cited in this report count each passenger departure (i.e., once).

[97] ACI Europe and Intervistas, *Economic Impact of European Airports*, 2015. Airports generally count each passenger twice (on arrival and departure), whereas most passenger/traffic numbers cited in this report count each passenger departure (i.e., once).

[98] SEO Amsterdam Economics, *The Economic and Social Impact of European Airports and Air Connectivity 2024* commissioned by ACI Europe (analysis based on survey among ACI Europe's members, 2019): https://ataglink.org/3YNnoW8

[99] Oxford Economics.

[100] Information from public sources and the Airport Services Association (asaworld.aero). The largest company is Swissport with a global workforce of 60,000 employees across 286 airports in 44 countries, followed by SATS from Singapore with 50,000 staff operating in 215 locations in 27 countries, dnata in Dubai employs 49,000 people across 136 airports in 30 countries, and the British firm Menzies operates with 47,000 employees in 250 locations across 60 countries.

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[102] Oxford Economics analysis.

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[261] Throughout the regional section, this figure is provided by IATA DDS and relates to all departing O&D passengers (does not include connecting passengers). Alternative passenger numbers are used by airports as they count individual passengers on arrival and departure.

[262] Throughout the regional section, this data is provided by ACI World.

[263] Throughout the regional section, this figure is provided by IATA DDS.

[264] Throughout the regional section, this data is provided by ACI World.

[265]Throughout the regional section, this figure is provided by OAG and includes airports with at least one commercial flight scheduled per week for a scheduling season.

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[271] Europe includes the following: Albania, Andorra, Austria, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Faroe Islands, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Liechtenstein, Latvia, Lithuania, Luxembourg, Malta, Monaco, Montenegro, Netherlands, North Macedonia, Norway, Poland, Portugal, Moldova, Romania, Russia, San Marino, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye, Ukraine and the United Kingdom. For data on the number of airlines, the countries included may differ slightly.

[272] Latin America and the Caribbean includes the following: Antigua and Barbuda, Argentina, Bahamas, Barbados, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago, Uruguay and Venezuela. For data on the number of airlines, the countries included may differ slightly.

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[279] European Union member countries as of 2024 total 27: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain and Sweden.

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[283] Developing countries for the purposes of this report are ICAO Member States (plus Chinese Taipei and Hong Kong SAR) that are not members of the OECD. These include the following: Afghanistan, Algeria, Angola, Antigua and Barbuda, Argentina, Armenia, Azerbaijan, Bahamas, Bahrain, Bangladesh, Barbados, Belize, Benin, Bhutan, Bolivia, Botswana, Brazil, Brunei, Burkina Faso, Burundi, Cabo Verde, Cambodia, Cameroon, Central African Republic, Chad, China, Chinese Taipei, Colombia, Comoros, Congo, Cook Islands, Côte d'Ivoire, Cuba, Dem. People's Rep. of Korea, Dem. Rep. of the Congo, Djibouti, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Equatorial Guinea, Eritrea, Eswatini, Ethiopia, Fiji, Gabon, Gambia, Georgia, Ghana, Grenada, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Hong Kong SAR, India, Indonesia, Iran, Iraq, Jamaica, Jordan, Kazakhstan, Kenya, Kiribati, Kuwait, Kyrgyzstan, Lao People's Dem. Rep., Lebanon, Lesotho, Liberia, Libya, Madagascar, Malawi, Malaysia, Maldives, Mali, Marshall Islands, Mauritania, Mauritius, Mexico, Micronesia (Federated States of), Mongolia, Morocco, Mozambique, Myanmar, Namibia, Nauru, Nepal, Nicaragua, Niger, Nigeria, Oman, Pakistan, Palau, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Qatar, Rwanda, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Samoa, Sao Tome and Principe, Saudi Arabia, Senegal, Seychelles, Sierra Leone, Singapore, Solomon Islands, Somalia, South Africa, South Sudan, Sri Lanka, Sudan, Suriname, Syrian Arab Republic, Tajikistan, Tanzania, Thailand, Timor-Leste, Togo, Tonga, Trinidad and Tobago, Tunisia, Türkiye, Turkmenistan, Tuvalu, Uganda, United Arab Emirates, Uruguay, Uzbekistan, Vanuatu, Venezuela, Viet Nam, Yemen, Zambia and Zimbabwe.

[284] Members of the Organisation for Economic Co-operation and Development include the following: Australia, Austria, Belgium, Canada, Chile, Colombia, Costa Rica, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Latvia, Lithuania, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Republic of Korea, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye, United Kingdom and United States. See www.oecd.org.

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[286] Landlocked developing countries are those that are designated as such by the UN and are also ICAO Member States. They include the following: Afghanistan, Armenia, Azerbaijan, Bhutan, Bolivia, Botswana, Burkina Faso, Burundi, Central African Republic, Chad, Eswatini, Ethiopia, Kazakhstan, Kyrgyzstan, Lao People's Dem. Rep., Lesotho, Malawi, Mali, Moldova, Mongolia, Nepal, Niger, North Macedonia, Paraguay, Rwanda, South Sudan, Tajikistan, Turkmenistan, Uganda, Uzbekistan, Zambia and Zimbabwe. See https://ataglink.org/3UxB84X

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[301] All in 2023 prices.

[302] All in 2023 prices.

[303] Gross value-added (GVA) is the difference between the revenue a firm or industry generates less the bought-in costs needed to produce that revenue. GVA summed across all firms and industries in an economy is equal to GDP, after minor adjustments for taxes and subsidies. GDP is the most commonly used metric for an economy's size and is often used to measure economic growth or to indicate when an economy has entered or exited a recession.

[304] Previous studies have indicated this additional benefit could mean aviation supports as much as 8% of global GDP.



METHODOLOGY

Oxford Economics analysed six key aviation sectors

ATAG commissioned Oxford Economics to estimate the aviation sector's global economic impact in the 2023 calendar year and how it might evolve over the next two decades. This follows Oxford Economics' analyses of the aviation sector's economic footprint for previous editions of *Aviation: Benefits Beyond Borders,* including those published in 2008, 2012, 2014, 2016, 2018 and 2020, and for previous similar publications reaching back to 1991.

The number of jobs and gross value added (GVA) created or supported by aviation are assessed for five key sub-sectors: airlines, airport operators, providers of goods and services on-site at airports (such as retailers and hoteliers), civil aircraft manufacturers and air navigation service providers. In addition, this report estimates the tourism activity that air travel makes possible.

The analysis was for 85 countries and 14 major regions or groups

Oxford Economics analysed aviation's economic impact in each of the 85 countries that together account for 96% of global GDP and in these 14 regions or groups: Africa, Asia-Pacific, Europe, Latin America and the Caribbean, Middle East, North America, APEC economies, European Union, ASEAN member states, small island states, developing countries, OECD countries, least-developed countries (LDCs), and landlocked developing countries (LLDCs).

Regional and group estimates are created by scaling-up individual country results. The scaling is based on revenue passenger kilometres or airport passenger numbers represented by the individual countries in the dataset relative to the countries represented in an entire region or group.

Three core economic impact channels were estimated

The analysis considers three channels of spending that are in all standard economic impact studies.

- The **first** is the direct channel, which is the operational spending that airlines, airports, civil aircraft manufacturers, airport operators and air navigation service providers undertake to generate profits and employ people at their operational sites.
- The **second** is the indirect channel - the aviation sector's procurement of inputs of goods and services from other businesses in the economy. This spending supports additional jobs and gross value added contributions along the sector's supply chains[303].
- The **third** is the induced channel, comprising wage payments to staff in the aviation sector and the supply chain. Some or all of those wages are subsequently spent in the consumer economy, which supports further economic activity and jobs in retail and leisure outlets and their supply chains.

Indirect and induced impacts are estimated at the country level using Oxford Economics' Global Sustainability Model—a bespoke inter-country Input-Output model covering 185 countries across the world—to trace how the procurement of goods and services by aviation subsectors stimulate economic activity across borders and industries.

In addition to these standard impact channels, Oxford Economics explores the economic impact arising from **tourists** who arrive by air and spend money on goods and services.

The estimates are based on comprehensive data sources

Building on the extensive data collection efforts undertaken for the previous edition of *Aviation: Benefits Beyond Borders,* Oxford Economics collected over 550 data points from national statistics agencies and international institutions such as Eurostat to improve estimates of employment and gross value added in the airline and civil aircraft manufacturing sectors. The newly collected data accounts for 96% of the country-level gross value added in the airline sector in 2023 and for 100% of gross value added at the country level for the civil aircraft manufacturing sector.

Airports Council International (ACI) generously provided detailed data on jobs, revenues, and costs from its 2022 Airport Economics Survey, along with employment data for 2023. This survey asked 1,069 airports around the world about their 2022 financial year. The respondents accounted for 82% of all airport traffic in 2019.

Oxford Economics made use of detailed employment and financial data published by the Civil Air Navigation Services Organisation (CANSO), a trade body whose members help manage over 90% of the world's air traffic. Where otherwise unavailable, estimates of direct ANSP employment were created using an econometric analysis based on flight hour data provided by Aireon.

Oxford Economics also received valuable data points from the Aerospace, Security and Defence Industries Association of Europe (ASD), the Aerospace Industries Association (AIA) and the International Coordinating Council of Aerospace Industries Associations (ICCAIA) on the split between civil and defence aviation manufacturing.

Finally, the Oxford Economics / World Travel & Tourism Council database of tourism impacts which is based on national statistics and International Monetary Fund (IMF) balance of payments data on tourist expenditures, was adapted for this project to assess the number of jobs and gross value added supported by tourists who travel to their destinations by air.

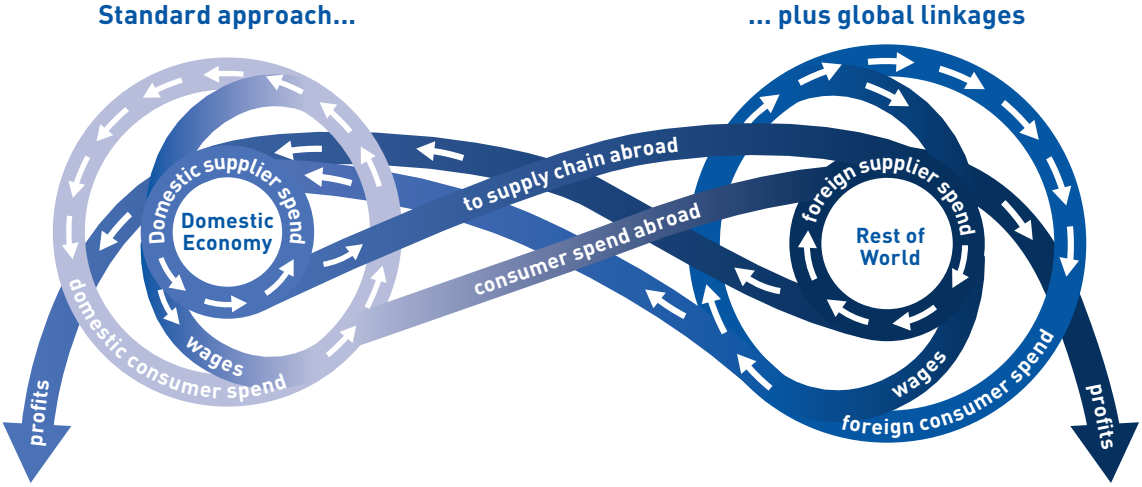
Where new data were unavailable, Oxford Economics leveraged the latest data collected on the aviation sector by the International Air Transport Association (IATA) and ACI.

Forecasts to 2043

At the regional or group level, Oxford Economics forecast gross value added for airlines, airport operators, airport on-site businesses, and air navigation service providers using revenue passenger kilometres forecasts produced by Oxford Economics in partnership with IATA.

The forecasts for tourism come from Oxford Economics Tourism Economics database, while the forecasts for civil aircraft manufacturing come from Oxford Economics' industry model.

How the Global Sustainability Model goes beyond the standard approach



Note on methodological change from previous versions

The figures in *Aviation: Benefits Beyond Borders* should be viewed as a snapshot of the aviation sector in 2023 and not as part of a trend. Differences in data sources mean the reports are not directly comparable with previous editions.

Over time, more official statistics on the aviation sector become available from government statistics agencies, particularly in small and developing countries. This means that in each update of this study, an increasing number of countries' direct GVA and employment estimates are based on official statistics, replacing older estimates.

In this study, we have also replaced the OECD Inter-Country IOT used in the previous study with the Oxford Economics Global Sustainability Model - a bespoke inter-country Input-Output model covering 185 countries across the world. This methodological change increases the country coverage of the model from 50 to 185, enabling more country-specific multipliers to be used instead of regional proxies. Furthermore, the model allows for trade-feedback loops to be captured, which more comprehensively captures the impact of the aviation sector across global value chains.

In the latest study, Oxford Economics introduced data and methodological improvements that enhance the accuracy of the study results. These mainly include introducing new data sources on the share of inbound tourists arriving by air, improving estimates of tourists' in-country spend, and incorporating improved estimates from Tourism Economics' Global Travel Service on bilateral visitor flows.

Specifically, the tourism catalytic category of jobs and GDP have been revised. If the same methodology were applied to the results from the previous *Aviation: Benefits Beyond Borders* report, the following would have been the outcomes:

	2018	Early 2021 (Covid-19 edition)	2023
Aviation direct	11.3 m	6.5 m	11.6 m
Indirect	18.1 m	9.7 m	20.4 m
Induced	13.5 m	7 m	17.2 m
Tourism catalytic	41 m (revised from 44.8m)	18.4 m	37.3 m
Total	83.9 m (revised from 87.7m)	41.7 m	86.5 m

CALCULATING THE BENEFITS OF AVIATION

This report looks at how the air transport industry contributes to social and economic development at different levels. The first four pillars below are included in this analysis. They do not include other economic benefits of aviation, such as the jobs or economic activity generated when companies or whole industries exist because air travel makes them possible (noted under 'other catalytic'). They also do not include the intrinsic value that the speed and connectivity of air travel provides or domestic tourism and trade. Including these would increase the employment and global economic impact numbers several-fold[304].

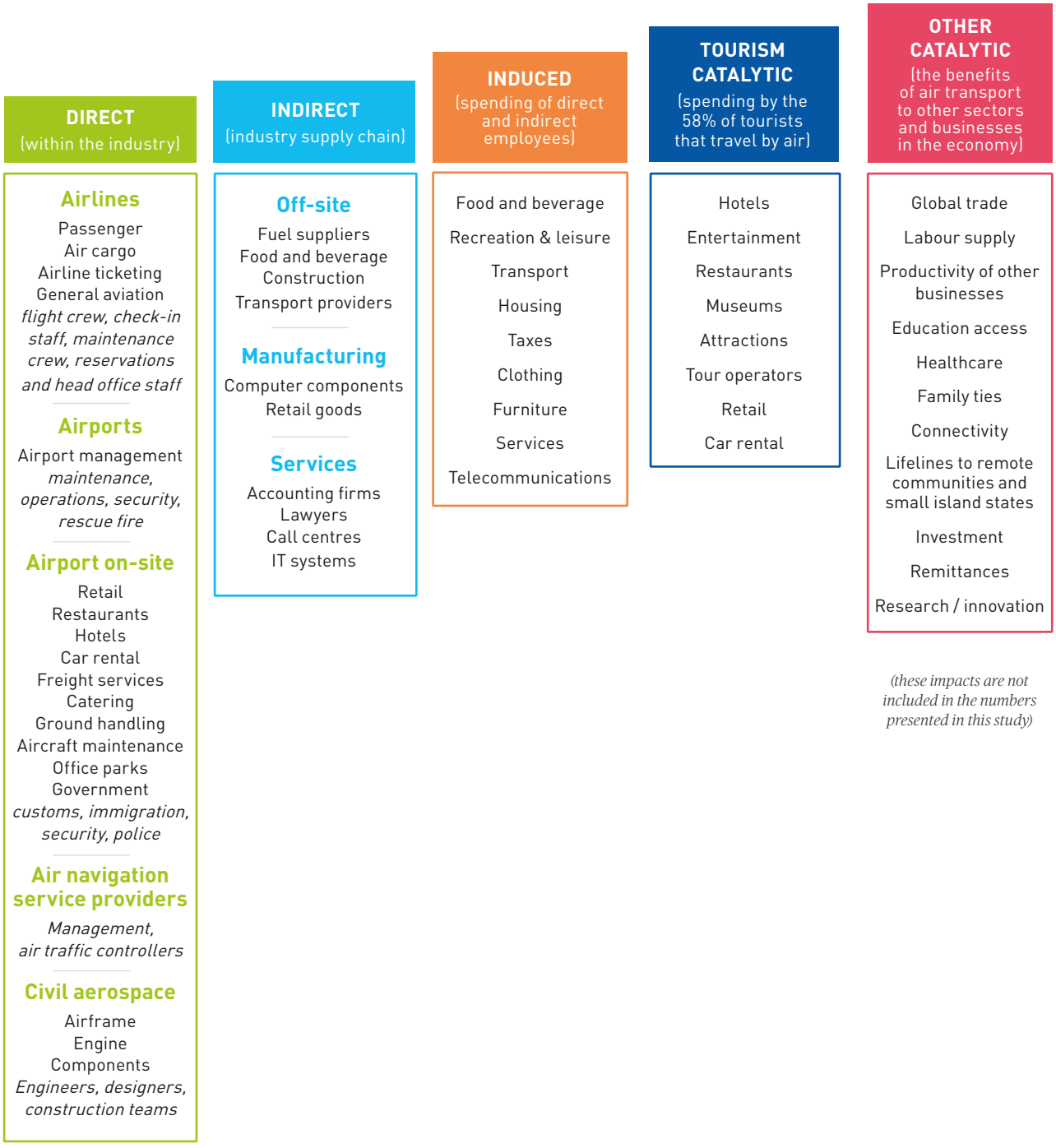




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