



# Vision 2050

Singapore, 12 February 2011

## Report

The passenger is at the core of our 2050 thinking. Over the last four decades the real cost of travel has fallen by about 60% and the number of travelers increased tenfold. We must continue to provide this great value to individual consumers and to society. To do so we need the right technology, efficient and sufficient infrastructure. And we need financial sustainability. Nobody has all the answers or a crystal ball to see the industry in 2050. But there was consensus among all present that there is strategic value in thinking together. And there was general consensus that one of the industry's biggest challenges is to evolve from the financial disaster of a partial deregulation that has created fierce competition among airlines but without giving them the normal commercial freedoms to do business. The industry is sick. To protect the value that aviation delivers to consumers, companies, countries and the global economy, we need a common vision to change as we move forward.

Giovanni Bisignani  
Singapore, 12 February 2011



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**Note: Unless specified otherwise, all dollar (\$) figures in this report refer to US dollars (US\$)**

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# Foreword

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A decade of change has transformed aviation. Airlines are leaner, greener, safer and stronger.

The industry had also grown to meet the needs of a globalizing world. Compared to 2001, freight shipments expanded by 17 million tonnes to 46 million annually. At the same time, air travel became accessible to a billion more travelers a year and we expect 2.8 billion people to fly in 2011.

The decade also saw industry revenues double to an expected \$598 billion. But industry profits are much less impressive. Over the last 40 years, the average net margin is 0.1%. And even in the best year of the last decade – 2010 – the industry's \$18 billion profit is equal to a pathetic margin of just 3.2%, that does not cover the 7-8% cost of capital.

Looking ahead, we can see that in 2050 aviation will fly 16 billion passengers and 400 million tonnes of cargo. We must be able to manage that with sustainable technologies and efficient infrastructure, while pleasing our passengers and rewarding our shareholders. At the 2010 IATA Annual General Meeting, I announced Vision 2050 with these principles as cornerstones. And I invited 35 strategic thinkers to challenge and develop this vision.

The group benefited greatly by the inspirational and strategic leadership and wisdom of Singapore's Minister Mentor, Lee Kuan Yew. And Harvard University Professor, Michael Porter, helped us to frame our analysis with his insights on global competitiveness.

Vision 2050 did not identify a silver bullet to secure a more successful future. The papers that follow highlight the need for ongoing change.

First, we must break down the silos that dominate the industry's value chain. This will allow for a rebalancing of financial reward to reflect the risk taken. By working together as a united industry, we can create new value propositions for our customers and move away from destructive competition based solely on price.

Second, we must challenge governments to join us in change. This means replacing interventionist micro-management and punitive taxation as the modus operandi of many, with a positive approach based on a level playing field and focused on commercial freedoms.

Third, we must embrace the reality of an industry whose centre of gravity is shifting away from our traditional leaders in the US and Europe. Asia-Pacific is already our biggest market. The continued development of China and India will keep this region at the industry's forefront. We must engage the region to deliver leadership for change.

The last decade has shown that by working together with a common purpose, change is possible. Vision 2050 is not a roadmap to the future. Flexibility and openness to change will mark the way forward. Instead, Vision 2050 is a challenge to all aviation stakeholders – to unite in articulating and delivering a dynamic vision of our wonderful industry's future.



Giovanni Bisignani  
Director General & CEO – IATA

# Participants

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**IATA's Vision 2050 Summit in Singapore, 12 February 2011, brought together a group of strategic thinkers, representing a broad range of industry stakeholders. Participants included government ministers, regulators, airlines, manufacturers, technologists, financiers, airports, air navigation service providers, labor and consumers.**

Lee Kuan Yew – Minister Mentor, Singapore

Anthony Albanese – Minister for Infrastructure and Transport, Australia

Raymond Benjamin – Secretary General, International Civil Aviation Organization

Yashwant Bhave – Chairman, Airports Economic Regulatory Authority, India

Philip L. N. Chen – Former CEO, Cathay Pacific

Chew Choon Seng – Former CEO, Singapore Airlines

Josh Connor – Head of Transportation & Infrastructure Investment Banking, Morgan Stanley

Nader Dahabi – Former Prime Minister of Jordan

Kevin Done – Former Aviation and Aerospace Journalist, Financial Times

Rod Eddington – Former CEO, British Airways

Tony Fernandes – Group CEO, AirAsia

Edward M. Greitzer – H.N. Slater Professor of Aeronautics and Astronautics, MIT

John Grier – Group Head of Global Transportation Investment Banking, Citibank

Paul Griffiths – CEO, Dubai Airports

Carlos Limon – President, International Federation of Air Line Pilots' Associations

Lim Hwee Hua – Second Minister for Finance and Second Minister for Transport, Singapore

Thierry Lombard – Managing Partner, Lombard Odier Darier Hentsch & Cie

Wolfgang Mayrhuber – Former CEO, Deutsche Lufthansa

David McMillan – Director General, Eurocontrol

Robert Milton – Chairman & CEO, ACE Aviation Holdings Inc.

Max Moore-Wilton – Chairman, MAp Airports Group

Leo F. Mullin – Former CEO, Delta Air Lines

Ronald K. Noble – Secretary General, INTERPOL

Ben Page – Chief Executive, Ipsos MORI

José Huepe Pérez – Former Director General of Civil Aviation, Chile

Emilio Romano – President & CEO, Air Group Latin America (AGL)

Sir John Rose – CEO, Rolls Royce

Ashley Smout – CEO, Airways New Zealand

Doug Steenland – Former CEO, Northwest Airlines

Chris Tarry – Aviation Industry Research and Advisory, CTAIRA

Steven Udvar-Hazy – Chairman & CEO, Air Lease Corp

Girma Wake – Former CEO, Ethiopian Airlines

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Michael E. Porter – Harvard Business School

Brian Pearce – Chief Economist, IATA

Kevin Dobby – International Aviation Adviser



“ ... Lack of profitability  
is driven by poor industry  
structure, misguided  
government intervention and  
inconsistent strategy choices ”

# 1

# Section 1. Profitability

## Vision 2050 – Structuring for Profitability

Produced with the assistance of

Prof. Michael E. Porter, Bishop William Lawrence University Professor, Harvard Business School

Brian Pearce, IATA Chief Economist and Visiting Professor, Cranfield University

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Air transport markets and the airline industry have been transformed over the last 40 years. The number of passengers has risen tenfold and cargo volumes have grown fourteenfold, despite repeated shocks from recessions, terrorism and disease. Demand is volatile but consistently returns to a rapidly growing trend. Supply has also changed significantly. Having been a highly regulated industry during the first three post-war decades, market access was increasingly liberalized starting with US domestic markets in the late 1970s, followed by US 'Open Skies' policy on international markets from the early 1990s, and the European single aviation market in the mid-1990s. There have been many new entrant airlines in the past three decades, while exit has been limited. As a result, the number of commercial airlines, flying Western-built jets, has risen to over 1,000.

Consumers and the wider economy have reaped the benefits of a substantial increase in the choice of travel options by destinations, frequencies, and business models available at lower cost, higher safety, and a smaller environmental footprint per passenger mile traveled than ever before. Airline owners have, however, not even been able to recover their cost of capital. This paper aims to identify the root causes for this imbalance, and to suggest steps to address it. The goal is an industry that continues to grow the value provided to consumers while earning returns that sustain further productivity improvements.

Chapter 1 provides detail on how the substantial value being created by the airline industry has largely been captured by consumers and some suppliers. Chapter 2 then analyzes the economic forces that have driven these outcomes, applying the Five Forces framework as an analytical tool. Chapter 3 builds on this analysis to understand whether the current path is sustainable and, if not, how it can be adjusted.

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# Executive Summary

In the past 40 years the volume of air travel has expanded tenfold and air freight has grown by a factor of fourteen. The world's economies have grown three to four times over the same period. Air transport has been one of the world's fastest growing economic sectors.

Travel markets do mature, and many of the OECD markets have seen growth slow. But there is still huge untapped potential to provide air transport services connecting the growing megacities and populations of the BRICs. The centre of gravity of the industry is shifting eastward. In these regions demand for air transport is set to expand substantially over the coming decades.

In meeting this demand the industry has benefitted from airframe and engine technology improvements that have doubled fuel efficiency in the past 40 years. Airlines have also substantially raised asset utilization and delivered large productivity improvements for all their major inputs. The unit cost of air transport has more than halved over this period as a result.

Utilization and productivity gains were driven by changing business models and substantially increased competition, as liberalized market access became widespread over this period and many new airlines entered the industry. This has been a tremendous benefit to the consumer. Virtually all of the reduction in unit costs over this period has been passed on through a halving of the real cost to consumers of air travel and air cargo.

By contrast the shareholders of airlines over this period have seen no return to compensate them for their risk taking. Over the past 40 years the net post-tax profit of the airline industry worldwide has averaged a paltry 0.1% of revenues. There are a small number of airlines that do consistently generate a return on capital that exceeds its cost. They include airlines small and large, LCCs, full-service network and regional airlines, and can be found in all the major regions. There is no simple, obvious reason for their success compared with the persistent poor profits of the majority of the industry.

Suppliers and other industries in the air transport value chain do generate sufficient profits to pay investors a normal return, in some cases with returns on capital well into double figures. Airlines stand out in the value chain as earning the lowest returns and bearing virtually the highest risk. However, the most profitable sectors in the value chain are relatively small compared to the capital invested in the airlines.

There is today over \$500 billion of investors' capital tied up in the airline industry. In a 'normal' industry investors would earn at least the cost of capital, implying a return of \$40 billion a year. In fact, over the past decade investors have seen their capital earn \$20 billion a year less than it would have invested elsewhere. Even at the top of the last cycle over \$9 billion of investor value was destroyed.

Michael Porter applied his Five Forces framework to illuminate the reasons why airline profitability is so poor; through the forces of rivalry, new entrants, customer and supplier bargaining power, and the threat of substitutes. There are few industries where all five forces act so strongly to depress profitability as they do in the airline industry.

Rivalry is intense, driven by a perishable product, difficulty in sustaining product differentiation, high fixed and low marginal costs, high exit barriers, capacity that can only be increased stepwise, and volatile markets.

The threat of new entrants is also high. Over 1,300 new airlines were established in the past 40 years. Barriers to entry are low as market access is increasingly liberalized, economies of scale in operations are limited, access to distribution channels is easy and consumer switching costs are low.

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Moreover, the bargaining power of customers is high and rising. Channels have become significantly more concentrated, travel agents more aggressive in pursuing the interests of end corporate customers, a significant share of end customers is highly price sensitive and for whom the impact of loyalty programs is limited.

The bargaining power for suppliers of several critical airline inputs is high. As a group suppliers earn higher returns than their cost of capital, and returns are significantly higher than for airlines. Manufacturing is a highly concentrated oligopoly, labor unions have been powerful in a number of airlines, many airports and ground handling companies are local monopolies.

The most powerful substitute to air travel is the decision not to travel, particularly for leisure travel. The threat of other substitutes has also started to become more significant in some segments, with high-speed trains, private jets and the improvement in video conferencing technology.

The Five Forces analysis reveals the deep underlying challenges facing airline profitability. Some other industry share similar product, industry and market features but nonetheless generate returns for their shareholders. The reason why the airline industry differs lies in government policies, strategic choices by airlines and the behaviour of suppliers.

The nature of government intervention is a key reason for poor airline profitability. Restrictions on cross-border investments, the nature of bankruptcy procedures, and subsidies for failing airlines are some of the key barriers that keep the industry from adopting a more effective structure.

A number of airline strategy choices appear individually rational but in aggregate contribute to a market environment that is worse for everyone. Competition is too often on size and network breadth, rather than on differentiation. Supplier behaviour creates further challenges.

Does poor airline profitability matter? Regulators will only care if there are societal costs. When airlines are forced into bankruptcy, there clearly are major costs. Fragmentation is also costly. The benefits of greater consolidation in terms of reduced congestion, emissions and efficiency have been substantial.

There are a number of lessons. Artificial barriers to exit and consolidation need to be removed. Artificial incentives for entry and capacity expansion also need to be addressed. Airlines need to change (but not reduce) the way they compete. Unnecessary system costs must be reduced through policy change and better coordination.

Moving to action requires the airline industry to invest in coherently documenting the benefits it provides in the global economy. For change to happen industry efforts must be framed as a campaign to reduce the societal costs of poor industry structure. All recommendations need to be supported by documenting the benefits for each stakeholder asked to act. The action agenda should build on the positive trends already under way, and needs to be communicated by the airline industry through one voice. To build momentum, initial focus should be on steps that can be taken by IATA, individual companies or more enlightened countries.

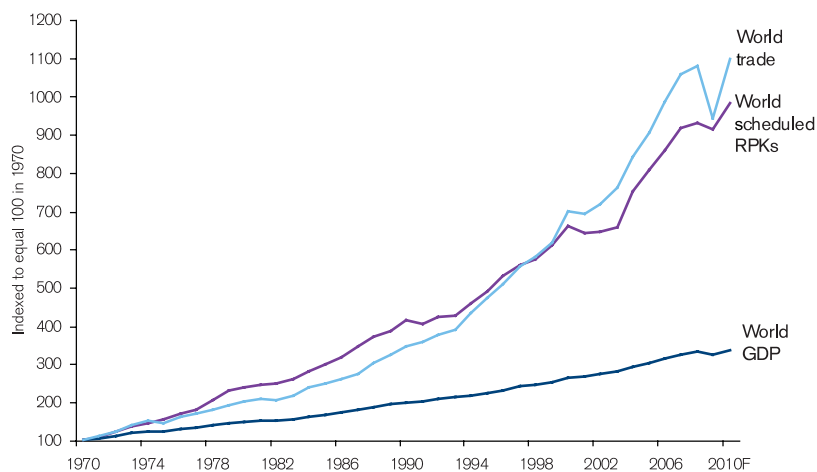
## 1.1 Industry value creation

This chapter describes how airlines add value to the inputs used in supplying air transport services, and how virtually all of that value is captured by consumers and the wider economy. We first look at the rapid expansion of air transport volumes and how income growth in the BRIC economies, together with increasing connectivity between major cities, will keep this a high-growth industry in coming decades. Next we examine the structure of costs and how substantial efficiency gains have been passed fully through to consumers in lower real transport prices. We also look at various facets of service quality. Finally we examine profitability. The few airlines that have created shareholder value are identified. We then report on a detailed assessment of the return on invested capital along the airline supply chain and, in particular, the persistent economic losses by the airline industry as a whole.

### 1.1.1 The value provided by the airline industry

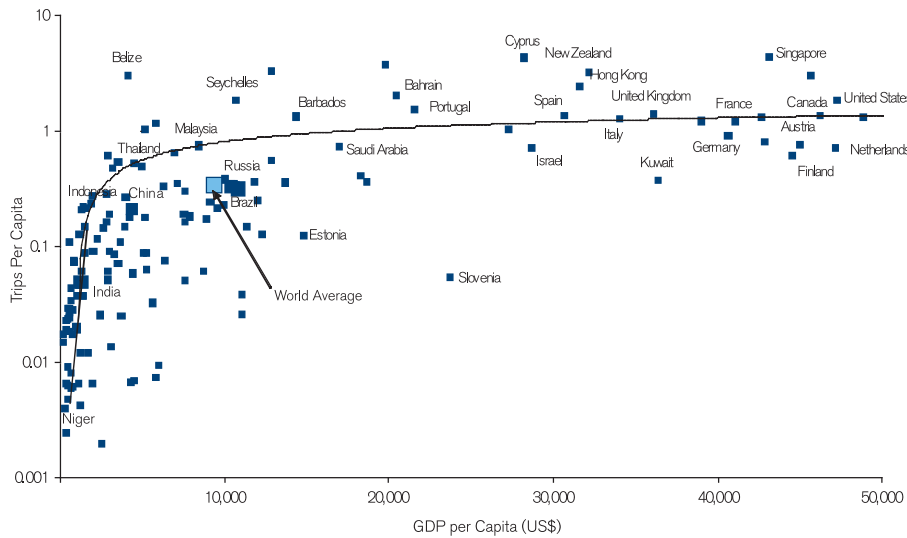
#### 1.1.1.1 The size of the industry

In the past 40 years the volume of air travel, as measured by worldwide scheduled RPKs (revenue passenger kilometers), has expanded tenfold. This is an expansion three times greater than the growth of the world's economies, which partly reflects the high income elasticity of air travel. It also reflects, and has facilitated, globalization. Air travel has risen broadly in line with world trade during the past 40 years. It has been one of the fastest growing economic sectors.



**Chart 1: Air travel has expanded tenfold in the past 40 years**  
Source: ICAO, IATA, Haver

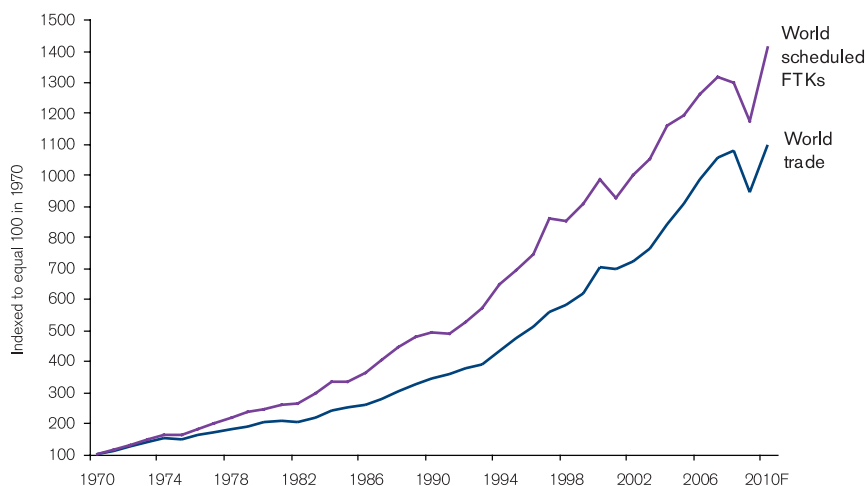
Air travel initially grew faster than world trade. As OECD markets matured in the 1990s and 2000s, average income elasticity declined and air travel grew more slowly than world trade.



**Chart 2: Travel markets at very different stages of development**

Source: IATA PaxIS, IMF

Travel markets do mature. The evidence suggests that once real GDP per capita reached \$15,000-\$20,000 the number of trips by air per head of population levels out. Today's large markets in the US and Europe are approaching saturation. However, the BRIC economies have very underdeveloped travel markets and are likely to be a very large source of new travel demand in the decades ahead.

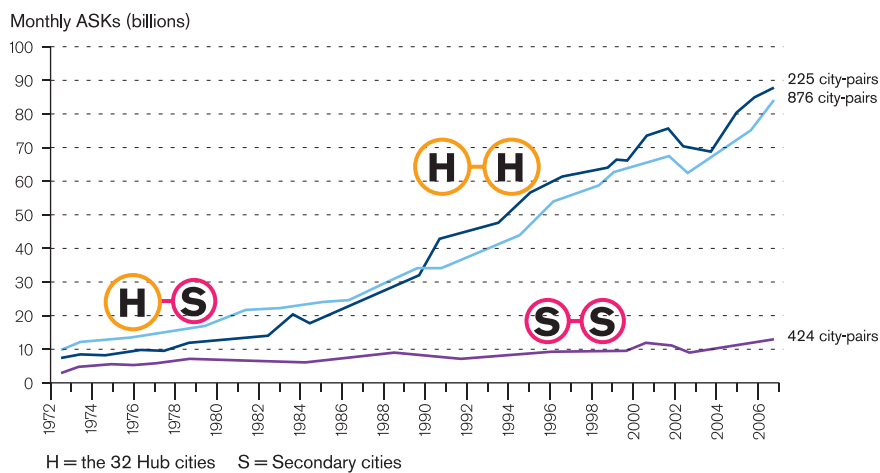


**Chart 3: Air freight has a higher share of world trade today**

Source: ICAO, IATA, Haver

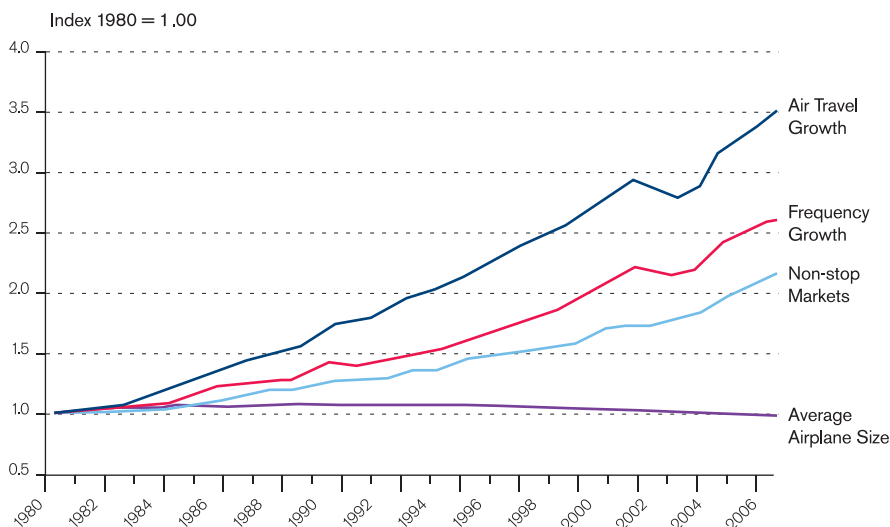
Air freight (freight tonne kilometers, FTKs) also saw initial growth at a faster pace than overall trade in goods, reflecting the globalization of business supply chains and increasing international trade. Fast, though costly, air freight is a key enabler of just-in-time inventory management. In the past decade air freight has moved in line or more slowly than overall world trade. Air transport is both driven by and enables globalization.

Urbanization is also key to the development of the industry. The air transport network is all about linking cities and urban agglomerations. The 26 ‘megacities’ of the world, with populations in excess of 10 million, account for more than 20% of air travel worldwide. There are 62 urban agglomerations with populations of 5 million or more, which generate 40% of air travel worldwide. As chart 4 shows most growth in capacity over the past 40 years has taken place on city-pairs with a major hub city (the 26 megacities plus the next 6 largest urban agglomerations) at one or both ends. Growth in services between smaller cities has been much slower. This industry-wide picture conceals the current concentration of air services between megacities in the OECD economies. The 15 megacities in Asia and the 6 in Latin America are relatively underserved and promise further substantial network development in the coming decades.



**Chart 4: Majority of network growth has been between large hub cities**  
Source: Airbus, OAG

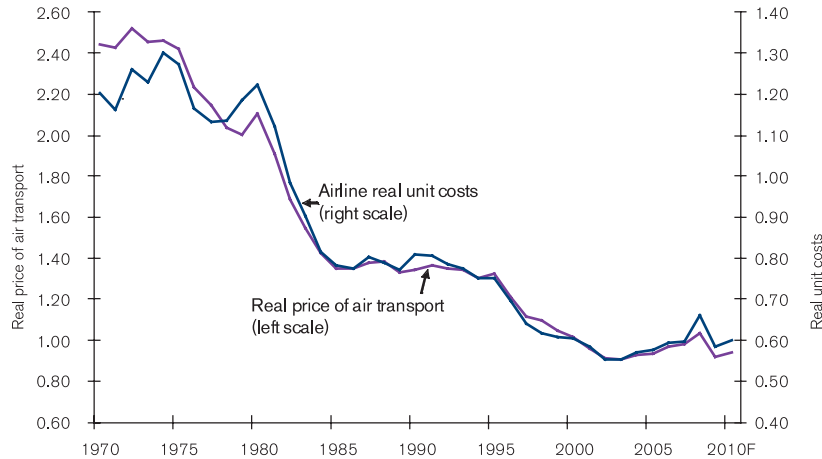
Consumers have benefited over the past 30 years from a 2.5 times rise in the number of weekly frequencies, a service quality feature particularly valued by time-sensitive business travelers, and also a doubling of non-stop city-pair origin-destinations.



**Chart 5: Network development has connected more city-pairs and added frequencies**  
Source: Boeing, OAG

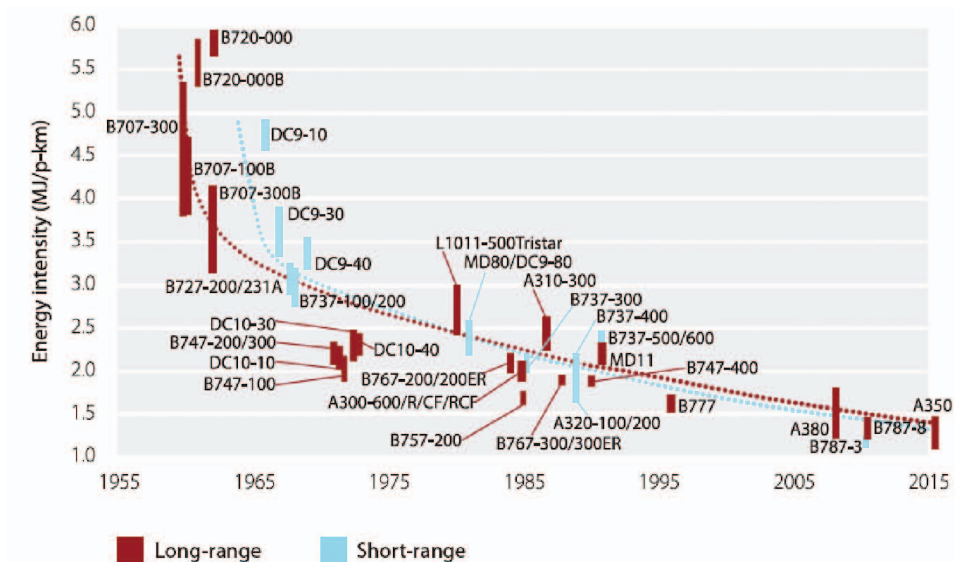
### 1.1.1.2 Costs and prices

Over the past 40 years the real cost of providing air transport services has fallen by more than 60%. The inflation-adjusted price for consumers has fallen by a similar extent.



**Chart 6: The real cost of air transport has more than halved**  
Source: ICAO, IATA

The sharp decline in travel costs is driven by increasing efficiency of new aircraft, higher utilization of airplanes, and better operational performance of airlines.



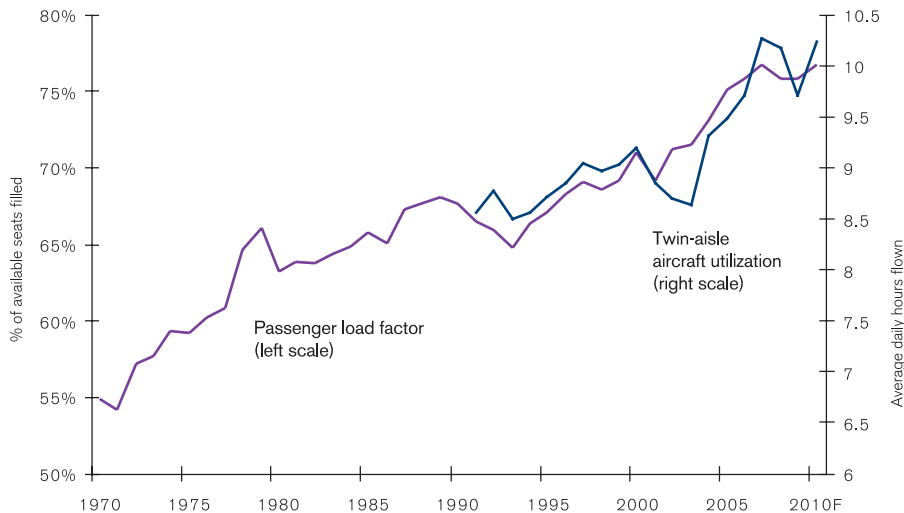
**Chart 7: Fuel efficiency of new aircraft has dramatically improved**  
Source: Lee

That pattern of real travel cost and real unit operating cost decline reflects the fuel and cost efficiency of new aircraft models introduced over the past 40 years. Aircraft have economic lives of 20-30 years, so new, more efficient models take time to impact fleet efficiency. Nonetheless, the scale of fuel-efficiency improvement in the past 40 years is very similar to the fall in unit costs and the decline in the real cost of air transport.



All of the cost improvements brought about by improved technology were passed through to consumers in lower fares and cargo rates, as shown in chart 6.

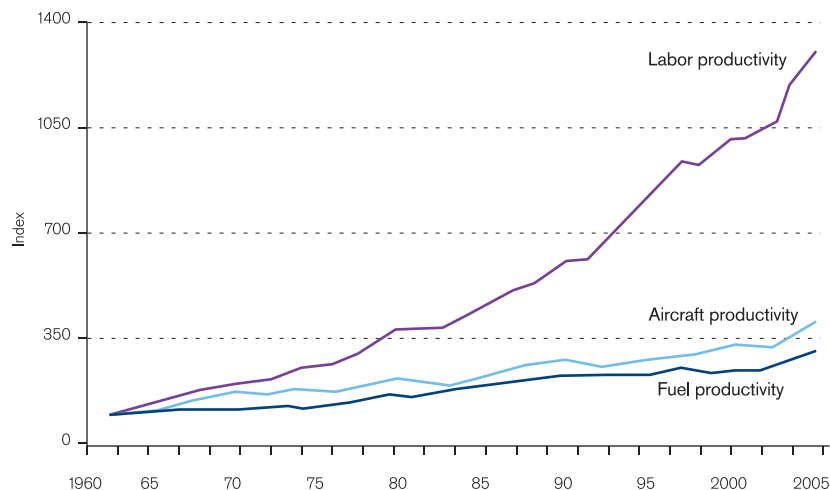
Airline operational performance has improved markedly over the past four decades. Passenger load factors have improved by 20 percentage points, better utilizing available seats in the air. Aircraft utilization has also sharply improved, with lengthening sectors and faster turnaround times leading to an increase in daily hours in the air for the average aircraft. Overall asset utilization by airlines has improved significantly.



**Chart 8: Aircraft asset utilization has improved significantly**

Source: ICAO, ACAS

The productivity of other key inputs has also improved, in terms of the Average Seat or Tonne Kilometer produced by each unit of input. The three major costs for airlines are fuel, labor and aircraft. Fuel efficiency was described in chart 7. Labor productivity has also been improved many fold. Flight crew numbers are strictly regulated. Efficiencies have been achieved in ground staffing. The extent of the rise in labor productivity in chart 9 is however overstated by the outsourcing over time of services such as maintenance and many back office functions.

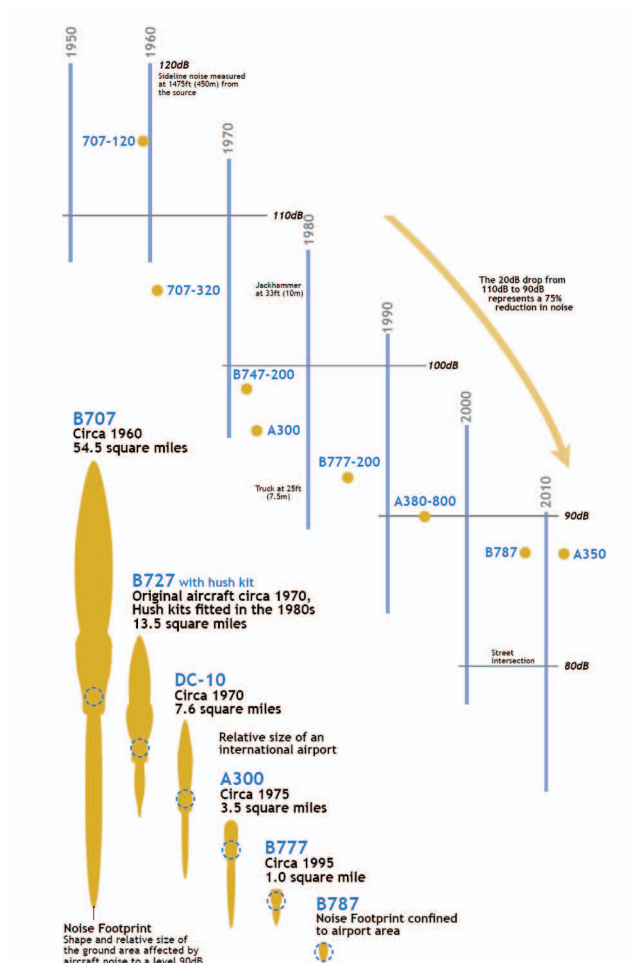


**Chart 9: Labor productivity has also risen sharply**

Source: ICAO, BACK, IMF, OECD

These productivity gains have been driven by changing business models in the industry, in addition to the technology changes shown in chart 7. Liberalization in the 1980s and 1990s led to new entry and stimulated considerable innovation, in particular on short-haul markets for price-oriented consumers, with the no-frills, low-fare, new-entrant airlines. Incumbent airlines responded with further efficiency improvements but, except for within the EU, deregulation has not extended to ownership and control, which has prevented the cross-border restructuring that would be expected in these economic conditions. Where consolidation has taken place, economies of scale in operations have proved elusive beyond a certain fleet size. But scale on the marketing side has clearly been important with scope economies from aggregating passenger flows and economies from route density allowing larger aircraft to be deployed on city-pairs, lowering unit costs.

The LCC or no-frills point-to-point model works well on short- to medium-haul high-density city-pairs, but many city-pair markets do not have sufficient origin-destination traffic. Hubbing was designed in the 1980s to aggregate flows in order to produce sufficient route density to justify larger and lower unit cost aircraft. Code sharing, the development of alliances and joint ventures are all different ways developed, in the past several decades, to organize the airline 'factory' to generate route density, and lower unit costs. These developments have been critical, together with the technological advances shown in chart 7, in lowering the real cost of providing air transport services.



**Chart 10: Aircraft noise has been reduced over time**

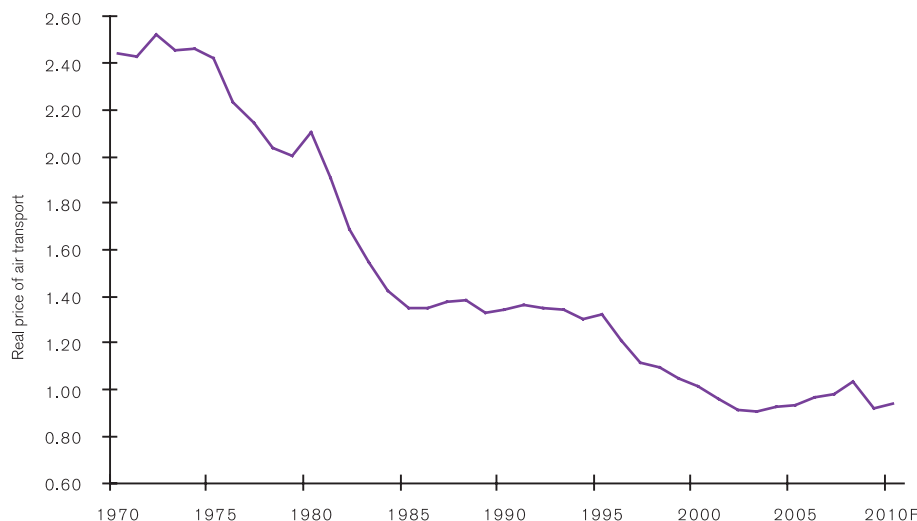
Source: NASA, Airbus

There are also external costs created by air transport services, in particular environmental costs from noise, local air pollution and greenhouse gases. These will not directly impact airline profitability but will have indirect effects through government regulation. Airlines, airframe and engine manufacturers have made substantial reductions in the economic cost of aircraft noise in recent decades. In spite of a many-fold rise in the number of aircraft movements there has been a reduction in the number of people exposed to noise levels that impose economic costs. This has allowed the expansion of services at some densely populated city hubs that otherwise would have been constrained.

Greenhouse gas emissions have also been dramatically reduced over time for the average flight or passenger departure. Chart 7 shows there has been a halving over the past 40 years in the fuel it takes to fly a passenger one kilometer. Air travel is much more fuel efficient, and each person flying today contributes much less to climate change than a passenger flying 40 years ago. The issue is that there are many more people flying today and so the absolute level of CO<sub>2</sub> emissions is still rising and adding to the industry's climate impacts.

In jurisdictions such as Europe this external cost is becoming a commercial cost for airlines in 2012, with the extension of the EU Emissions Trading Scheme to cover all air travel to and from EU airports. This will add a new commercial cost to air transport for about one-third of the industry.

The price to consumers of air transport services reflects its operating costs, as chart 6 shows so clearly. Consumers have experienced a large boost to their economic benefits from the halving of the real price of air transport, as shown in chart 11. The size of customer benefit has also been boosted by increasing choice (the 2.5 times rise in frequencies and 2 times rise in the number of non-stop destinations shown in chart 5).



**Chart 11: The real price of air transport**

Source: ICAO, IATA

The benefits air transport brings to an economy, over and above the benefits to users, are often expressed in terms of the gross value added produced by the industry (its contribution to a country's gross domestic product) or the jobs supported through the value chain. However, this is not the best way of understanding the economic value of air transport to an economy.

The resources required in order to produce air transport services can always be employed by other industries, in economies close to full employment. More important than the resources required for the supply of air transport services is the infrastructure asset created by air transport connections between major cities and markets. This network asset provides connectivity, both internationally and within an economy, and has facilitated the modern, globalized, business sector. Businesses cluster around major hub airport cities, specialization has been enabled, economies of scale and the flow of capital and ideas have been facilitated as well as the flow of people and goods.

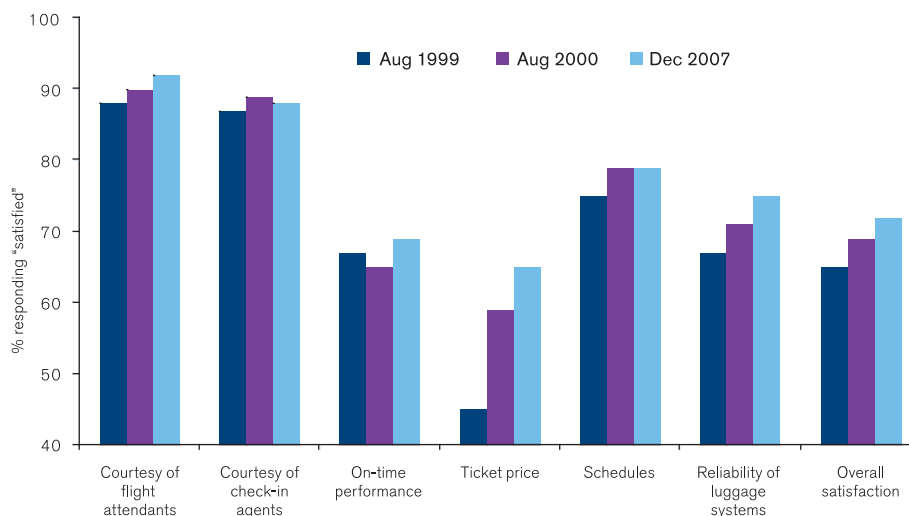
These wider or 'external' economic benefits are not easy to measure. But they become obvious when air transport is not possible, as Europe found when volcanic ash from Iceland led to the prolonged closure of its airspace. Just-in-time manufacturing was disrupted, transactions requiring face-to-face meetings were postponed or abandoned, travel times for holidaymakers were substantially increased.

Governments recognize these benefits to varying degrees. In most economies with liberalized markets external benefits do not generate any regular revenues for airlines. Though arguably in times of crisis governments step in to support national airlines in recognition of these wider economic benefits. Some government-owned airlines in less-developed markets are subsidized, with the intention of developing an economy's connectivity to boost foreign direct investment, trade and tourism.

The principal economic benefit driving demand and influencing airline profitability is clearly the benefit to consumers. However, there are indirect influences on airline profitability arising from the response of governments in many economies to the wider economic benefits produced by air transport connectivity. These responses are not always to the benefit of industry-wide profitability.

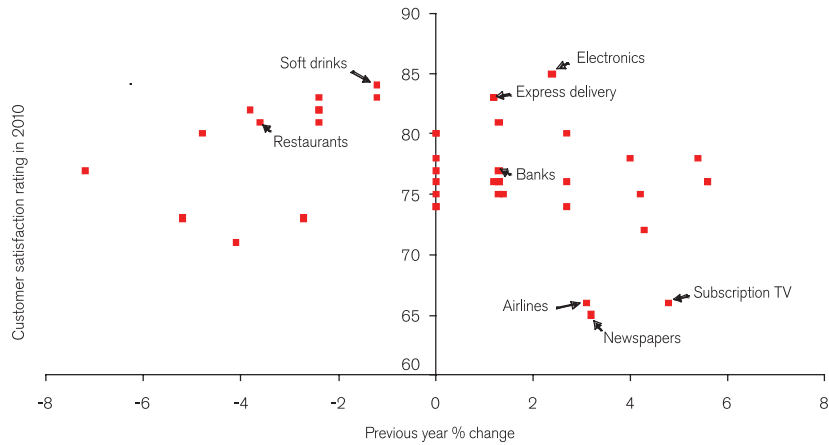
### 1.1.1.3 Quality

Increasing consumer benefit from lower ticket prices is reflected in the regular surveys of US air passengers by Gallup, shown in chart 12. Passenger satisfaction with other facets of the air transport service appears to have either improved or remained stable during the last decade. In fact overall passenger satisfaction increased moderately over this period.



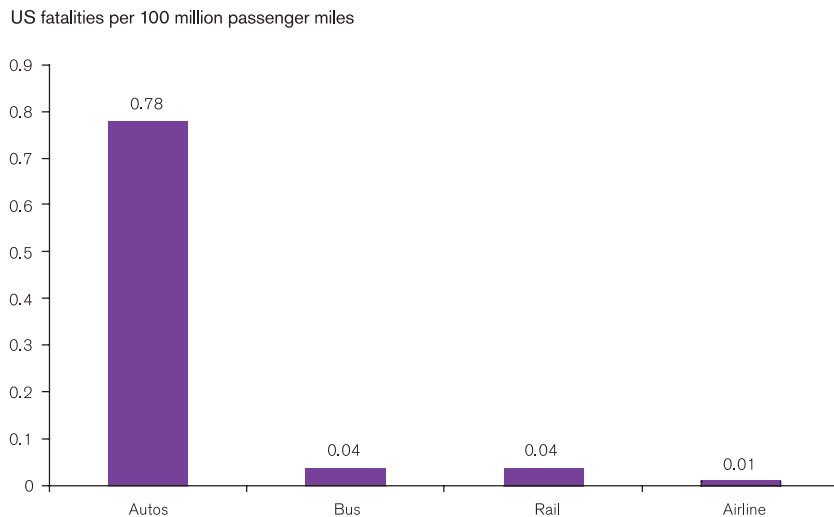
**Chart 12: Passenger satisfaction with different facets of the service**  
Source: Gallup surveys

While customer satisfaction with airline service may have improved in the past decade it nevertheless rates badly compared with other industries, at least in mature markets like the US. US consumers rated airlines as one of the three lowest rated industries in 2010, along with newspapers and subscription TV services. Studies show that demand for air transport in the US now rises less than proportionately with GDP. Air travel is now commoditized for US consumers. But this is the situation in the most mature aviation market in the world and income elasticity evidence shows that consumers rate air travel services much more highly in the so-called emerging economies.



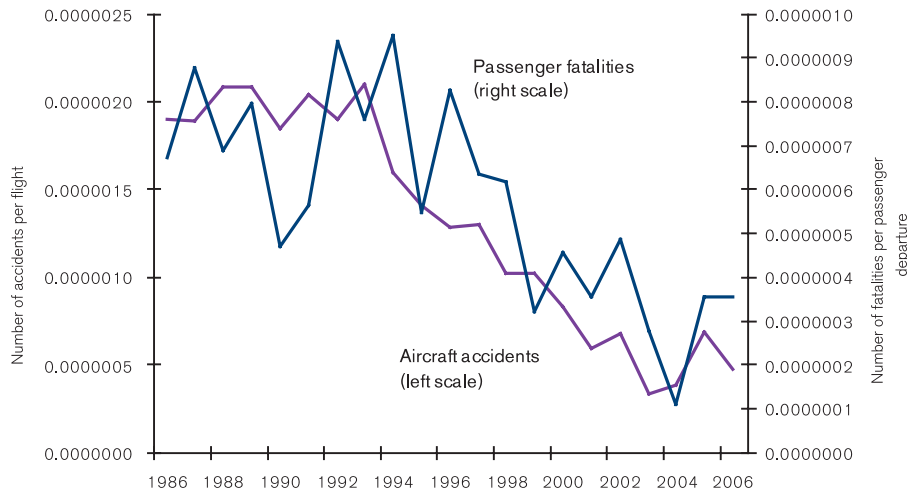
**Chart 13: Customer satisfaction with airlines compared to other industries**  
 Source: University of Michigan

Safety does not seem to be an issue in the low (US) customer satisfaction rating of air travel. As chart 14 shows, air travel is one of the safest modes of travel.



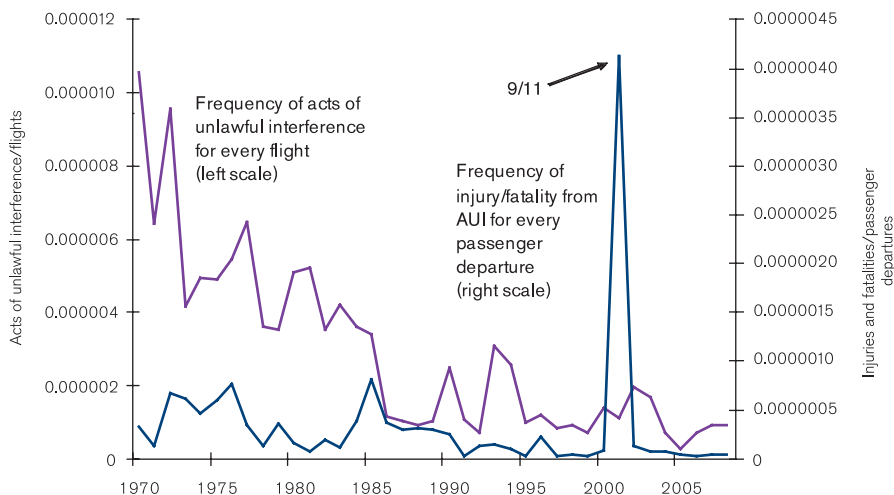
**Chart 14: Safety of different transport modes**  
 Source: US National Safety Council Injury Facts 1997-2006

Moreover, as shown in chart 15, air travel is becoming increasingly safe with a worldwide average risk of being involved in a fatal accident of only around 0.0000003 for every flight taken.



**Chart 15: Increasing safety**  
Source: ICAO

Following the terrorist attacks of 11 September 2001, security is another significant facet of the air transport service. The impact of 9/11 may well have an enduring adverse impact on passenger perceptions of air travel security. However, the data suggests that security has steadily improved over the past 40 years to a point where the risk of being in a flight subject to an 'act of unlawful interference' is less than 0.000001.



**Chart 16: Security incidents**  
Source: ICAO, IATA

All of these facets of the air transport service (price, choice of frequency and destination, in-flight service, safety, security) influence the benefit consumers derive from the service. It is consumer benefits from air transport services that drive demand in the market place. Consumer surplus today is estimated to be in the region of \$200-300 billion each year.

### 1.1.1.4 Summary

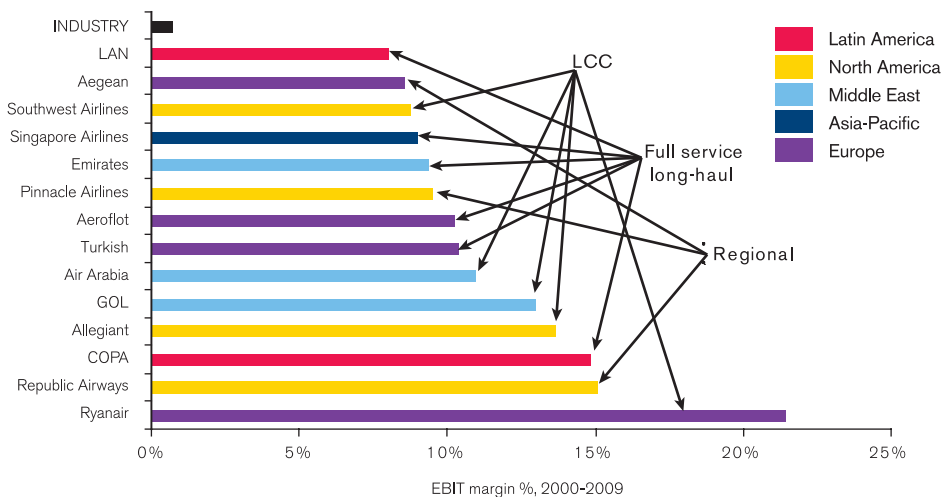
Over the past four decades there has been tremendous growth in air transport services, with a 10 times expansion in travel volumes and a 14 times expansion in freight, compared with the 3-4 times growth of the world economy. Airlines have delivered this expansion in service together with a halving of operating costs, as technology improved and efficiencies were achieved in operations. During this period all of these cost efficiencies were passed on to consumers in lower real air transport prices. Although consumers in the mature US market now view air travel as a lowly-rated commodity service many aspects of the quality of the air service product have improved in recent decades. Clearly consumers have been the major beneficiaries of the value created by air transport. The next section looks at where else the value or economic profits have been distributed among airlines and along the airline supply chain.

## 1.1.2 Airline profitability

### 1.1.2.1 Airlines that have created shareholder value

Consistently low airline industry profits over the past 40 years aggregate a wide variety of performances. There have been a small number of airlines that have performed far better than the average. During the 2000s the average airline generated an EBIT margin of just 0.7%. Excluding small airlines, there were less than 15 that managed to produce an average EBIT margin in excess of 8%.

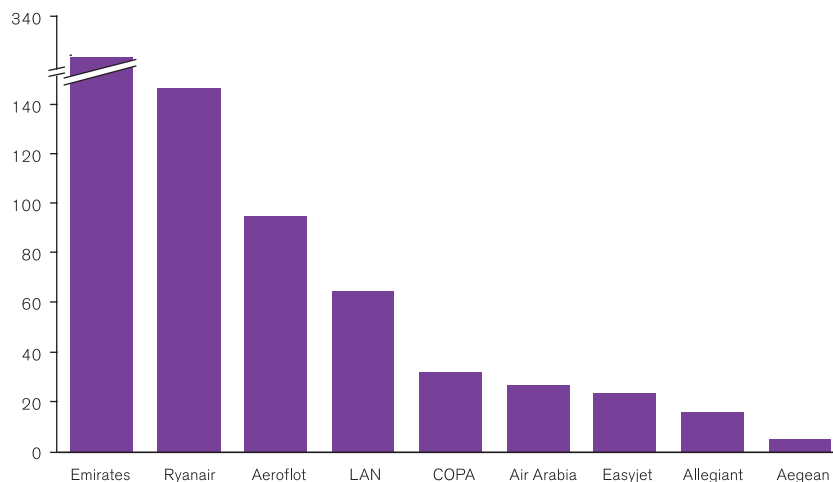
As chart 17 shows there are no easy size, business model or geographical pointers as to why they were profitable. These profitable airlines represented a number of different business models, small and large, and several profitable airlines can be found in most major regions of the world.



**Chart 17: Airlines generating average EBIT margins of 8% or more during the 2000s**

Source: Bloomberg

The weighted average cost of capital for the average airlines in normal times is 7%-8%. For the typical airline it takes a dollar of invested capital to generate a dollar of revenue each year. So to generate a return on capital equal to its cost – really the minimum investors will expect – airlines need to generate earnings as a percentage of revenues i.e. an EBIT margin of 8% or more. However, EBIT needs to be adjusted for accounting distortions such as operating leases and some hedging instruments. As a result some of the airlines in chart 18 with EBIT margins of 8% or more do not make it into the list of those airlines creating economic profits. And a few that have lower EBIT margins are creating economic profits. Economic profit measures the excess of returns over cost of capital. It indicates airlines that justify – from a private investor's point of view – the capital invested in them.



**Chart 18: Airlines creating economic profits during the 2000s**

Source: McKinsey & Company for IATA

An assessment of those airlines that do consistently generate economic profits suggests that there are no easy lessons to transform the poor historical performance of the industry. Many of these airlines occupy geographical or market niches, or benefit from strategic assets that are hard to replicate. Others have established brands and reputations that would require substantial time and investment to challenge. We look at the key features of some of these value-creating airlines and two airlines that have in the past created substantial shareholder value, Southwest and Singapore Airlines:

- **Emirates** does not have the highest pre-tax margins but it has generated the largest amount of economic profit in the industry during the past decade. In part this is due to the favourable corporation tax regime, but even at a 30% corporate tax rate Emirates would have generated over \$50 million of economic profit a year. Fuel prices are lower in this region. The airline also benefits from the deep pockets of its owners, as its rapidly expanding fleet of new aircraft has lowered unit costs. Perhaps most importantly the airline's hub is geographically located in a good position, with 4.5 billion people living within an eight-hour flight. With substantial investment having also taken place in airport facilities Emirates has a strong position in a number of long-haul markets, transferring passengers through its Dubai hub.
- **Ryanair** has the highest margins and generates the second largest amount of economic profit in the industry. It is the lowest cost airline in pan-European markets and clearly has a strong focus on cost leadership. But there are some special factors. One source of low cost was due to its timely acquisition of aircraft from Boeing in the aftermath of 9/11. Low purchase prices allowed Ryanair to sell



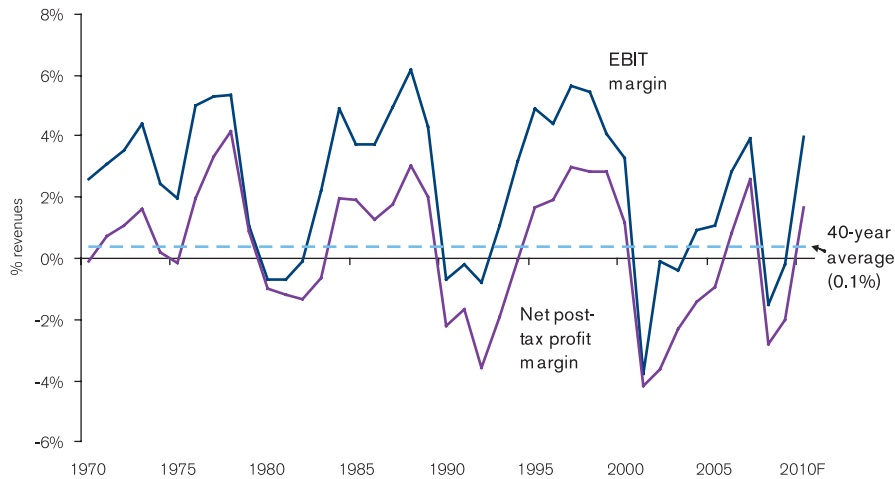
the aircraft close to book value before their costly 'D' service, keeping its fleet young, fuel efficient, low in ownership and maintenance cost. This advantage is now ending. Ryanair also benefits from low airport costs, due to deals and subsidies from the tertiary airports it connects. Market position is also important. Ryanair is focused on the bottom end of the demand curve, where there is an important kink in the demand curve for price-oriented leisure and VFR passengers, which means Ryanair is able to defend its position. Competitors offering higher fares than Ryanair find price-sensitive demand falls off rapidly. Competitors trying to undercut fares find little benefit in increased demand as their price changes will be matched by the lowest cost airline in the market.

- **Aeroflot**, a full-service international network airline, generates the third largest economic profit in the industry. Its competitive advantages are less transparent. The airline appears to benefit from strategic assets (slots, route rights) giving a strong position to serve large and fast-growing markets connecting Russian Federation to international markets. In addition the airline benefits from airspace access revenues. If the latter are removed from Aeroflot's economic profits the airline moves down the ranking.
- **COPA's** model, based on over 50% of its passengers connecting through its hub, also benefits from strategic assets. Its geographical position under S-N flows and an airport with 25-30 gates available for hubbing at peak hours is hard to replicate. Panama has attracted the regional headquarters of many multinational companies, strengthening O-D traffic. Route rights are also important, with the airline being dominant on more than half its city-pair markets.
- **LAN** is another economic profit generator in South America. Another full-service network airline, but based on its hybrid cargo/premium passenger model. The airline has a strong brand for premium travel in the region. In addition it has been able to overcome the restrictions of bilateral regulations to create a multi-hub network with operations based in several countries, helping to reduce the bargaining power of labor as well as improving the reach of its network for business passengers and cargo.
- **Allegiant Air** is a relatively small LCC in the US but has consistently created shareholder value. Its model is based around connecting secondary cities with holiday resort destinations using an old, but fully depreciated, fleet of MD80s.
- **Southwest Airlines** – a strong LCC value creator in the 1980s and 1990s – is seen to have destroyed shareholder value during the 2000s, once the impact of very well timed fuel hedging is removed from its EBIT. Expansion into less-dense city-pairs has diluted Southwest's competitive advantage, and its average pay has now become the highest in the industry.
- **Singapore Airlines** produces a higher EBIT margin than LAN but, by contrast, has not been generating economic profits in the 2000s. This recent lack of economic profit disguises a successful network airline business model, reflected in the 40% of its passenger revenues that come from premium ticket sales. Success in the business travel market is driven by brand and reputation, for safety, reliability but most importantly for the quality of the product and its network. These capabilities have proved hard to replicate. Product quality and competitive costs in this market segment is partly driven by its decision to base its fleet around the successful B777.

These were the consistently successful airlines for their shareholders in the past decade. Yet the median airline has not created financial value for their shareholders over the past 40 years. Shareholder value has been consistently destroyed.

## 1.1.2.2 Industry level profitability

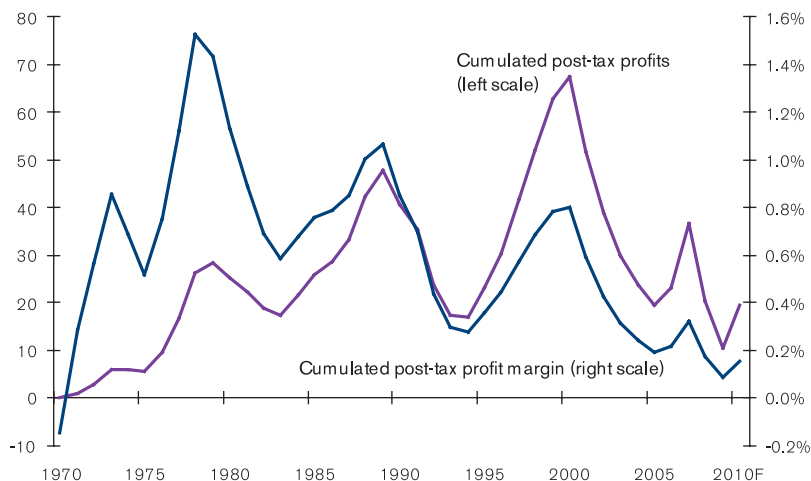
In providing the air transport services described above the worldwide airline industry has generated an average annual post-tax profit, net of debt servicing costs, of just 0.1% of revenues over the past 40 years. In other words the airline industry has been able to pay its bills, renew its fleet, and service its debts. But there has been almost nothing left to pay its owners or shareholders for their risk-taking.



**Chart 19: Airline profitability over the past 40 years**

Source: ICAO, IATA

During the 40 years to 2010 the airline industry generated over \$12,000 billion of revenue, in today's prices, but only a total of \$19 billion of net post-tax profits; a margin of only 0.1%. The trend has also been downward in annual and cumulated margins following US deregulation in the late 70s.



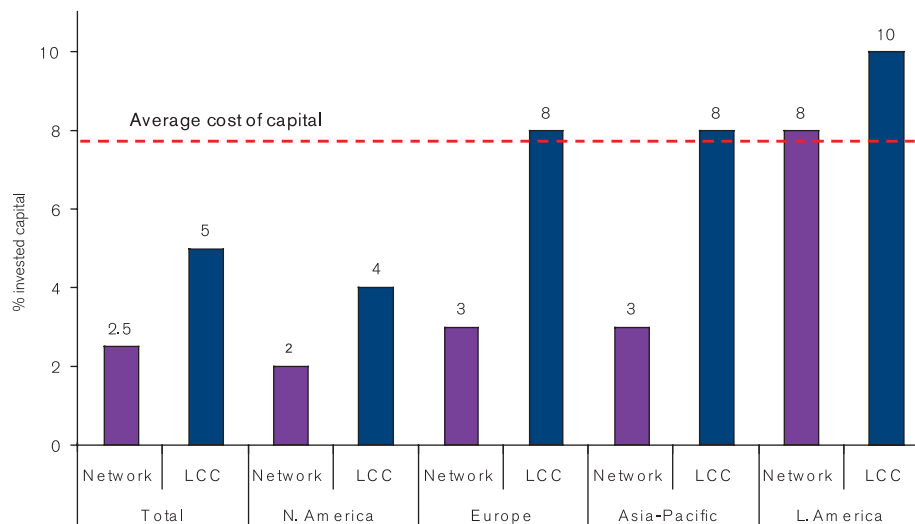
**Chart 20: Profits cumulate to very little over 40 years**

Source: ICAO, IATA

There is today \$500 billion of investors' capital tied up in the airline industry. In a 'normal' industry those investors would expect to earn at least the industry's average cost of equity and debt capital, which is essentially the next best return that capital could earn elsewhere. For the airline industry this cost averages 7%-8%. That implies that the airline industry should generate a minimum of \$40 billion in annual returns to keep that capital invested in the industry.

In fact investors in airlines during the past decade have seen their capital earn over \$20 billion a year less than it would have earned elsewhere. Even at the top of the cycle in 2007 over \$9 billion of investor value was destroyed.

Airlines in all regions and of all business models, with some exceptions, fail to generate a return on invested capital equal to their weighted average cost of capital. Returns are sufficient to pay the bills, renew aircraft fleets and service debt. Owners and shareholders see their capital eroded, consistently.

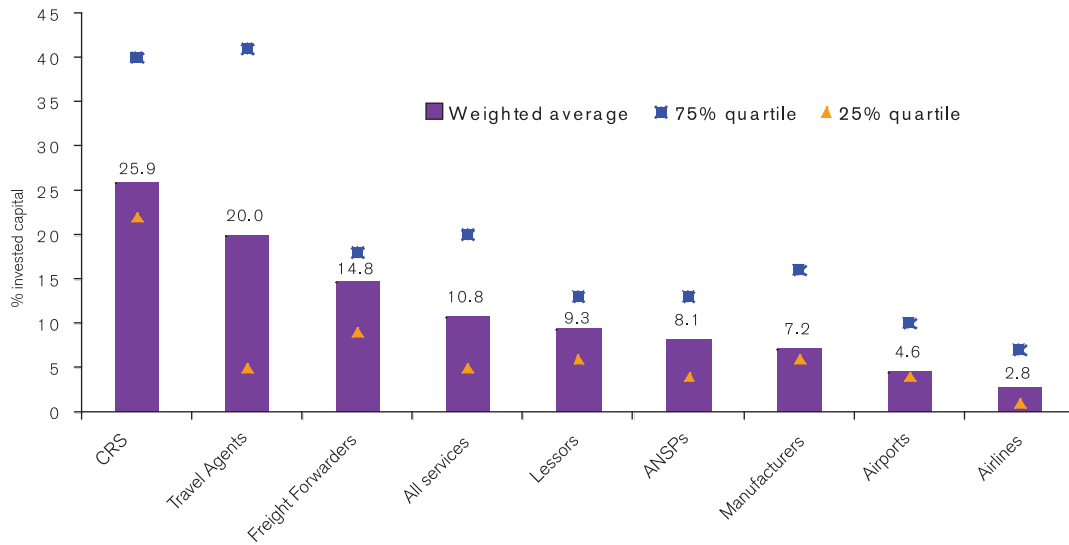


**Chart 21: Airline ROIC below WACC for most regions/business models**

Source: McKinsey & Company for IATA

### 1.1.2.3 Value creation in the wider airline industry value chain

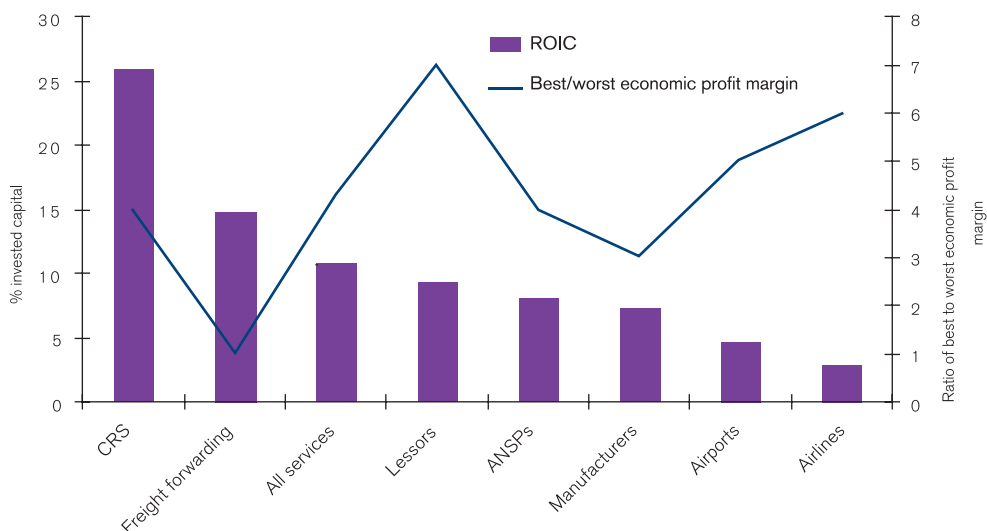
Returns differ markedly along the supply chain. Four sectors generate double-figure returns, delivering excess returns to their shareholders. Two others make their cost of capital. Airports and the manufacturing sectors just failed to generate returns equal to their cost of capital during the 2002-2009 cycle. Airlines get the lowest returns in the whole supply chain.



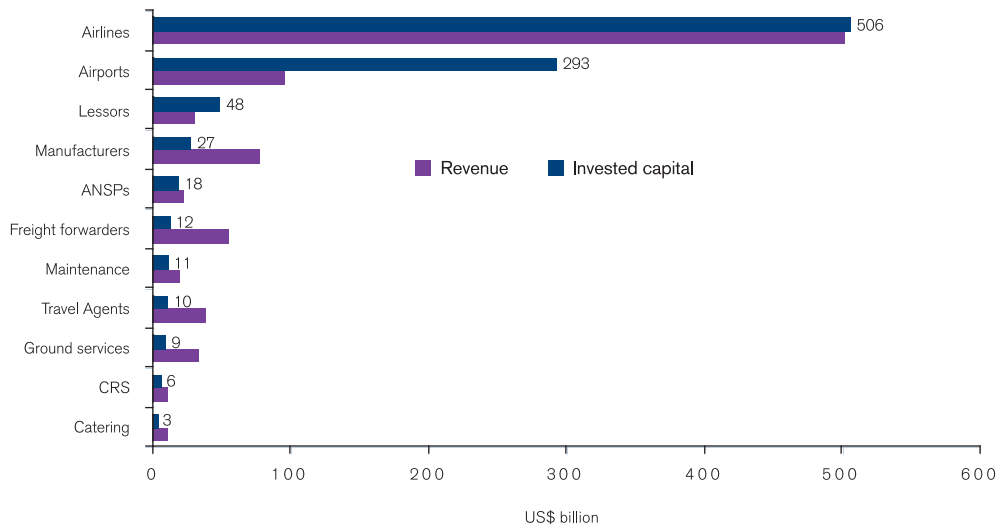
**Chart 22: Excess returns are earned in parts of the supply chain**  
 Source: McKinsey & Company for IATA

The relatively low ROIC for the airport sector is the result of the US and Japanese airports, which are run by governments to deliver a low investment return. In Europe and non-Japan-Asia airports do generate excess returns, at least over part of the cycle.

High returns in parts of the supply chain do not appear to be justified by high risk. In fact the sector with the second most volatile earnings, airlines, has the lowest return. These high-return sectors are mostly highly concentrated, so the excess returns may well be due to a lack of competition rather than any distinctive capabilities.



**Chart 23: Returns do not seem to be related to risk**  
 Source: McKinsey & Company for IATA

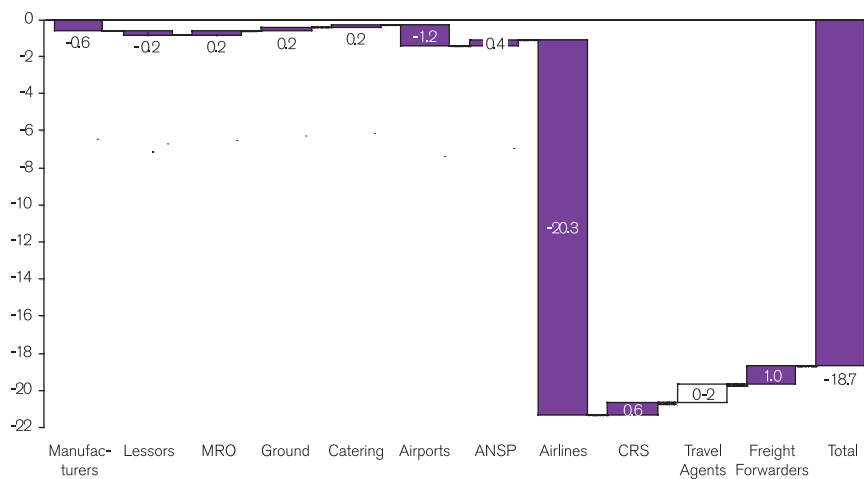


**Chart 24: Majority of capital invested in airlines and airports**

Source: McKinsey & Company for IATA

However, there is little invested capital in the high-return sectors of the supply chain.

As a result subpar returns in the airlines sector, where most capital is invested, dominate the whole supply chain. On average through the 2002-2009 business cycle the industry as a whole destroyed \$19 billion of shareholder capital each year.



**Chart 25: Shareholder value is consistently destroyed**

Source: McKinsey & Company for IATA

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## 1.2 Understanding airline profitability: what drives the industry's poor financial returns?

The previous chapter has provided ample evidence of the challenging and, in many ways, perplexing situation the global airlines industry finds itself in. The industry has grown rapidly over the last few decades, adding new customers, new connections, and additional frequency. Deregulation has opened markets first in the US (1970s), later in Europe (1980s), and then to some degree also in other regions. Costs have fallen significantly, driven by better technology and more sophisticated operational management. Much value has been created, especially for consumers and the broader economy but also for employees and some suppliers.

Despite this, most airlines have failed to earn their cost of capital over airline business cycles of 8-10 years. This has not been for the lack of trying: airlines have streamlined operational cost (often through the outsourcing of activities like maintenance and ground handling), cut services considered non-core, introduced much more sophisticated yield management, dramatically increased aircraft utilization rates, added additional revenue streams (charging for previously included services; selling additional products and services to passengers), introduced wide-ranging customer loyalty programs, and established alliances with global reach. Still, margins across the industry are abysmal compared to other industries.

This chapter is devoted to understanding the causes of this disappointing profitability performance. The framework for this analysis is the Five Forces model, first introduced by Michael Porter in 1979. The Five Forces framework is a robust approach to understanding profitability in any industry and guiding strategic choices. It expands industry analysis beyond direct rivals to encompass the role of suppliers, customers, potential entrants, and substitutes. This approach is extremely relevant to the airline industry, where much value is being created but which ends up almost exclusively with customers and some suppliers rather than with the airlines themselves.

This chapter is organized in four parts:

- *Identifying the relevant industry participants and stakeholders*; identifies the key suppliers, customers, substitutes, potential entrants, and industry rivals
- *Defining the relevant level industry boundaries*; identifies the appropriate industry scope, both geographical (e.g., domestic vs. global) and airline (e.g., low cost vs. full-service carriers) segments
- *Determinants of industry profitability*; analyzes the industry to understand the underlying causes of low profitability
- *Implications*; identifies important implications of the analysis for the purpose of developing recommendations

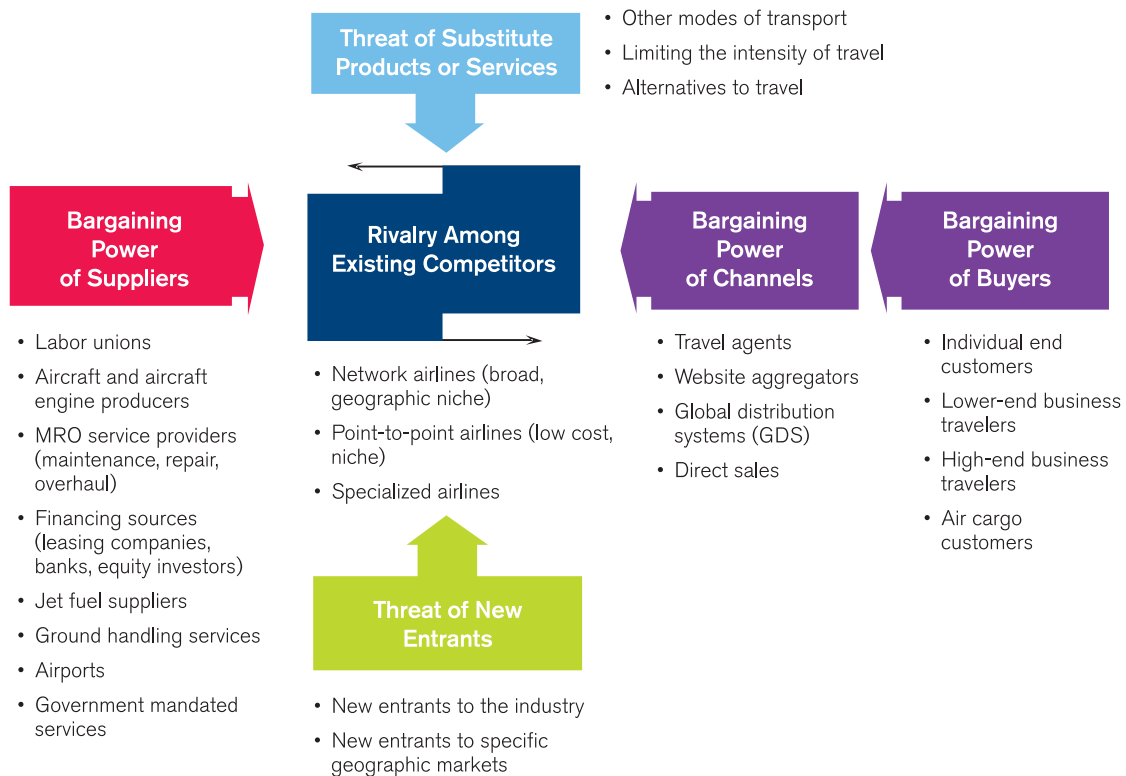
We find the low industry profitability is driven by challenging underlying industry economics that result in an overly-fragmented industry, that competes almost solely on price. This is further exacerbated by government-policy choices that have limited exit and hindered effective competition among different business models. Industry profitability is made worse by airlines and some of their suppliers acting in ways that lead to more destructive, price-oriented competition.

The analysis in this report focuses on the features of the global airline industry. However, there are industry variations that lead to differences in some circumstances. While the underlying economics of the industry are the same everywhere, government policies and the behavior of companies vary.

Comparisons with other industries sharing similar underlying economics provide further insights into the state of the airline industry. Extreme fragmentation is the result of a unique combination for airlines of low entry barriers and high exit barriers. Destructive price competition is partly the result of the underlying cost structure but is further exacerbated by highly volatile demand.

## 1.2.1 Actors in the airline industry

This section introduces the different types of companies that compete in the airline industry or that affect its profitability as suppliers, customers (channels and end customer groups), potential entrants, and substitutes.



**Chart 26: Determinants of airline industry profitability**

Source: Michael Porter

### 1.2.1.1 Customers

#### Channels

- *Travel agencies*; traditionally the dominant channel for airlines, and paid by commission, which supported prices. Incentive payments were used to steer travel volumes to particular carriers. Travel agents have become much less dominant overall, and changed their role. For individual travelers, both leisure and some business travelers, websites have largely taken over from travel agents. For corporate customers, travel agencies remain important but have shifted strategy to reducing travel costs for clients.
- *Aggregator websites*; have become the dominant sales channel, especially for lower price tickets. Allow easy comparison of prices across airlines and have dramatically increased price transparency. Some offer only search while others package flight itineraries (even across airline alliances), occasionally also giving 'lowest price' guarantees and other travel-related services, such as delay notices.

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- *Global distribution systems (GDS)*; pull together seat price and availability data from airlines and provide it to travel agencies and aggregator websites. Three GDSs, e.g., Amadeus, Sabre, and Travelport, dominate the market. While they all trace their roots back to airlines, they are now independently owned. Some of them also own aggregator websites, through which they directly sell airline tickets to end customers.
  - *Direct sales through airline websites*; have grown over time, partly to reduce the cost of handling tickets and to bypass GDS. Offer a broadening array of customer services (information check-in, seat assignment, boarding pass generation, handling of frequent flyer miles, etc.) and increasingly also 'lowest price' guarantees.

### End customers

- *Individual end consumers*; travel primarily for vacation or to visit friends and family. This customer group is highly price sensitive and often flexible as to length and date of travel. While they have traditionally bought heavily through travel agencies, a large share buys via the internet either through airline websites or aggregators. Travel agents are more important where air travel is sold as part of package deals including transport and accommodation.
- *Lower-end business travelers*; buy air travel through corporate purchasing departments/travel agents that adhere to corporate travel policies, or they buy directly, mainly through websites. This customer group is relatively price sensitive and flexible as to the length of travel, and tends to react significantly to customer loyalty programs.
- *High-end business travelers*; seek high frequency and direct connections whenever possible. They are not as price sensitive but can have preferences for individual carriers and react to some degree to customer loyalty programs.
- *Air cargo customers*; either freight forwarders that buy air cargo capacity for integrated logistical services, or large cargo customers that have sufficient volume to contract with the airlines directly. Both groups are professional in their purchasing behavior, with low loyalty to specific carriers and high price sensitivity for less-urgent items.

## 1.2.1.2 Suppliers

### Airframe manufacturers

- New aircraft are bought directly from producers, usually with a significant delay between order and delivery. Manufacturers operate globally and concentrate on different size-classes of aircraft. Airbus and Boeing dominate the market for large aircraft on longer routes but also produce some larger single-aisle aircraft operating on shorter distances. For medium-sized aircraft there are a number of additional suppliers including Bombardier, COMAC, Embraer, and Fokker.

### Aircraft engine manufacturers

- GE, Pratt & Whitney, and Rolls & Royce are among the largest suppliers, and operate globally. Customers can usually choose among a number of different engines for a given airframe. Engines account for a significant part of the total cost of an aircraft and a high proportion of the cost of use.



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## Maintenances, repair, and overhaul (MRO)

- While many airlines perform line maintenance in-house, 60% of carriers outsource at least part of their MRO activities. About 30%-50% of MRO work is estimated to be provided by external suppliers. Among these suppliers are OEMs (airframe and aircraft engine manufacturers), other airline maintenance operations, and independent service providers.

## Financing sources

- The expansion of the aircraft industry over the recent past has been financed in roughly equal shares through new equity and debt. Equity has been raised from a wide range of investors. The longer-term returns on airline shares have been below the average of major stock indexes, in line with their consistently low profitability over the cycle. Airline shares are highly volatile and tend to attract short-term oriented traders.
- Debt is provided mainly by banks, often through specialized airline financing divisions. Bank loans are secured against the aircraft owned by an airline.
- Direct purchasing of aircraft is financed through loans, often provided by the aircraft manufacturers or with the support of public export-financing agencies. Export-financing is thus far only available to airlines operating outside the home country of the major aircraft producers.
- Aircraft can also be leased from leasing companies, which keeps the aircraft loans off airline balance sheets. Leasing contracts are usually long-term.

## Jet fuel

- A commodity where prices follow global oil prices. Fuel is provided through a mixture of global and national/local suppliers at airports around the world. Prices have been volatile, and trending higher. Jet fuel now accounts for more than 25% of total airline operating costs compared to less than 15% in 2000.

## Labor

- Wages are often negotiated separately for ground staff, cabin crew, and pilots at the level of individual companies. Unions often have a strong position and different unions represent each group. Wage levels differ significantly by location.

## Ground handling services, catering

- Ground handling services like baggage handling, check-in, cleaning, etc., tend to be local monopolies or duopolies. Traditionally airlines provided a significant share of these services in-house, but over recent years there has been a trend to outsource them to external providers.
- Catering services are often provided by specialized companies, either local specialists or larger international groups.

## Customer management services

- Loyalty programs have become an important element of the airline business. While they are still dominantly organized within airline, there are some examples of where these activities have been organized in separate companies or fully outsourced.

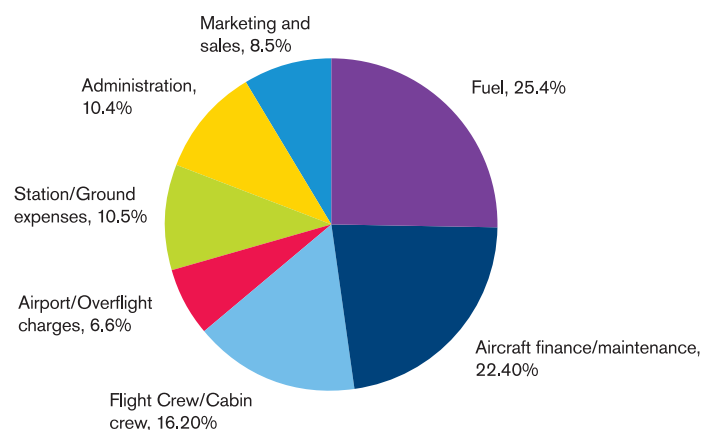
## Airports

- Airport operators charge fees for gate usage as well as for take-off and landing slots. Most airports remain owned by governments. Privatization has led to the entry of private companies, some of which operate airports around the world.

## Government-mandated services

- Security control and air traffic control are public services that are required by law. Governments either provide them themselves, or select private service providers to do so. Airlines finance these activities through administratively set fees. In the US, for example, there are federal ticket tax and flight segment fees to cover the running costs of the FAA and the Air Control System, a federal security surcharge to recover some of the costs incurred by the DHS for security controls on airports.
- On international routes, countries can charge overflight rights from foreign carriers travelling through their airspace.
- Some governments impose special taxes on the airlines industry, sometimes with the intention to invest the revenues in the public infrastructure used by the industry. The US airport passenger facility charges (PFCs), for example, are levied to cover capital costs at publicly-owned airports. The German Air Transport Tax (Luftverkehrssteuer) does not specify any particular use for the revenues raised; it was introduced as an environmental tax to reduce air travel but it is poorly designed to do so, and its revenues are intended to reduce the Government's budget deficit.

## Input cost structure



**Chart 27: Breakdown of airlines' total operating costs**

Source: Doganis, 2010

Fuel is the only major cost item that has become significantly larger over time. Distribution channel costs have fallen, while all other major cost categories have remained roughly stable as a share of total operating costs.

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### 1.2.1.3 Potential entrants

#### New entrants

- Over 1,300 new airlines have been set up in the past 40 years, an average of over 30 each year.

#### Potential entrants to specific markets

- Existing airlines, especially if they are operating in adjacent geographies, are potential entrants into other markets. The US-EU Open Skies agreement in early 2008, for example, resulted in a number of airlines from both sides of the Atlantic providing new services.

### 1.2.1.4 Substitutes

#### Other modes of transportation

- High-speed trains but also cars, traditional trains, ships, and buses. All are potential substitutes for both passengers and cargo. Their impact becomes significant when the speed advantage of aircraft becomes less important.

#### Limiting the intensity travel

- Selection of tourism destinations nearby; decision not to travel
- Decision not to make business trips
- Near sourcing, better inventory management, and adjustments in supply chain management all have an impact on the frequency and quantity of transportation demand in the value chain

#### Alternatives to travel

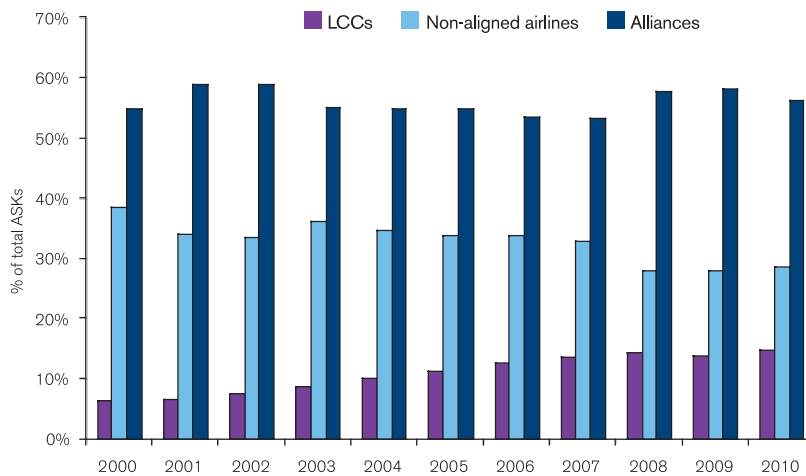
- Depending on the motivation for travel, video conferencing or other forms of communication can be substitutes.

### 1.2.1.5 Airline rivals

#### Network airlines

- Network airlines connect (often large) sets of destinations through one or more hubs. Many of them are so-called legacy airlines that have their roots in the period before deregulation. While they differ in the geographic scope of their operations, all have a core geographic market in which they are located.
- Such airlines usually offer transportation in all classes of service (first, business, economy) and carry cargo on many of their flights. They use a range of aircraft types, and their customers often connect flights.
- Large network airlines use 'feeder' networks to aggregate flows into their main hubs where customers can connect to a large number of long-haul flights. Some airlines, like JAL, Lufthansa, Qantas, and the large American network carriers, combine feeder networks and long-haul business with extensive point-to-point connections within their home market.

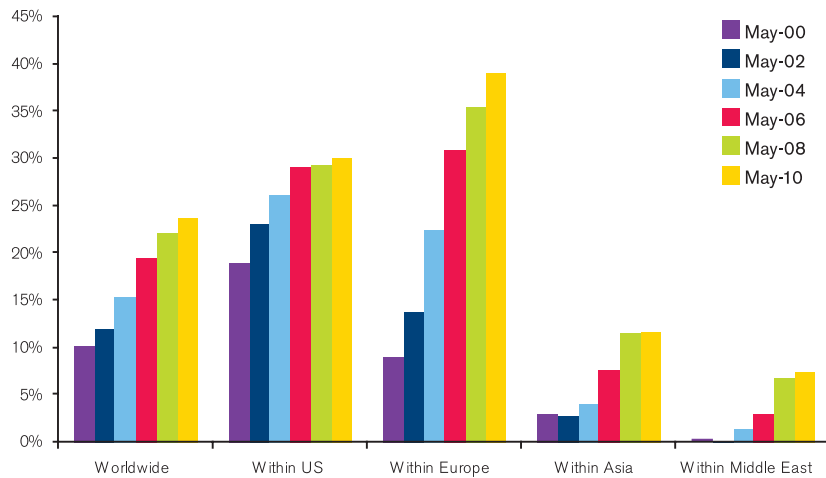
- Other network airlines, like Cathay Pacific, Emirates, and Singapore Airlines, focus largely on long-haul connections.
- Smaller network airlines, e.g., SAS, Czech Airlines, Malev, etc., provide local connections within their home market, a limited number of longer-haul connections where travel volumes are sufficient, and otherwise connections to the hub(s) of larger carriers.
- The majority of network airlines now belong to one of three alliances that coordinate operations globally. The exceptions are largely newer entrants in growth markets, for example Emirates, that are concerned about possible limitations to their freedom to compete.



**Chart 28: The capacity share of non-aligned network airlines**  
Source: SRS Analyser

### Point-to-point carriers

- These airlines offer direct travel with limited focus on connectivity through hubs. A significant subgroup of these companies are the low-cost carriers (LCCs) that compete on cost leadership. They provide only one class of service, no or very limited amenities, and operate a narrow range of aircraft types. LCCs also operate from specific airports as technical bases and add new such bases whenever they enter a new geography.
- LCCs account for 25% of globally available seats and 15% of average seat kilometers (ASKs), a reflection of their focus on short- and medium-haul markets. Their position is particularly strong in Europe (both domestic and cross-border within Europe) and the US (domestic). More traditional airlines in the point-to-point category are the charter carriers that provide non-scheduled connections, largely to tourism destinations.
- A smaller group of carriers provides point-to-point long-haul connections with either all classes, e.g., Virgin, or business-class-only flights, e.g., the now-defunct EOS, MaxJet, and Silverjet. As the LCC, these airlines also tend to focus on one type of aircraft.



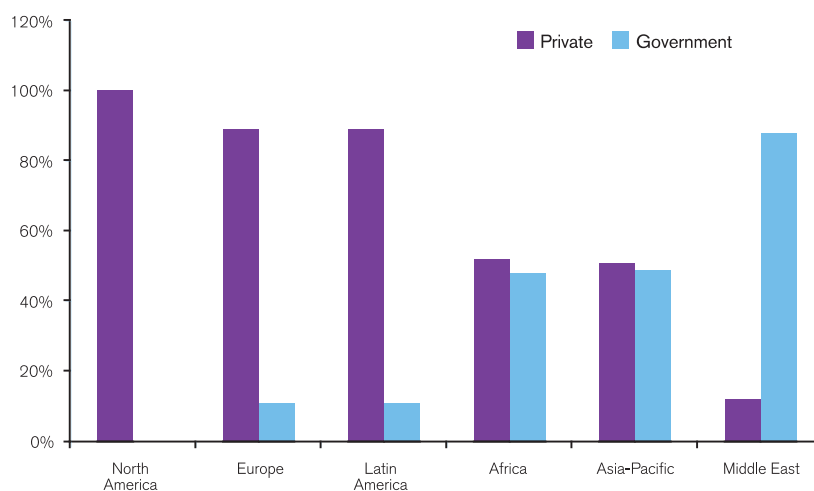
**Chart 29: LCCs now supply a quarter of scheduled seats worldwide**  
Source: SRS Analyser

### Specialized airlines

- These include pure play cargo carriers or integrators that run air services as part of their integrated logistical offering.

### Ownership

- While many older airlines were government-owned at some point, this has changed dramatically through liberalization, especially in the mature markets of North America and Europe. In emerging economies, the role of government-owned airlines is still significant. Government-owned airlines in the fast-growing Middle East are often dominant.

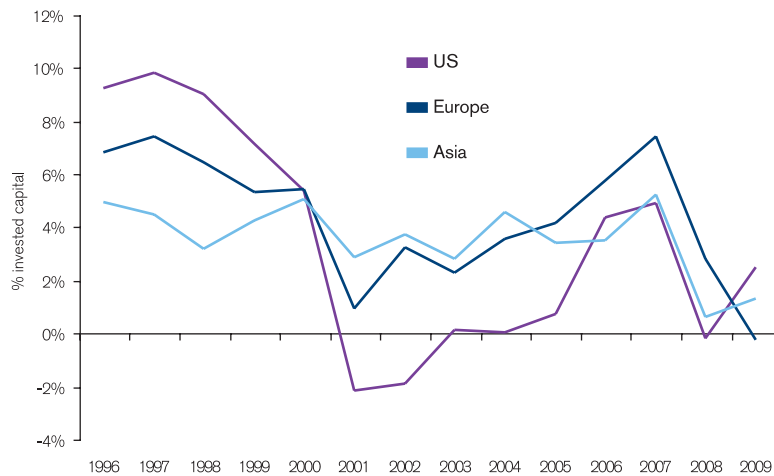


**Chart 30: Majority of airlines are privately owned in most regions**  
Source: Company websites, Ascend

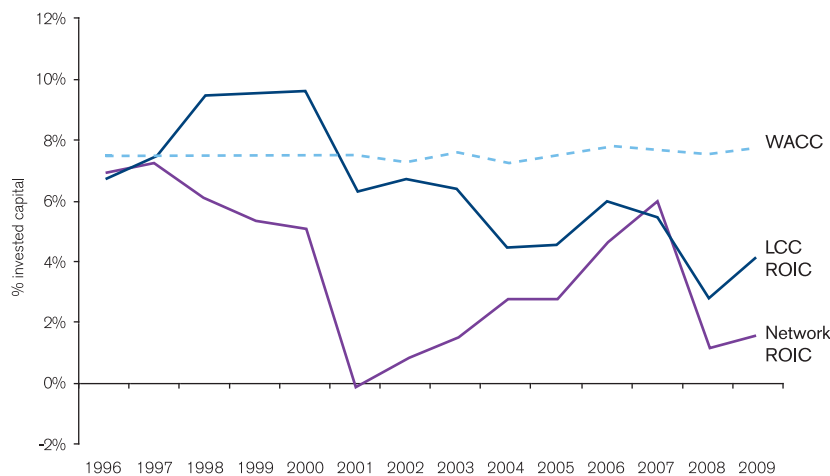
## 1.2.2 Industry scope and segmentation

Industries range in geographic scope from local to global. Other segment dimensions include customer needs and product features. This leads to segmented markets, which can vary in industry structure. A key indicator of this might be the case is systematic difference of company profitability across segments. If industry structures are significantly different across segments, Five Forces analysis is more meaningful at the level of the relevant segment market than for the overall industry.

The data on airline profitability is consistent with the hypothesis that all segments are subject to the same underlying economics. The airlines that have been generating average EBIT margins of 8% or more during the 2000s (see chapter 1) cover all continents (except Africa) and many types of airline operating models, from LCCs to regional niche players to more traditional network airlines. Interestingly, however, the list of the most profitable airlines does not include any of the large and most mature North American or European network airlines, and none of the North American LCCs, including Southwest Airlines.

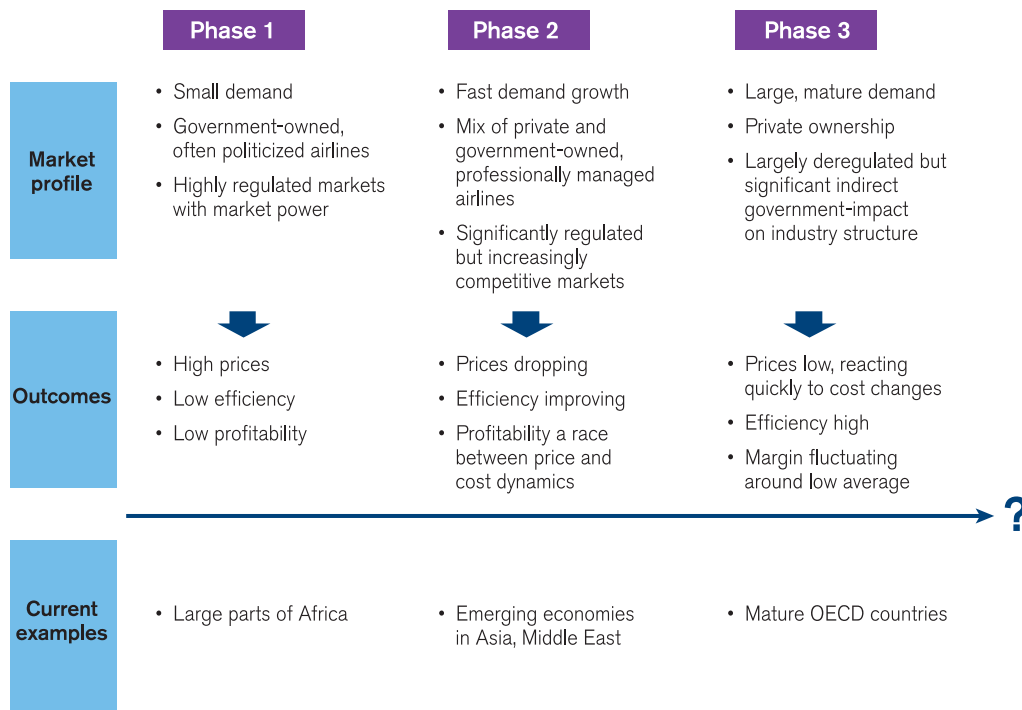


**Chart 31: Return on capital for airlines by region, % of invested capital**  
Source: McKinsey & Company for IATA



**Chart 32: Network and LCC worldwide ROIC and WACC**  
Source: McKinsey & Company for IATA

While systematic differences by geography (cost levels, demand, regulation, competitive set of rivals) as well as segment (cargo/passenger, different classes of passenger service) are clearly present, the data suggests that underlying average profitability over time is remarkably similar across segments and geography. Where profitability differences exist, they are related to the growth and maturity of the local market, the maturity of competing airlines, and differences in government policies affecting rivalry, rather than underlying structural differences.



**Chart 33: Indicative evolution of airline markets**

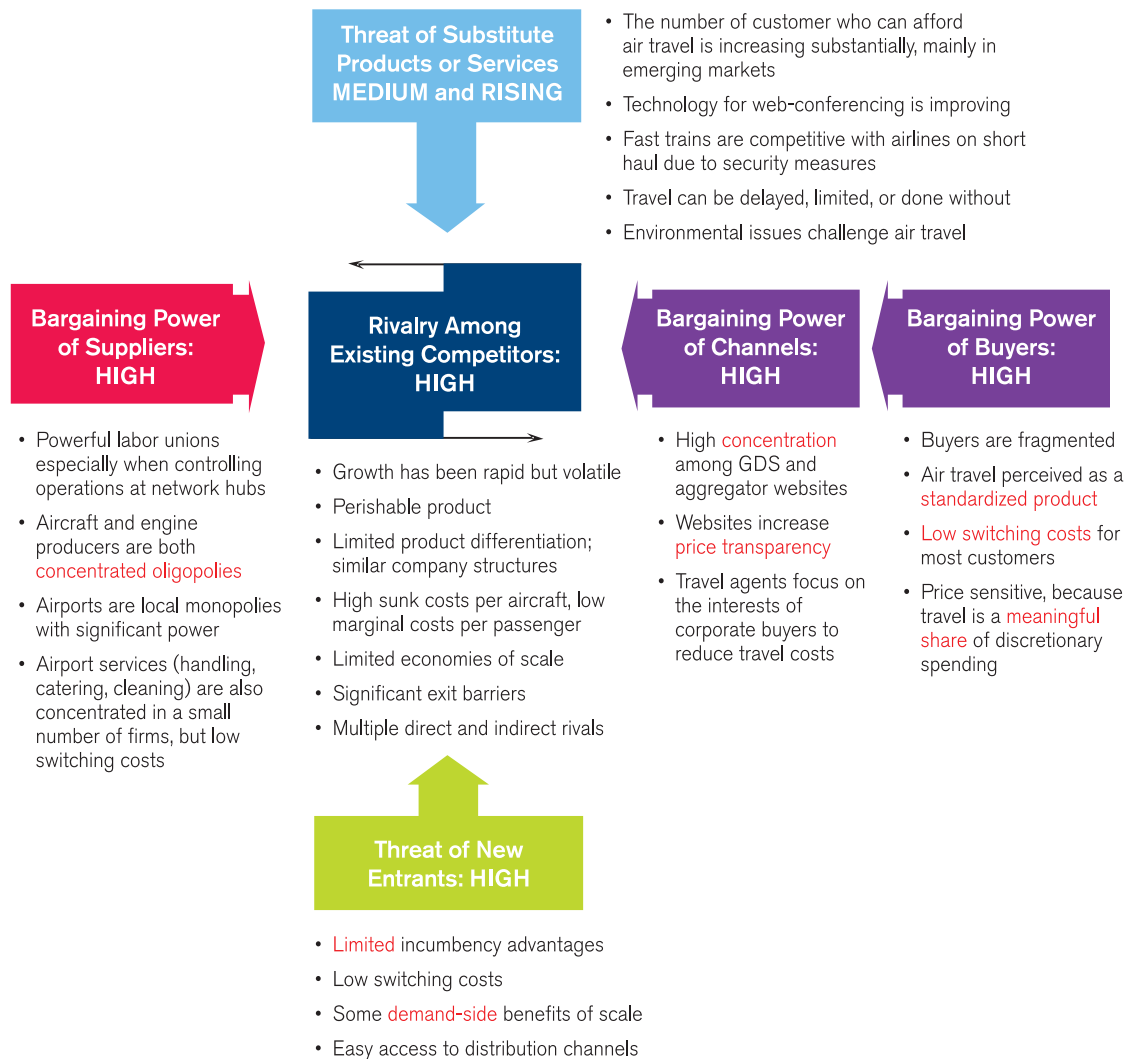
Source: Michael Porter

For the remainder of this chapter, then, we apply Five Forces analysis at the overall industry level. The focus is on scheduled passenger services which account for 67% of the total market. The markets for air cargo and charter services are not analyzed in detail to reduce the complexity of the discussion. Both are important segments but neither affects the fundamental conclusions.

### 1.2.3 Five Forces in the airline industry

Profitability is a function of the collective strength of the Five Forces as well as the interaction among them. These forces shape the behavior of the actors and determine both the overall value created in the industry and the way in which this value is divided among them.

The Five Forces framework identifies the underlying drivers of industry profitability. However, though the underlying economics of an industry limit the set of possible industry outcomes, the actual outcome depends to some degree on the decisions made by rivals and other industry actors. In a low-profitability industry like airlines, a key question is thus whether the fundamentals would be consistent with a different set of company choices resulting in a more sustainable level of profitability.



**Chart 34: Five Forces in the airline industry**

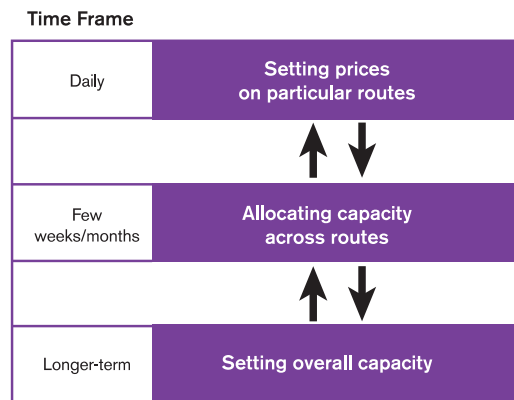
Source: Michael Porter

### 1.2.3.1 Intensity of rivalry

Rivalry in the airline industry is highly intense; a dramatic shift in an industry that historically was highly regulated with little or no competition. Intensive rivalry is driven by a number of underlying characteristics of air transport. At its core, the aggressive buildup of capacity that never leaves the market drives pricing decisions that fail to support attractive returns.

Airlines compete by making a number of sequential choices about quantity and price. First, an airline has to choose its overall capacity, i.e., its aircraft fleet. This choice is often set for longer time periods, given by time lags in aircraft delivery and building the necessary company infrastructure. It also includes choices about the service amenities to include on an airplane. Second, the airline has to choose how to allocate its capacity across different connections. These choices tend to be set for a period of up to six months; changes in aircraft size on existing connections can be made with higher frequency within the capacity of an airlines' overall fleet. Third, the airline has to set prices for each connection. These prices can be changed frequently, sometimes even many times during a day. While more fundamental choices on capacity influence subsequent choices on price, the view on the prices feasible in the market determine the earlier (and not easily reversible) choices on the size of the aircraft fleet.





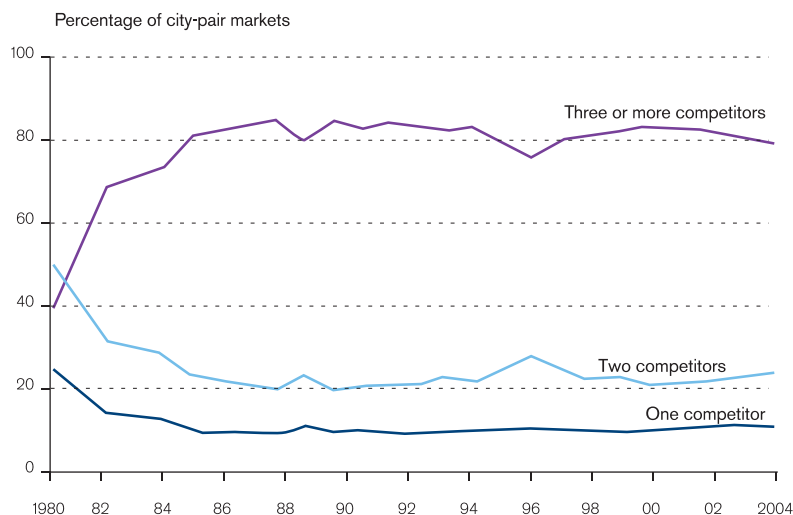
**Chart 35: Multi-stage competition in the airline industry**

Source: Michael Porter

When setting capacity, airlines are faced with individual incentives to make aggressive choices. Some of these incentives are related to costs: Buying more planes gives higher rebates. And operating larger planes reduces marginal costs per passenger. Others are related to risks: The upward returns of having free capacity in periods of high demand are high and fully accrue to airline owners, while airline owners' losses in periods of low demand are limited by their equity stake. Airlines end up acquiring too much capacity and operate many connections that cover only their marginal costs of operation, not the capital cost already incurred.

When making pricing decisions, airlines have powerful tools (e.g., yield management systems) to maximize profits. But competition limits the payoffs of these tools: while individually every airline is better off using them, they lead to more intense price-based competition. Airlines end up pricing more of their seats at marginal costs per passenger.

Deregulation, especially in the US and other mature OECD markets, has led to a significant increase in competition. This competition has taken the form of frequent price changes and a huge variety of prices paid by passengers on the same flight, depending on the time of purchase, the rebooking conditions, the class of service, and the bundle it is part of, i.e., whether a specific flight is part of a larger itinerary or not (the last three do usually not apply to LCCs). This competition has also reduced the ability of airlines to capture customer value through rules like the 'Saturday night minimum stay' requirement (a practice called 'fencing' that had already existed in a similar form before deregulation).



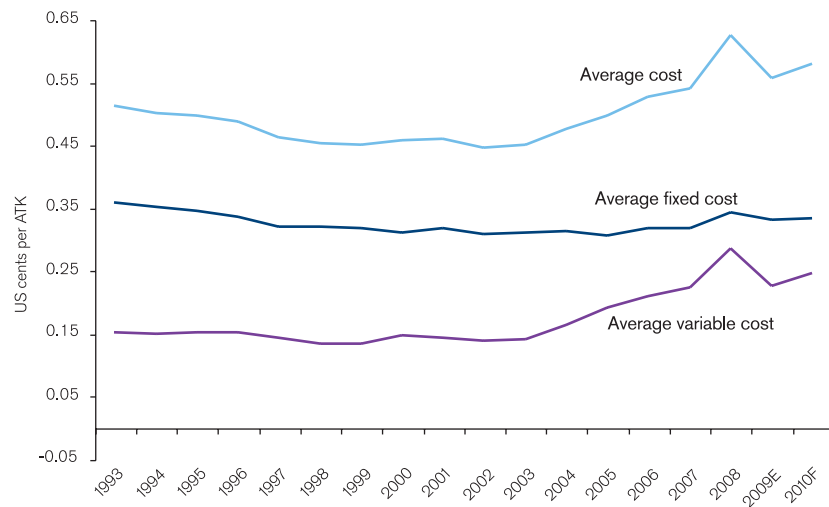
**Chart 36: Competition intensified sharply after deregulation in the US**

Source: US GAO

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The specific economic characteristics of the airline industry that drive intense rivalry are:

- *Perishable product*; transportation capacity is available only for a period of time and disappears afterwards, whether it is used or not. Costs for providing capacity are thus largely sunk in the short term. This creates severe pressure on price discounting.
- *Similar products*; within a given class of service, the product offered is highly similar across airlines. Other industries have succeeded in providing product differentiation through branding, quality differences, or specific technical features. In the airline industry this has not happened to a significant degree, partly because of safety standards but also because of the competitive choices companies have made.
  - The core transportation service is not differentiated across airlines, at least not within the broad types of airlines (network airlines, low-cost airlines). New product features (flat bed, entertainment system, etc.) are quickly imitated among peers.
    - For airlines operating multiple classes on one aircraft, i.e., network airlines but also some point-to-point airlines, the basic 'factory' producing the service is identical across all customer groups. This provides cost benefits through the use of larger aircraft but limits the potential for product differentiation.
    - However, a significant barrier for adopting service innovation is the cost of taking aircraft out of service to change physical product features. This is usually done only in parallel with larger scheduled maintenance cycles.
  - For business-class passengers, airlines have more ways to differentiate their offering.
    - On specific connections, a main differentiating factor across airlines is frequency of service. Airlines providing higher frequency can capture higher market shares.
    - Frequent-flyer programs have been introduced to create more customer loyalty; they have some effect, for example, allowing airlines to charge higher prices on connections through their hubs.
    - For leisure passengers traveling on airlines only infrequently, many of these service attributes have little effect.
- *Low marginal cost structure*; high fixed costs exist at the level of individual aircraft. Average cost per available seat kilometer (ASK) is decreasing in the size of the aircraft, i.e., in the capacity that an airline offers on a given connection. Marginal costs for additional passengers transported are very low, which reinforces price discounting. Variable costs per aircraft, however, are significant and have increased as jet fuel prices have risen over the last few years.
  - The fall in operating costs with aircraft size drives the importance of route density. Routes with higher density can support larger aircraft, which in turn enable lower costs and prices that can attract additional customers.
  - This feature also leads to network effects: adding an additional connection creates not only additional revenues and costs on the new route but also enables additional traffic/revenue to be generated for existing connections.
  - The combination of these two dynamics drives the business model of network airlines, where feeder flights to hubs provide the customers that make larger planes economical to fly on higher-density, longer-haul connections. Hubs are also a key driver of code-sharing, which brings in additional feeder flights operated by other airlines.



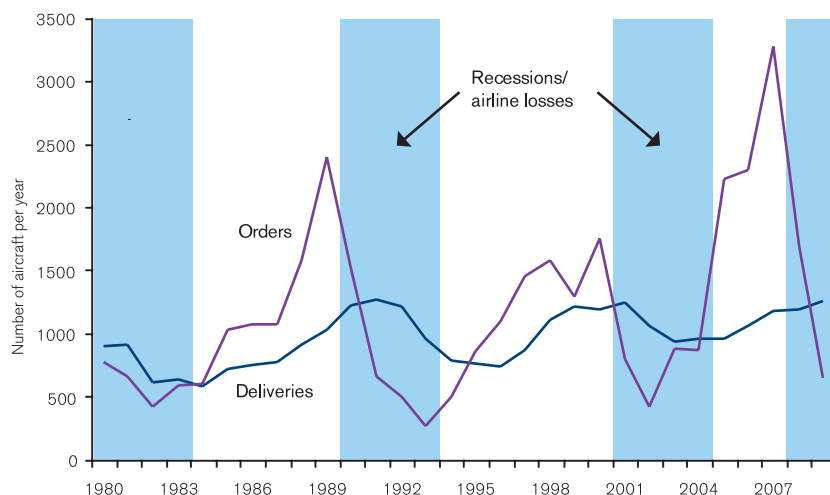
**Chart 37: Relative high proportion of costs fixed over short term**

Source: ICAO, IATA

➤ *High exit barriers*; the disappearance of capacity and the exit of companies are two key adjustment mechanisms through which other industries support normal rates of returns. In the airline industry, however, neither of these two adjustment mechanisms works:

- Aircraft capacity usually stays in the market, and disappears only in the very long run, even if particular companies might leave the market.
  - Aircraft can be easily redeployed to different geographic markets. This high degree of fungibility is a critical feature that has encouraged aircraft suppliers, banks, and leasing companies to provide ample financing for aircraft acquisition with the aircraft used as collateral, even in a low-profit industry.
  - Airport infrastructure (gates, slots) never fully disappears and can be put back into service at low marginal cost, even if left idle for some time.
- Less than 1% of airlines exit the market in an average year.
  - Governments have a tradition of bailing out airlines. In the US, Chapter 11 forces debtors to provide the bailout; both mechanisms allow companies to shed some of their sunk fixed costs. Management is often not held accountable in bailouts, reducing the disincentives for managers to avoid going through such periods.
  - The rules on the nationality of owners limit the pool of potential owners (and sometimes also of potential managers) that could acquire and run an airline.
  - Antitrust rules limit the ability/incentives for companies to buy rivals; acquirers can be forced to hand over capacity (slots) to competitors.
  - Membership in an alliance also leads to situations where alliance partners provide equity financing to avoid the exit of an unprofitable partner. These decisions can be individually rational to retain the presence of an alliance partner in a particular geography or preempt a competing alliance from gaining ground.
  - Exit rates differ significantly by country; US carriers have a higher likelihood to exit but are also (together with Japan) the only market where many bankrupt carriers continue operations; these companies tend to keep prices stable but reduce capacity and costs.

- There are a number of barriers that limit airlines' ability to reduce capacity overall and on specific routes.
    - Airlines are forced to take a capital loss if they sell aircraft in a downturn. Getting out of leasing contracts is equally costly in downturns. Keeping capacity idle is costly, but avoids the capital loss.
    - Gradual reduction of capacity in reaction to demand slumps is complicated by need to retire capacity by aircraft, not by seat.
    - Use-it-or-lose-it rules on airport slots create barriers to exit from routes.
    - The network model means that lost traffic from exiting a connection can have ripple-on effects on the economics in other parts of the network.
    - Reducing capacity by moving to smaller aircraft on specific connections increases the average cost per ASK.
- *Capacity* can only be increased stepwise (size of the aircraft times number of hours aircraft can be in the air; number of gates/runways at an airport times number of times it can be used per day). The capacity added through one plane is usually higher than the demand from adding one new connection.
- Aircraft manufacturers provide extensive financing support, either directly or through government-run export financing programs, and volume discounts. Prices have dropped significantly in terms of costs per unit of passenger-mile capacity.
  - There is an active market for used airplanes that allows airlines to add capacity relatively quickly. For new and usually more cost effective planes, however, there is a significant delay between order and delivery.

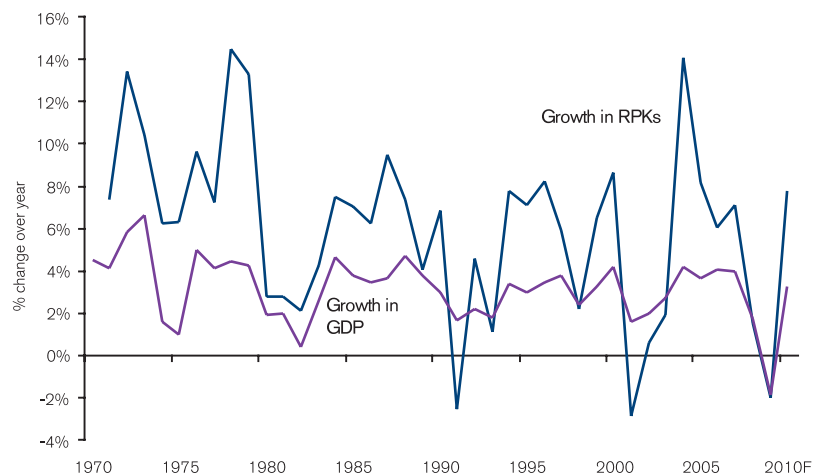


**Chart 38: Aircraft orders and deliveries**

Source: Ascend

- New airport infrastructure becomes available only years after an investment decision has been made. The construction of new airports and the addition of new capacity at existing ones (new runways, new terminal buildings) is a highly political process, involving extensive government permitting and often also financial contributions. In mature markets like the US several analyses have identified a large backlog in airport investment, leading to increasing capacity constraints. In growing markets like the Middle East, aggressive public investments in airport capacity have been a major driver in attracting travel volumes.

➤ *Industry growth* has been rapid overall, but volatile and highly heterogeneous across geographies. The volatility has led to repeated short periods of profitability, even when average returns have been low. Airlines invest in capacity to be available when demand picks up. Investors enter the industry with the hope of earning returns based on the timing of their entry and exit decisions. Governments are lured into believing that the industry's structural problems have disappeared when a temporary upswing leads to temporary benefits and strong investments in capacity.



**Chart 39: Volatility of air travel vs. GDP**

Source: ICAO, IATA, EIU

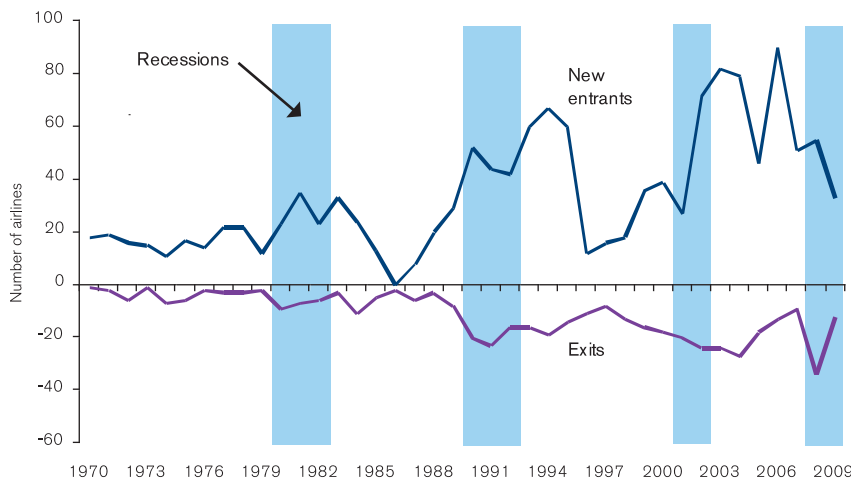
- Airline travel reacts disproportionately strong to changes in GDP growth rates.
  - While other services (electricity, financial services) also tend to grow in line with GDP, consumers view them as essential. Airline travel can instead be cut much more easily, at least in the short term.
  - Short term demand shocks are mostly geography-specific, not company- or connection-specific. This is most pronounced when the demand shock is unrelated to the business cycle, i.e., in cases like SARS, terrorist attacks, severe weather/natural conditions.
- The trend growth rate in individual market depends on GDP growth and GDP per capita level. Airline industry growth is high when large segments of the population reach middle-income status (emerging economies); it then falls towards the trend rate of GDP growth when the size of the middle class begins to stabilize (OECD).

➤ *Heterogeneity of companies*; more heterogeneous rivals tend to compete more aggressively, partly because they view the impact of specific competitive moves differently.

- On individual markets, airlines tend to be in highly heterogeneous positions. While the market for flights between two cities is the core market for an airline that offers direct flights, it is often a marginal market for another airline, which is providing the service through a transfer connection. Between such heterogeneous rivals the ability to avoid deep price competition is less likely.
- Airlines are exposed to the specific policy context in their home market. As they compete internationally, they meet companies operating under different conditions. This can affect the competitive interaction between the two in ways unrelated to underlying efficiency or value proposition.
- Airlines often face different cost structures based on their time in operation and thus different economic incentives. Over time, labor costs tend to rise and the pressure to grow forces airlines to increase the complexity of their operations.

### 1.2.3.2 The threat of new entrants

The threat of new entrants is high. Over 1,300 new airlines were established in the past 40 years, an average of over 30 each year (excluding those operating non-Western-built jets). Entry has been highly cyclical. Remarkably, entry rates have shown no sign of slowing down despite low industry profitability. In fact, entry is increasing even though total market growth rates have slowed. A significant share of new entrants in the industry ultimately fails, even in the LCC segment.



**Chart 40: Net entry of new airlines continues even during recessions**  
Source: Ascend

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Entry occurs regularly, mainly through existing airlines expanding their services to new markets. The mere threat of entry, however, seems to have limited impact: Prices are cut after entry, but not in anticipation or to deter entry. Entry barriers play some role for new entrants to the industry but are very low for existing operators. The barriers to entry into the industry are low:

- Economies of scale exist on the demand side, i.e., it is easier to generate demand with a strong brand, a wide distribution presence, and a large network of connections. There are also benefits from established operations in generating route density to allow larger aircraft (lower costs) and higher frequency (higher price). But since most of the entry is through existing airlines operating in adjacent geographies that do not face these barriers, these factors do not significantly deter entry.
- Supply-side economies of scale are limited if airlines grow beyond a level of around 50 aircraft. This creates some disadvantages for new airlines but not for existing ones looking to expand into new markets. Because capacity comes in lumps, airlines operating in adjacent geographies face the lowest entry barriers. They can serve a new destination through spare capacity on existing airplanes.
- Access to distribution channels is easy for new entrants, much more so than in the past. GDSs and the internet now enable new airlines to list and make their flights available through a larger number of aggregator websites and travel agencies. This is a big change from the past where reservation systems and travel agents were controlled by incumbents.
- Legacy rights on slots give some advantages but there is secondary trading of slots at congested airports and thus no advantages until slot capacity is reached. If infrastructure does not grow in line with travel volumes, however, it can become an increasing bottleneck limiting entry at the most highly frequented hubs. There are also some legacy rights in governmental air policy agreements that allocate international travel rights to specific existing carriers. But deregulation has in many cases opened the door to other established airlines, even when they might still provide some barriers to new entrants to the industry.
- Substantial capital is needed to acquire new aircraft. Prior to the financial crisis, however, external finance was widely available, from investors, banks, and aircraft producers. The growing presence of leasing companies reduces capital requirements. However, it remains hard for new entrants to meet operational cash flow requirements through persistent downturns.
- Customer switching costs are low. Loyalty programs by alliances provide some cover across alliances but not between airlines within an alliance.
- Government policies to defend the position of incumbent flag carriers were important in the past but are in most markets no longer important. The situation is different in some emerging markets, where entry does occur but only in ways that are sanctioned by government.

### 1.2.3.3 Bargaining power of customers

The bargaining power of airline customers is high and rising. Channels have become significantly more concentrated (internet websites) and travel agents more aggressive in pursuing the interests of the end customers. A significant share of end consumers is highly price sensitive, especially among the new consumers that have driven demand growth in mature markets. There is a low perceived willingness to pay for service features unrelated to ticket flexibility. Their loyalty to specific airlines is relatively low, but frequent travelers react to the incentives of customer-loyalty programs.

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Customer power is driven by a set of underlying factors:

## **POWER OF CHANNELS**

### **Aggregator websites**

- Aggregator websites have concentrated consumers' buying power.
- Websites focus on price comparison and significantly increase the transparency of prices across carriers.
- GDSs have made it very easy for new aggregator websites to enter the market. The strong market power of the three dominant GDSs has triggered the current conflict between GDSs and US airlines.

### **Travel agents**

- Agents now often represent the entire demand of large corporate clients, with significant power to shift demand across carriers.
- Agents have to comply with corporate travel policies that have become more price oriented.

## **POWER OF END CONSUMERS**

- Air travel tends to be a significant discretionary spending item, increasing price sensitivity.
- Most of the new growth is from business customers at lower levels of the corporate hierarchy. Business travel can be delayed or reduced in frequency.
- Switching costs between airlines are limited; switching costs due to loyalty program rules increase in individual customers overall travel volume.

### **Business customers**

- Frequency is a key differentiator among airlines of a similar type on a given connection.
- Airlines have tried to create higher switching costs but these are meaningful mainly for business travelers.
  - Loyalty programs create switching costs; they have significant effect, especially for business travelers. Expiration/'inflation' of frequent flyer miles creates incentives to use miles/stay loyal to a given airline/alliance but reduce their value.
  - Operational coordination in alliances or a large own network is also creating some switching costs for consumers; there is evidence of a (limited) hub premium for network airlines.

### **Leisure customers**

- The choice of carriers is almost entirely based on price, with low willingness to pay for shorter travel time or carrier-specific services.
  - Intransparent pricing structure due to price discrimination (time of purchase, overall bundle, flexibility) creates incentives for consumers to search for "better price".



- Intransparent additional costs for add-on services (baggage, priority boarding, credit card use, booking fees, etc.) differentiate between airline types and classes of services, but not within these groups.
  - Service is highly similar across airlines, at least within the broad classes of carriers (Network vs. LCC) but also across these groups for economy class service.
- For leisure customers there are no inherent costs associated with flying with another airline. Loyalty programs only matter for those passengers that are travelling extensively on business.

#### **Air cargo customers**

- Freight forwarders control 60% of the global market and wield significant power. Consistent with this, they earn significant returns on capital relative to airlines.

### **1.2.3.4 Bargaining power of suppliers**

The bargaining power of suppliers is high for several critical inputs. As a group, suppliers earn higher returns on capital than the airlines themselves (see the data in chapter 1). Among the most significant changes in recent years in the share of individual supplier groups to airline total costs have been an increase in the share of fuel costs, and a reduction in distribution costs.

#### **Airframe and engine manufacturers**

- Airframe and aircraft engine manufacturing is highly concentrated globally. These suppliers have high bargaining power. Some new entrants from emerging economies may change this over time.
- Switching costs between airframes and engines are moderate. There are some fixed costs of introducing a new aircraft/engine type to a fleet (infrastructure, training if the new type is provided by a new supplier). For new aircraft, the often significant time lag between order and production – driven to a large degree by capacity constraints in aircraft producers' production lines – creates some switching barriers.
- Airframe and aircraft engine manufacturers have important alternative markets, especially the market for defense equipment.
- Airframe manufacturers (engine manufacturers have less influence) have thus far not exploited their significant bargaining power to maximize short-term returns. They have, however, been able to shift most of the market risk associated with aircraft purchases to the airlines.
- The aggressive competition between airframe manufacturers has hurt airline industry structure by encouraging aggressive capacity buildup and reducing barriers to entry.

#### **Labor**

- Airlines are dependent on their skilled employees, especially pilots and technical personnel. Network airlines are particularly vulnerable to disruptions at their hubs, which increases the power of unions at these locations. For other services, like station/ground services, general administration, and marketing/distribution, outsourcing is an alternative that has been widely used.
- Unions tend to be local monopolies. In airlines there are usually different unions for different types of staff, with each of them having the ability to disrupt operations. Union power and regulation have led to a significant lack of downward flexibility in staffing levels and wages, especially for legacy airlines.

- There are significant cost differences between new entrants, companies in bankruptcy protection, and unionized incumbents, where high wages continue to be paid relative to other industries, especially for employees with specialized skills like pilots.
- Employees have traditionally been one of the groups most successful in capturing the value created by the airline industry. They remain powerful where labor regulations and the hub-spoke system given them critical leverage. Because union power often rises as companies mature, the nature of labor relations also erodes industry structure by encouraging entry (and bankruptcy) to avoid union-related costs, even if there is no other productivity advantage.

### Airports

- Many airports are local monopolies with limited competition from nearby secondary airports. There is little entry by new airports, so the main check of the exploitation of market power is through economic regulation or, to a lesser extent, competition policy (or potentially the licensing policy if airport operations are put out on temporary license). The pricing power that the local monopoly gives to an airport depends significantly on the potential traffic flows to which it provides access.
- Many airports have become more aggressive in their fee structures following privatization. But many airports, especially in the US, continue to be used by local government to foster economic development through subsidizing airlines' operations. On average airports do not earn their cost of capital, but in Europe and the Asia-Pacific region they generally do.
- Airport switching costs are high, especially for network airlines that are focused on providing connections. It is easier for point-to-point airlines, especially LCCs flying to larger metropolitan areas with a number of airports or regional airports not served by network airlines. Cargo airlines, too, might have a stronger position, especially where the logistical service includes different modes of transportation.
- Airports only marginally better profitability compared to airlines indicates that their effective bargaining power has been limited. Their main impact on airline industry structure has been through infrastructure capacity constraints and other operational practices that have limited effective airline capacity adjustments in serving particular connections.

### Ground handling services/catering

- Ground handling suppliers tend to operate as local monopolies or oligopolies. Airlines are often the dominant or only buyers of the services provided by ground handling companies. Their services are technically homogenous and there are many potential entrants outside the industry with the necessary skills. Switching costs within the existing set of providers are small. The main barrier to entry is regulation that gives service providers local monopoly rights.
- Most airlines still provide ground handling services themselves (estimated 60% of the market in 2005) but the degree of outsourcing to independent handlers (24%) and airports (16%) is expected to rise significantly. Some of the independent handlers belong to larger international groups but the global market is still highly fragmented. The market for ground handling services has been liberalized in the US and Europe; here the market share of independent handlers is already the highest. Elsewhere, there is little competition and airlines usually provide these services themselves. Many of the independent handlers are profitable, at levels comparable to companies providing similar services in other parts of the economy.
- Ground handling/catering providers have limited bargaining power, largely because airlines have the option of providing the service in-house. More liberalization in this market will lead to more outsourcing but limit the market power of these service providers by reducing entry barriers.

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## Sources of financing

- Providers of debt financing have many alternatives for investment, and can demand financing terms that create solid returns taking into account the risks of the airline industry.
- Providers of equity capital, often critical to survival in times of distress, are able to push for attractive conditions. Given the low overall market capitalization of the airline industry, investors view equity positions in airlines as high risk but high-return opportunities.

### 1.2.3.5 The threat of substitutes

The most powerful substitute to aircraft travel is not an alternative mode of transport, but the decision not to travel. This is particularly the case for leisure customers that can allocate their spending to other activities. It is to some degree also the case for business travelers that can – at a cost that is often hard to measure, at least in the short run – delay travel or reduce the need for travel.

The threat of other substitutes has in the past played a moderate role, but has started to become more significant in some segments. Substitution depends on the relative cost/benefit profile of other modes of transport/communication relative to air transport.

- Aircraft are still in a class of their own in terms of speed of travel and have seen their real costs drop significantly over the last decades. However, the time and inconvenience of security measures have reduced the overall attractiveness of scheduled airline transport relative to substitutes.
- The significant drop in the real cost of air transportation has increased the advantage of air travel versus substitutes, and further technological improvements are likely.
- In principle, it is easy for consumers to use other modes of transport or communication, though psychological factors provide stickiness in behavior. The demand for airline travel highly is reactive to changes in consumers' and companies' willingness and ability for discretionary spending.
  - The slightly growing role of substitutes for travel has been driven by improvements in their performance as well as in increasing burden on airplane travelers from growing security controls and procedures. Phone/Web/Video conference technology provides increasingly high quality at falling costs.
  - High-speed trains for European and Japanese short haul provide increasing competition on point-to-point connections. There is significant political pressure for this type of substitution to occur, with the use of policy tools likely to be intensified until a desired level of substitution has occurred.
  - Private jets on time-share programs offer some competition to business and first class travel on scheduled connections, especially at the very top end of the market and to locations with low density of traffic.
  - For short-haul connections, a key concern of airline passengers is punctuality. While airlines have some influence, the key drivers for delays are the air control system and airports.

## 1.2.4 The role of government

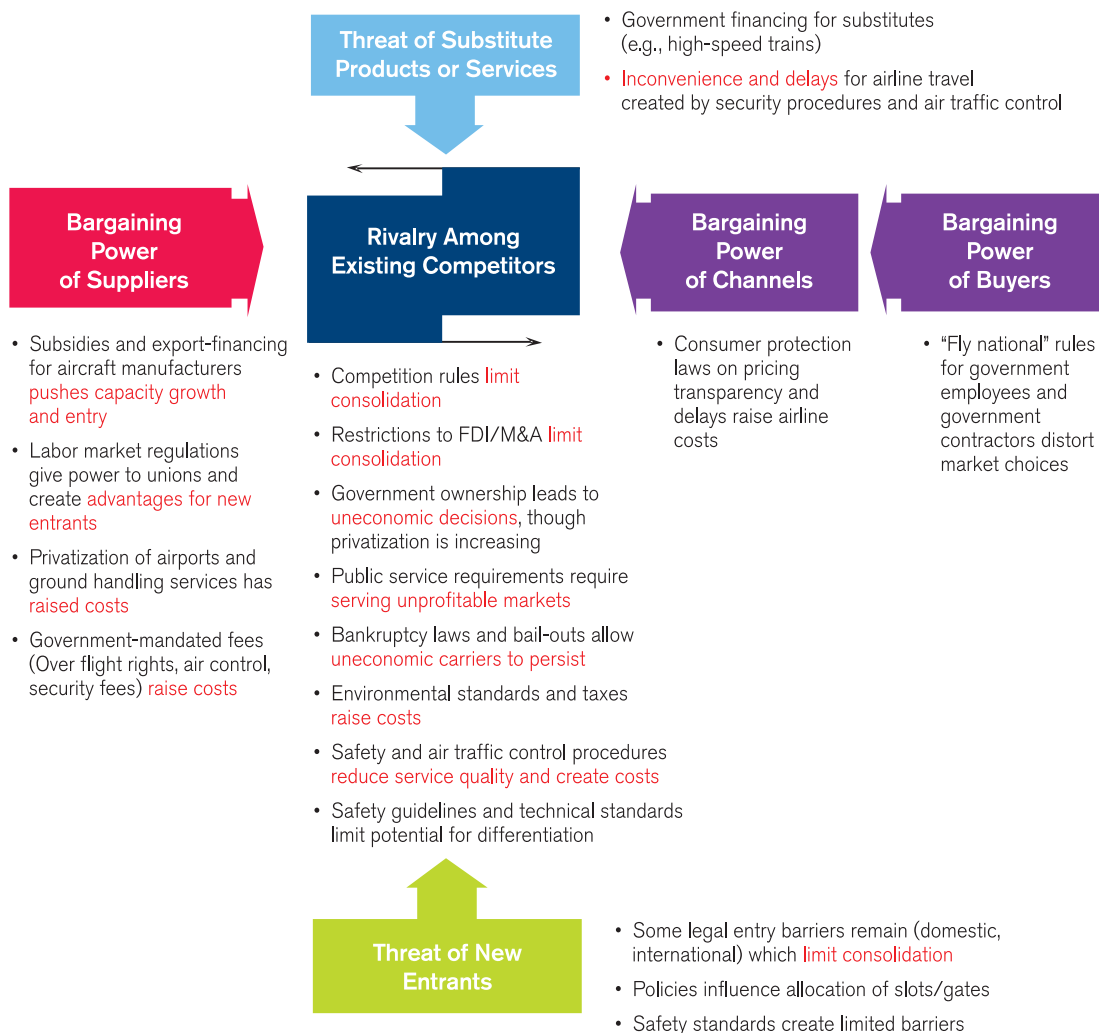
Government policy towards the airline industry has changed significantly over time. This process has occurred at different speeds, leading to a high degree of heterogeneity in terms of the policy environment airlines face across countries. Deregulation has been partial, leaving the airline industry fiercely competitive in some areas while lacking the freedom to react to the consequences of intense rivalry in others. Many of the regulations in place today, especially for international travel, can only be understood as a reaction to industry conditions that have long ceased to exist. Government policies towards airlines have in the process of liberalization often also become less coherent, with individual policies driven by competing policy objectives (fiscal, environmental, economic development) working at cross-purposes. Politicians react to the short-term interests of narrow interest groups, not to a long-term strategic policy concern.

Even where government has become less important as an owner, it continues to influence the profitability of the airline industry in multiple ways.

Government's role is best understood through the way it affects each of the five forces.

- ↗ Government effects *rivalry* at all levels, often in conflicting ways. Policy differences across countries can severely distort competition if policies at home give an airline key advantages in foreign markets.
  - Short-term price setting is affected by competition laws that limit coordinated action (see the recent fuel surcharge case in the air transportation market). Government bailouts and bankruptcy laws allow companies to continue operations after writing off their sunk costs, reducing exit and encouraging price competition at marginal costs. Safety rules can lead to product commoditization. Environmental taxes and cap-and-trade schemes, too, can lead to distortions if they are not applied equally at all airlines competing in a specific market.
  - Medium-term capacity choices are affected by government ownership of airlines in some markets (Asia, Middle East), driving either implicitly or explicitly aggressive capacity growth. Even privately owned airlines sometimes face political pressure to serve specific non-profitable destinations (or shift the location of their hubs) without adequate compensation. Accounting rules affect airlines' incentives to shed capacity in downturns. Environmental standards, too, can affect the renewal rates of aircraft.
  - Longer-term choices about entry/exit and corporate structure are affected by airline-specific restrictions on foreign investment, which limit the potential for M&A activity and thus cross-border industry restructuring/consolidation. Competition law has blocked many mergers or forced airlines to give up slot times in exchange for exemptions from competition rules.
- ↗ *Bargaining power of suppliers*; Government reduces the power of suppliers through subsidies and export-financing schemes. If these benefits are not available at equal terms to all airlines, they distort competition. This has led to the current debates between airlines located in Airbus' and Boeing's home markets vs. other locations. Labor market regulation can increase the bargaining power of employees, raising costs and limit flexibility in capacity adjustments and work practices. The privatization of infrastructure, without regulation or rules to control the private market power that emerged, and more aggressive pricing policies for government fees are increasing the cost pressure on airlines.

- *Substitutes*; Government policies affecting the attractiveness of alternative modes of travel or communication affect the impact of substitutes on airlines. Cumbersome security procedures on airports make air travel less attractive.
- *Threat of new entrants*; Government policies limit market entry in some cases, especially on international connections but also on some domestic markets outside of the US and Western Europe. Restrictive rules on FDI and M&A create additional limitations to exit and the emergence of new business models.
- *Bargaining power of consumers*; Consumer protection laws strengthen the bargaining power of consumers. They create the framework under which websites (airlines, aggregators) operate. They also affect airlines' cost levels in terms of compensation rules for delays, etc. Countries like the US require government employees and contractors to fly on national carriers. Visa rules and other requirements affect the ability of individuals to travel.



**Chart 41: Government influences on industry profitability**

Source: Michael Porter

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## 1.2.5 Implications

The analysis above reveals the deep underlying challenges the airline industry in achieving attractive economic returns. The industry's low profitability is due to fierce, price-dominated rivalry among established and new competitors. Price sensitive consumers and a few powerful supplier groups capture almost all of the value that airlines create. The availability of substitutes, including customers who do not need to travel, further limits the ability of airlines to avoid this leakage of value.

The intense rivalry and frequent entry in the airline industry are driven predominantly by the underlying economics of the industry: Product features (perishable product, a commodity 'factory' providing the core transportation service, a cost structure with low marginal costs per passenger and fixed costs per available seat mile (ASM) that are decreasing in airplane size), demand profile (high volatility of demand; individual customer value increasing in connection frequency) and the nature of capacity adjustments (time lags in adding aircraft/ infrastructure capacity; stepwise changes in capacity; capacity can easily be redeployed to other markets; capacity leaves the market only after decades) creates incentives to drive prices down to marginal costs and aggressively increase capacity when demand prospects are high.

### **Other industries share similar characteristics, but airlines are uniquely challenged**

While the combination of factors that drive the economics of the airline industry is unique, its individual elements are not. Many service industries provide a perishable good, from hotels to health care providers. High fixed costs are present in even more industries, whether they are highly capital- (automotive), R&D- (pharma), or marketing- (consumer goods) intensive. Slow and stepwise changes in capacity with are features of, for example, shipping lines or commercial real estate. A positive association between the breadth of the offer and customer value is typical for network industries like telecommunication services or credit cards.

Why, then, are these other industries doing better than airlines, many by a large margin? Our analysis reveals that government policies, strategic choices by airlines, and the behavior of suppliers all play a role.

### **Partial deregulation places the industry in the worst possible world**

One key reason is the nature of government intervention. Airlines operate in a semi-liberalized market environment, where the remaining restrictions are often a legacy of the pre-liberalization period rather than the reflection of current public policy objectives. Price setting and capacity choices are increasingly liberalized. But company structures, i.e., choices about which markets to serve within the boundaries of one firm, remain restricted in many ways, particularly for international travel. And exit barriers inhibit the market selection processes that allow more-productive companies to grow and force less-productive companies to improve or disappear. Restrictions on cross-border investments, the nature of bankruptcy procedures, and subsidies for failing airlines are some of the key barriers that keep the industry from adopting a more effective structure. As a result, the airline industry competes with pre-liberalization company structures in a post-liberalization market place.

In addition, liberalization has substituted a highly controlling policy approach with a mixture of often conflicting individual interventions. When governments privatized airlines, they let labor unions gain powerful positions to gain their approval rather than creating an efficient market structure. When governments privatized airports, they looked at maximizing revenues rather than the overall value created in the industry. When governments are concerned about environmental costs or air service to specific locations, they focus on narrow regulatory solutions or political pressure instead of creating a market environment in which airlines have an incentive to serve these objectives.



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## Airline strategy choices have exacerbated the problem

Another key reason is the pattern of behavior within the industry, both by airlines and by their suppliers. Too many airlines are focused on volume and yield, rather than on margin. They compete on size and network breadth, rather than on differentiation. And they take a myopic view on the consequences of capacity expansion. There are always reasons for why these choices appear to be individually rational; they avoid capacity left unused, increase short-term profitability of cash flow, and create first mover advantages. But on aggregate they contribute to a market environment that is worse for everyone. Two good examples are the drive to improve yield management and the growing outsourcing of activities:

- Yield management, i.e., the short-term management of prices to maximize revenue per available seat mile (RASM), and price discrimination, i.e., the pricing of the same underlying transportation service by bundle, time of purchase, rebooking conditions, etc., are important tools to improve airline profitability. But their extensive use, driven by the availability of increasingly sophisticated technology, has been associated with chronically low profitability: It is likely that these very practices have actually had a negative effect on industry structure. Frequent price changes have reduced the transparency of prices, leaving customers constantly uncertain about whether they got a 'fair price'. This drives customers to aggregator websites looking for a 'better deal', focusing them on price as the key product feature. The ability to extensively discriminate prices for the same actual service, especially through bundling, has enabled (and forced) airlines to be more aggressive rivals, pricing closer to marginal costs more often.
- Outsourcing has been one of the key mechanisms to reduce costs in the short run. But it has negative longer-term effects on industry structure: It gives less control to airlines over their value chain, reducing the potential for differentiation. It harmonizes cost structures and service levels across airlines, reducing competition to price. And it further reduces entry barriers into the industry.

## Supplier behavior has reinforced excessive capacity competition

Supplier behavior creates further challenges: aircraft manufactures, often supported by government subsidy, push equipment into the market, exacerbating the (to some degree inherent) overcapacity problem and reducing entry barriers. They are able to force airlines to take on the market risk of volatile demand, leading them to make more aggressive and short-term competitive moves. Banks provide debt financing for new aircraft which can be easily redeployed to other markets, encouraging aggressive risk-taking through entry and capacity buildup. Investors look at airlines as speculative trading opportunities, driving airline management to adopt an overly short-term view. Labor unions create incentives for entry and operations under bankruptcy protection. Airports' capacity and operational choices reduce airlines ability to adjust capacity, encouraging them to hold on or extend capacity even if it is unprofitable just to avoid losing it to rivals.

Some of these drivers of the airline industry profitability are in flux; government policies are changing, and industry structure is already adjusting. Others will only change if concerted action is taken.

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## 1.3 Different angles of view

### Why are low-cost airlines doing (somewhat) better?

The comparison of segments provides further insights into the dynamics of industry structure. The key difference is between network airlines and low-cost airlines. Low-cost airlines are more profitable and are among the list of the most profitable airlines overall. But on average they still do not cover their cost of capital. Why are they doing better, and why is that better performance still relatively disappointing? There are three main reasons for why the industry structure for low-cost airlines is more attractive than for their network peers:

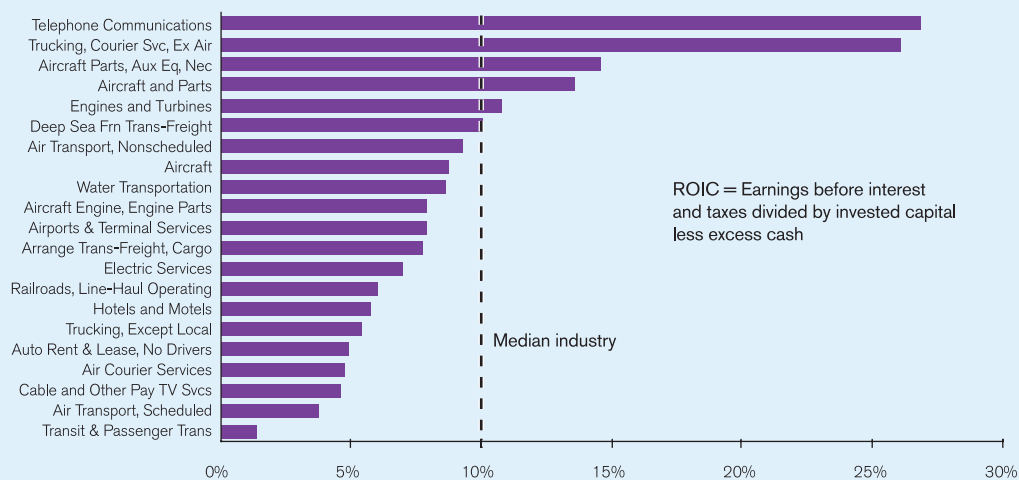
- *Exit has occurred*; while the example of Southwest and Ryanair has triggered many copycat entrants, there were no barriers for exit. This has led to a shakeout of low-cost airlines that allowed the remaining companies in this segment to achieve more sustainable profit rates.
- *The point-to-point business model reduces the room for excessive price discrimination*; network airlines price the same connection very differently if it is part of a bundle of connections. As was discussed above, the ability to do so creates additional risks of aggressive rivalry in price setting that leaves all airlines worse off. Low-cost airlines with their point-to-point system do not face this additional challenge.
- *Low-cost airlines face systematically weaker suppliers than the average network airline*; some of these advantages are related to the business model of low-cost airlines, some to their lack of legacy structures. Low-cost airlines often choose secondary airports where they are in a good position to negotiate favorable conditions. Low-cost airlines run only a limited number of aircraft types, often just one, which increases their purchasing power versus aircraft producers. And low-cost airlines have been able to create non-unionized workforces with lower wage levels, often also by hiring staff in less-prosperous regions – in the US this has been found to account for about 45% of the cost advantage between LCCs and network airlines.
- *Low-cost airlines have created a distinct value proposition*; while network airlines use one ‘factory’ to offer different products to different customer groups, low-cost airlines have been able to organize themselves around providing one key consumer benefit: low prices.
- *Government policy* has provided some benefits, especially through lower costs/subsidies for using regional airports and none of the requirements to serve unprofitable connections that burden some legacy airlines. More recently regulators have become more active in reviewing airport fee subsidies and some of the pricing policies of LCCs, especially in Europe.

While these advantages exist, low-cost airlines are not immune to the challenging economics of the industry: the underlying cost economics are the same, creating pressure to price close to marginal costs. This suggests that it is not low costs that explain the somewhat higher profitability of low-cost airlines, but the slightly more attractive market structure that allows them to keep margins up a bit more. The shorter history of LCCs on average also plays a role, enabling cost advantages available to new entrants. Interestingly, low-cost airlines make more money from ancillary services than from ticket sales alone. Low-cost airlines also face challenges when generating future growth requires them to change their business model and when wage costs increase over time; both of these effects are already visible for Southwest. And the advantages related to their age will inevitably disappear over time.



## Learning from other industries

Some elements of airline industry structure can be found in other industries. Network economies also occur in utilities, telecom, railroads, cable network providers, delivery services, and banks. High cyclicity of demand with slow adjustment of supply is present in areas such as commercial real estate, hotels, and pulp and paper. A highly fungible asset base is present in car rental services and shipping lines. The figure below shows long-term average profitability by industry for the 1999-2009 period. This data shows that airlines are among the least profitable of all industries, a result which has been true for decades.



**Chart 42: Profitability of selected industries 1999-2009 ROIC, Global Data**

Source: Compustat – Michael Porter

While a full analysis of similar industries is beyond the scope of this paper, the comparisons are suggestive of some preliminary observations:

- The existence of overcapacity is not sufficient to explain low airline profitability; it exists in many industries with similar characteristics as airlines but that are more profitable.
- The presence/absence of entry barriers is likely to be a major impact; among the similar industries examined, entry barriers are crucial in explaining profitability.
- Competition among business models with differentiated strategies can improve industry structure, even when the underlying economics are challenging.
- Low exit barriers are key to enable different business models to emerge and consolidation to occur.

## Network industries

Network industries that provide perishable goods have low marginal costs to serve an additional customer, combined with stepwise increases to expand capacity (e.g., higher-cost power plants have to be brought on line). Such industries have traditionally been heavily regulated and are currently at different stages of liberalization. The level of differentiation of services among companies is usually moderate. Such industries almost always have overcapacity in the system. Substitutes exist but usually play only a moderate role. All these characteristics bear some similarities to airlines.

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However, there are important differences: Assets in such industries are truly sunk, i.e., the network infrastructure cannot be easily redeployed to other geographies as in airlines. Demand growth is roughly proportional to changes in GDP and thus much less volatile than for airlines. Entry barriers are for some significant because of economies of scale in production and licensing, not just marketing and the purchasing of major inputs. Customers and suppliers tend to have limited power, unlike in airlines.

These differences with airlines turn out to enable significantly higher profitability in most network industries than in airlines. Curbing market power arising from high-entry barriers becomes a key policy challenge.

### Car rental services

Car rental companies, like airlines, provide a perishable good with low marginal costs in serving an additional customer. Car manufacturers traditionally provide huge volume discounts, pushing rental companies to add to their fleets. Barriers to entry are low, especially for local players. And, maybe most importantly, the assets involved in car rental can be easily redeployed to other markets. Demand is often highly volatile demand, like the demand for business travel on airlines. The level of product differentiation is usually moderate. There is almost always overcapacity. The main substitute is using other modes of transport, or not travelling.

Unlike airlines, however, competition is fully liberalized. There are few barriers to exit and consolidation, nationally as well as internationally. As a result, a small number of industry leaders exist. Customers and suppliers tend to have limited power.

The profitability of the car rental industry is low, though not as low as airlines. Focused players do somewhat better.

### Shipping

In many ways, shipping comes closest to being an analogy with the airline industry. As in the other industries discussed above, shipping companies provide a perishable good with low marginal cost in serving an additional customer. Like airlines, they have significant stepwise cost increases when adding a new ship but only limited operational economies of scale in fleet size. Costs per tonne are falling with ship size for a given type of cargo, creating incentives to operate larger ships. Shipbuilders are heavily subsidized and push capacity into the market. Ships can be easily redeployed to other markets, and leave the market only after a long life. Demand for shipping is highly volatile, driven by the business cycle. The main substitute is using other modes of transport, or avoiding the need for transport.

Unlike airlines, however, competition is fully liberalized. There are few barriers to exit and consolidation, nationally as well as internationally. A significant number of differentiated business models have emerged, involving specialization by type of cargo (container, bulk, oil, gas, cars, etc.) and the type of ships used (new vs. second-hand). There is also specialization by geographic scope: local feeders and global connectors are usually not integrated. In the international market, there is some consolidation with a number of large shipping lines dominating different segments. Local markets are still largely fragmented. Customers and suppliers tend to have limited power.

Profitability in the shipping industry is volatile and has historically been below the average of the overall economy, even though it has come close over the last decade before the recent crisis. The industry has outperformed airlines over the cycle.

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## 1.4 Improving airline profitability: towards a path to sustainable industry returns

The previous chapter has decomposed the reasons for the airline industry's low average profitability, many of which are well known in the industry. But how can the current dynamics be changed? This chapter is devoted to developing actionable recommendations that would improve the structure of the airline industry. This is an ambitious objective and there is no certainty that such a set of such recommendations exist.

This chapter is organized around four key questions:

- *Why is airline profitability important for other stakeholders besides airlines?* While airlines have an interest in improving their profitability, the case has to be made why other stakeholders should be concerned.
- *Is industry structure already improving?* Industry structure is constantly evolving. Actions are only necessary if the industry is not 'self-healing' or moving towards a more attractive structure as the consequence of ongoing changes in underlying economics, the policy environment, or the behavior of companies.
- *What actions could improve industry structure?* The previous chapter has identified the key drivers of low airline industry profitability. What feasible steps would address these structural problems? Actions will only be effective if they address the root causes.
- *How can the industry win support and mobilize action?* Actions to improve industry profitability need to be feasible, not just effective. The industry needs to convince other stakeholders to take steps that are consistent with higher airline profitability. And it needs to convince individual airlines in the industry that the changes envisioned will be in their interest, not just benefiting the industry overall.

### 1.4.1 Why does airline profitability matter?

Low airline industry profitability is only a problem for other stakeholders if it has societal costs. These costs could be related to underlying problems for which low airline profitability is a symptom, or they could be the result of choices airlines make as a consequence of low profitability.

- Low profitability can lead to a reduction of service quality and reliability. Airlines under pressure to reduce costs may reduce expenditures related to service and reliability. This may be one of the reasons for the low esteem in which airlines are held by consumers, despite low prices.
- Airlines are also pressured to increase utilization rates, and average load factors have climbed to 77%. Load factors above a certain level reduce the service experience, create delays, make reservations difficult, and lead to passengers bumped from flights. Signs of this are visible in many markets. Excessive load factors also lead to an automatic reduction in service quality. It might also lead to lower reliability as airlines' operations have less 'slack' to react to external shocks in terms of bad weather, etc. Such issues regularly flare up when consumers press for policy changes in the wake of major service disruptions.
- Low profitability results in a financial burden for governments through bailouts, subsidies, etc. For unprofitable airlines to remain in the industry, someone has to cover their operational losses. In many cases, governments have ended up paying the bill. In others, employees lost their pensions or were forced to take on airline equity instead.

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- Low profitability can inflict costs on employees in terms of bankruptcies, pension losses, layoffs, wage cuts, and requirements that employees take equity instead of maintaining salaries.
  - Low profitability can potentially constrain capacity growth and thus access to service. Chapter 1 touched upon the considerable benefits that communities and locations gain from airline transport connectivity. If airlines are under severe profit pressure or lack the financial resources they may pare back routes and only serve high-density markets. So far, most industry observers are concerned about too much capacity (growth), not too little. There has been capital available so far (both debt and equity) to finance capacity expansion. However, service cutbacks are a reality, especially in mature markets.
  - Fragmentation that is associated with today's low profitability also has significant costs. Fragmentation into many smaller companies leads to use of less-efficient small aircraft, more congestion, higher operational costs and greater environmental impact. While there is limited overall data on these costs, there is evidence that mergers have resulted in significant reductions in the size of fleets while maintaining the overall level of transport service. The benefits of greater consolidation in terms of congestion, emissions, and efficiency have been substantial.

These challenges have so far been seen more as signs of inefficiency or poor choices by airlines. Consumers and the broader public tend to view delays, cutbacks of service, and intransparent pricing as choices by “powerful” airlines to capture value at their expense. The public has little awareness of the disastrous profitability of airlines compared to virtually all other industries. Economists and regulators remain concerned with airline market power, despite the fact that low profitability signifies an absence of market power. Airlines have far less market power than firms in most other industries. Airline alliances, loyalty programs, fuel surcharges, and the use of hubs are viewed with suspicion. While market power exists in some specific niches, the low level of overall profitability despite dramatic reductions in costs and prices suggests that market power (or its abuse) is not a significant problem in the industry. Indeed, it is an artificial barrier to consolidation and subsidies that are the greater public policy challenge.

This discussion suggests that the industry must fundamentally change the way it engages the public and governments. Currently, low airline profitability has not been a concern for other stakeholders. However, it has real potential costs for all stakeholders. The current structure of the industry is artificially constrained. Removing these constraints should be a shared concern for airlines and other stakeholders.

The airline industry needs to become more aggressive in exposing the market distortions that are driving its poor performance, especially policies of government. But such efforts will only be successful if they focus on reducing the societal costs of the current poor airline industry structure, not just raise the profitability of airlines. And this will only be the case if the actions recommended will lead to greater value creation, not simply redistribution from consumers to airlines.

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## 1.4.2 Is industry structure already improving?

Airline industry circumstances have changed significantly over the last three decades. Major markets have been deregulated, technology has become more efficient, and millions of new consumers have reached income levels at which airline travel becomes affordable.

The role of governments in the airline industry is also changing. The most visible changes are in the OECD countries. The tight fiscal position of many governments is reducing their willingness to rescue failing airlines. In some countries, governments have even imposed new taxes or fees on the industry.

Some governments and competition authorities are becoming more willing to let market consolidation happen, even if that means some reduction in the number of rivals or the loss of a flag carrier. Easier exit will create room for more successful and more efficient business models to gain market share. It will also reduce the incentives for aggressive capacity expansion, which depends on risk mitigation by government bailouts.

The outlook for demand growth in the industry is also changing. Fuel costs are on the rise following the temporary moderation during the global economic crisis. Emission charges are likely to go up. If these higher underlying costs are not compensated through technological improvements, which is likely to be the case, prices will have to rise with negative consequences for demand. Bottlenecks in infrastructure are another constraint to demand growth. Infrastructure extension is, at least in the OECD countries, increasingly hard to achieve politically and harder to finance. Slower demand growth in mature markets will reduce the incentives for aggressive capacity expansion there, forcing airlines to compete on other dimensions. In the growth markets, capacity expansion will continue and there is less clarity on the market structures that will emerge.

Finally, the profile and behavior of airlines is changing as well. Airlines aligned with global alliances might reduce fragmentation. In the OECD countries, mergers among major carriers are occurring, even though most international agreements that limit cross-border mergers are still in place. Some smaller-network airlines are becoming feeder networks for large-network airlines. International long-haul and domestic short-haul are increasingly being served by different entities. While it is not clear which models will ultimately survive, there is a trend towards more differentiated business models in the industry. In addition, some airlines are becoming much more explicit in their focus on profitability rather than unbridled growth.

All of this can have a meaningful impact on rivalry in the industry. Airlines might increasingly compete not on price and volume alone but differentiate their product along multiple dimensions. New kinds of competition would increase value to consumers but also provide more opportunities for airlines to capture part of that value creation.

We believe, however, that it is unlikely that the above changes are strong and rapid enough to make a major impact on industry structure in the near future. Also, there is no overall roadmap that would guide the multiple steps needed by airlines, governments, and other stakeholders to address the industry's structured problem. The different and often conflicting policy signals that airlines face across countries and government agencies as a result create additional barriers against a coherent change of strategy. Realistically the airline industry cannot rely on existing trends alone to dramatically reduce the structural challenges it is facing.

### 1.4.3 How failures in airline industry structure can be overcome

The analysis in chapter 2 lays the foundation for actionable recommendations to improve airline industry performance. To be successful, recommended actions must meet the following tests:

- *Improve industry structure*: enable airlines to capture a fairer share of the value they generate.
- *Be attractive to multiple stakeholders*: e.g., increase value for other actors whose support is needed if airline industry performance is to improve.
  - E.g., better customer service and satisfaction
  - E.g., simpler pricing for consumers
  - E.g., reduced costs of fragmentation
  - E.g., reduced congestion, delay, environmental impact
  - E.g., fewer layoffs and more predictable wages for workers
- *Not reduce the level of competition*: shift the nature of competition to be more positive sum and thereby allow airlines to share in higher overall value.

The solution to the low profitability problem of the airline industry has to come from changing the *nature of competition*. Competition needs to create more value for customers and society in ways that allow airlines to better share in that value.

#### 1.4.3.1 Reduce artificial barriers to exit and consolidation

The most pressing problem of airline industry structure is high barriers to exit which restrict both ceasing operations and merging with another entity. The issue is keeping capacity in the market (airplanes do not disappear just because their owners have gone bankrupt) and market structures need to remain competitive. The problem is that artificial barriers to exit do not allow market forces to work and keep inefficient companies in the industry and maintain inefficient use of capacity. Lowering artificial barriers to consolidation and exit will allow more efficient companies to grow and new business models to flourish. Lowering barriers to exit will also support competition on service and not just on price.

The following five steps would reduce artificial barriers to exit and consolidation without leading to undue industry concentration:

- *Eliminate government subsidies for airlines*, allowing unsuccessful carriers to exit the market.
- *Remove barriers for cross-border investments in airlines*, allowing more efficient owners to grow and more international/global airlines to emerge.
- *Liberalize existing bilateral air service agreements/remove cabotage restrictions*. This opens up competition, increasing pressure on low-performing carriers, creating greater market opportunities for more efficient airlines to grow, and allowing new international/global airlines to emerge.

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- *Sharpen bankruptcy procedures*, requiring a substantial change in control, management and operations, not just a write-down of costs.
  - *Review competition policy procedures*, to allow mergers if they increase customer value through productivity gains while barriers to entry remain low to new carriers.

All of these recommendations will require policy changes by government. The key challenge is to encourage concerted policy changes across countries, not just unilateral moves. This need is most obvious for cabotage rules, cross-border investment rules, and the renegotiation of bilateral air travel agreements. However, there are still many subsidies and the need for competition policy changes.

Such policy changes are politically much more likely if they are done by multiple countries in concert. However, steps towards a more liberal market can undermine competition if other barriers to competition remain, a classic result of second-best welfare economics.

### 1.4.3.2 Reduce artificial incentives for entry and capacity expansion

Another harmful set of policies exacerbates the natural industry tendency towards overcapacity through creating artificial incentives for entry and capacity expansion. We want new entry to be open, and to challenge to existing market positions based on higher productivity and new business models. The problem is that many current policies distort these market forces and erode profitability even for those airlines that create the most value for customers. Artificial incentives for entry and capacity expansion also drive competition towards only price rather than on a broader range of dimensions.

The following four steps would enable more rational choices about entry and capacity adjustment:

- *Reduce government subsidies for aircraft manufacturers*, eliminating hidden subsidies that lead to too many aircraft and uneconomic financing of aircraft. Some aircraft manufacturers that are not viable stay in the market.
- *Remove government subsidies for airlines*, reducing their ability to engage in excessive/predatory capacity expansion based on public funding or risk guarantees.
- *Sharpen bankruptcy procedures*, reducing the incentives for excessive capacity expansion.
- *Modify labor policies* that impose extra costs on legacy airlines compared to new entrants and airlines under bankruptcy protection. Limit excessive power by some labor unions to disrupt key airline hubs and impose high costs of airlines that must be passed on to consumers.

Some of these recommendations will require government action through new international agreements. Others depend on the willingness of labor unions to renegotiate existing contracts, balancing possible short-term losses against the long-term opportunities of a more healthy industry structure.



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### 1.4.3.3 Change the way airlines compete

While governments, suppliers, and industry economics have had much to do with the current airline industry structure, the way airlines compete has exacerbated the problem. Too many airlines compete narrowly on price and capacity. Too many airlines make decisions about pricing and capacity with a short-term perspective, overlooking the longer-term implications on industry structure and ultimately their own ability to earn an attractive return. While other industries face financial market pressure, this pressure is particularly challenging given the poor industry structure of airlines.

The following steps would shift the nature of competition in the airline industry from a short-term focus on price and capacity towards service and a broader set of dimensions of customer value:

- *Develop a shared understanding of the current industry structure.* Industry participants must understand the full economic costs of the current structure (e.g., write-offs, bankruptcies, subsidies, job losses) and the consequences of the current structure for customer satisfaction, service, environmental impact, etc.
- *Set pricing and capacity decisions based on longer-term profitability,* reducing the tendency for competition to be focused on price at the expense of service, brand, and other dimensions.
- *Contract with suppliers* in a way that reduces fixed costs or shares the demand risk, to enable more rational choices about capacity and pricing.
- *Simplify the pricing model* to better link price and service quality, and discriminate less among customers receiving a similar service.
- *Explore a broader range of service and business models* to encourage competition to occur on many different dimensions, not just price.

These steps require action mostly by airlines themselves. Some of these changes only make sense if they are pursued by multiple airlines. If there are individual incentives to cut price or add capacity in the short term, such industry progress is hard to achieve.

Realistically, it will require leading companies to be willing to take a first step in these directions. Leaders are best positioned to benefit from such changes, whether or not others decide to follow.

### 1.4.3.4 Reduce unnecessary system costs through policy changes and better coordination

Airlines have taken significant individual steps to reduce their costs. IATA has organized collective efforts in areas like e-ticketing that have led to huge industry savings. But the lack of cooperation across all stakeholders has led to many choices that not only raise airline costs but also create an unnecessary burden for society.



The following steps could reduce costs, lower congestion, and improve environmental impact. This would create benefits for all, even in the current industry structure. Importantly, the failure to address these challenges would be seen as a failure of airlines, even though airlines are at best partly responsible.

- *Rationalize and improve the air traffic control system* to reduce its direct cost to airlines and its indirect costs in terms of fuel costs, the environmental impact of unnecessary fuel consumption and noise, and delays for customers.
- *Reduce the cost and delays of the airport security system* by coordination between airlines and security authorities to pool passenger data to better match security costs and risks.
- *Shift the nature of contracts between airlines and suppliers to enable more risk sharing and flexibility in capacity adjustment.* This would reduce the level of overinvestment and the societal costs associated with excess capacity in the presence of significant exit barriers.

#### 1.4.3.5 Recommendations to avoid

Almost as important as identifying what to do is gaining consensus on steps that will not have the intended effect. Steps that fail to change industry structure will not ultimately succeed. Nor would changes that benefit airlines alone and not other important stakeholders be feasible.

- *Further cost cutting within airlines with no change in structure:* massive cost cutting has already occurred over the last few decades, especially in the mature markets. Yet all the benefits have essentially been passed through to customers.
- *Adding new related revenue streams per se:* this has been done already in mature markets and by LCCs. LCCs are charging for previously free services and selling additional products/services to their customers, amounting to roughly 20% of ticket sales. However, there is little evidence that this fundamentally changes the structure of profitability.
- *More lenient competition policy to give airlines more market power;* this would increase airline profitability but shift value from consumers to airline owners, and lack of effective competition would reduce the overall amount of value created for the economy/society.
- *(Re-)regulation to administratively set prices and limit capacity:* this could increase airline profitability but would lead to major inefficiency and lack of innovation. It would also significantly destroy value for the broader society as airline services are cut back and service becomes more expensive.

#### 1.4.4 Conclusions: moving to action

This paper seeks to support a discussion on how to solve a very challenging problem. It does not outline a quick fix. If such a quick fix would exist, the industry would have implemented it a long time ago. Instead, it provides a serious analysis of the root causes of the low profitability in the airline industry and develops a set of action recommendations that offer a realistic path forward. As the industry ponders how to react to these recommendations, there are a few key enabling factors:

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**The airline industry needs to invest in coherently documenting the benefits it provides in the global economy.** The broader public and politicians currently take airlines largely for granted. Many politicians, especially those in less-prosperous economies, view air transport as a nonessential luxury service despite its fundamental performance to their economic development. Yet the evidence on the value created by the industry is striking. Also, many of the economically most successful cities in the world rely heavily on a competitive airport and many airline connections, usually in a liberal regulatory environment (e.g., Dubai, Hong Kong, Singapore). Countries like Costa Rica have benefited tremendously from opening their air transportation market. The industry needs to make the case that it is, in fact, a powerful tool for economic development.

**For change to happen, it is crucial that the airline industry frames its efforts as a campaign to reduce the societal costs of poor industry structure.** Consumers, governments, and suppliers are concerned about some of the consequences and root causes of low airline profitability. The airline industry needs to invest in documenting the societal costs of the current industry structure, not focus on low airline profitability per se.

**All recommendations need to be motivated by documenting the benefits for each stakeholder asked to act.** While much of the debate is led in terms of the overall industry, most changes involve individual countries or companies. What is important is improvement in service, less congestion, less environmental impact, greater economic development, etc. Among airlines, a new industry structure will for some create opportunities to significantly improve profitability while for others it will mean exit from the industry. Across governments, some will see a new industry structure as an opportunity for enabling growth, while others will fear losing jobs and influence.

**The action agenda should build on the positive trends already under way.** This paper outlined a number of trends that are likely to enhance industry structure (evolution in policy, shifts in demand). While these trends are currently strong enough to substantially alter industry structure, the action agenda should leverage and strengthen them wherever possible.

**The action agenda needs to be communicated by the airline industry ideally through one voice.** The airline industry will only be able to mobilize action if it makes its position clearly known. In the past, however, individual airlines have sought to improve their respective position, while the collective interest of the industry is obscured. Multiple groups represent different parts of the industry but no one focuses on the collective interest of all. This will need to change if the steps discussed here are to be implemented.

**To build momentum, initial focus should be on steps that can be taken by IATA, individual companies, or more enlightened countries.** This paper discusses a mix of actions, some by individual actors and others requiring extensive coordination, sometimes across multiple countries. Momentum is most likely to build through steps that are either within the mandate of IATA or can be taken unilaterally.

“ One thing is absolutely certain:  
the passenger market will  
expand and diversify beyond  
our wildest dreams by 2050 ”

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# Section 2. Consumer

## 2

## The customer of the future

Vision 2050 participants were presented with a 'thought piece' on the Customer of the Future, produced with the assistance of Ben Page, CEO of Ipsos MORI. This thought piece is included below and formed the basis of the discussions in Singapore.

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### 2.1 Discussion highlights

The discussions avoided focusing too closely on specifically how many billion passengers will be carried by air in 2050 and instead concentrated on the more basic certainty that the passenger market will expand and diversify significantly by that time. As air travel becomes accessible to more regions and sections of society, it was agreed that airlines of the future would have to market and provide their services to a far more heterogeneous customer base. For example, while falling birth rates mean that future Western demographics might well tend towards a 60 years+ majority, the population explosion in developing nations is logically more likely to come from the bottom up. To successfully adapt to these changes, airlines' marketing strategies will have to be refined from the current broad-based orientation towards focused segmentation, from mass customization to insight-driven development and from mass marketing to differentiated branding.

A further point of lively debate was how the industry will ensure it keeps ahead of the rising demand curve. Training enough skilled manpower was raised as one concern – possibly requiring government intervention to ensure safety standards are maintained. However, the recent rapid expansion of the air travel industry in China and the USA, accompanied by decreasing accident rates, were given as examples that this could be successfully achieved.

Airport capacity was identified as potentially the greatest impediment to the airline industry's ability to satisfy customer demand in 2050. The UK government's refusal to permit the construction of a third runway at London Heathrow indicates that airport expansion is already a highly contentious subject in Western liberal democracies. In contrast, China is in the process of building vast numbers of airports. It was suggested that Western governments, in particular, may seek to address problems caused by capacity constraints through re-regulation, rather than infrastructure improvements. To counter this, it was proposed that industry still has much to do in communicating its needs and convincing government of the economic benefits airports bring to local communities.

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## 2.2 Thought piece: an optimistic view of the customer of the future

Produced with the assistance of Ben Page, Ipsos MORI

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### 2.2.1 The world in 2050

The global population has grown from 6.9 billion to 8.9 billion in the past 40 years. But birth rates in general, and particularly in the developed world, have continued to decline over the same period and radical new healthcare technologies have resulted in the average life expectancy in the developed world increasing to 99 years.

The global economy has also seen reasonably steady growth over the past 40 years, with the GDP of the G20 countries increasing from \$38 trillion in 2009 to \$170 trillion today. China became the world's largest economy just over 15 years ago and today China, India, Brazil, Russia and Mexico account for just over 50% of the GDP of the G20 countries. Indonesia, the Philippines, Vietnam, Iran, Turkey, Chile, and South Africa are not far behind.

New technology has revolutionized the way that people live their lives. Access to information in real time at any time of the day and anywhere on the planet is now a more widely held expectation. Virtually all people manage their lives using Lifestyle Integrated Management Pods (LIMPs), which are small portable devices containing all necessary personal data related to their owners. All LIMPs are allocated at birth and managed by parents until individuals reach 16 years of age.

LIMPs incorporate a real-time link to Internet 8, the global integrated communications and lifestyle management matrix. Through LIMPs, individuals can manage literally every part of their lives, including all communications, entertainment, business, commercial and information needs. They contain all biometric data and allow individuals to constantly monitor their own health and, to a certain extent, fix health problems that arise. They incorporate a means of contacting every other person on the planet that has their own LIMP. They facilitate the buying, selling and shipping of goods from any point to any destination and the ability to know precisely where those goods are every second of their journey. They provide a single portal for accessing all desired forms of electronic entertainment, including the ability to spend time in custom-designed or community-based virtual reality "lifestyles". They also provide access to information, including audio/video coverage, in real time of virtually every event that is taking place anywhere on the planet at any one time.

Both economic development and technological advances have changed the shape of global geopolitics for the better. After the turbulent period between 2010 and 2030, when tensions relating to ethnicity, religious beliefs and natural resources threatened to become unmanageable, global geopolitics have become generally more stable. Economic development in different parts of the world has generally resulted in greater economic parity amongst states, although the distinction between developed and developing still exists, and technology advances have facilitated real-time diplomacy. However, tensions between different states still exist over a number of issues. For example, concerns over fresh-water supplies are a cause of some tension even though 80% of the population now derives 80% of its drinking water from desalination plants. In addition, there are still disillusioned non-state-sponsored groups that are inclined to use violence to further their causes.

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## 2.2.2 The airline industry in 2050

An industry that carried 2.4 billion passengers and shipped 40 million tonnes of goods in 2010 carried 16 billion passengers and shipped 400 million tonnes of goods this year. Air transport has grown at almost twice the rate of GDP expansion, meaning that more people are travelling than ever before and more frequently than ever before. Global advances in general technology have been mirrored in the airline industry, which has made the sector unrecognizable from what it was in 2035. Travelling by air is faster (when desired), safer and more seamless than ever before.

Unsurprisingly, mobile technology available to air transport consumers is also affecting their behaviour when they travel. LIMPs mean that they have the ability to effortlessly and seamlessly change itineraries as and when they see fit. Passenger information and transfer offices are a thing of the past. And fortunately so are queues. In-flight entertainment systems are also no longer present on most aircraft, because passengers have all of their personal audio, video or virtual entertainment needs to hand and available to take on board, downloaded directly from Internet 8, which automatically charges them the correct amount.

Vastly improved high-speed train networks are now the norm in developed economies. As such, the train is often the preferred alternative for journeys of fewer than 500 miles. But for customers wishing to travel longer distances, air travel remains the only option available.

The shipment of cargo has been equally revolutionized. Businesses rarely have corporate centres anymore and manufacturers move their operations from one site to another with increasing regularity as labor and raw materials are more easily available anywhere and at any time. So as with passengers, cargo operators have had to evolve their operations based on the need for ever-increasing flexibility and customization. Individuals with shipping needs have also come to enjoy the benefits of greater flexibility and customization.

## 2.2.3 Who are our customers in 2050?

The general aging of the world population has resulted in airline customers being on average older than ever before. However, healthcare advances mean that even though our customers are older, they are not necessarily less mobile.

Younger travellers are significantly more aware of air travel and more worldly-wise than previous generations. Many are frequent fliers by the time they have learned to talk. As a result, most 4-5-year-olds have already established preferences about air travel, including brand loyalty. Historically, as children become adolescents, their tastes and values relating to many parts of their lives change. In 2050, and because of their extensive experience of air travel by the time they reach adolescence, such changes in preference are mirrored when it comes to air travel. This shift now provides new opportunities for companies to generate brand loyalty amongst a new generation of travellers.

Younger travellers are also much more technologically advanced than ever before. They have never known a world in which virtual reality was not present, and thus even have difficulty imagining a world in which it is not possible to control or at least influence one's own reality. They also take for granted the speed with which communication is possible and the sheer volume of communication taking place. This demand for technology is central to every aspect of their lives.

Increased access to advanced communications tools and the widespread use of social media have resulted in individuals and businesses having increasing networks of global friends or business contacts. But no technology has been able to replace the human-to-human contact facilitated by air travel.

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Forty years ago the industry's two largest markets were still the United States and Europe. But this has not been the case for a long time. The shift eastward started early in the century supported by strong growth in China and India. When Indians started travelling with the same propensity as North Americans, that market alone jumped to four billion passengers. A similar leap has already happened in the likes of Brazil, Russia, and Mexico. It is starting to happen with Indonesia, the Philippines, Vietnam, Iran, Turkey, Chile, and South Africa. The result is an increasingly socially, culturally, and ethnically diverse pool of customers, with increasingly diverse demands based on their culture, social background, or ethnicity that wish to visit an increasingly diverse range of destinations. In turn, operators have made their product offerings equally diverse to cater to such an array of demands. This has been best achieved by the truly global operators with highly developed loyalty programs.

Increased access to information has also led to our customers being better informed than ever before. And better informed customers are more demanding customers.

### 2.2.4 What are our customers' priorities in 2050?

In 2050, safety and security are still top priorities for passengers, but the increasingly rare nature of safety and security incidents means that these priorities are less frequently reinforced. Safety in particular is less of a concern, as automation and new technology have continued to revolutionize safety standards. The same technology has meant that reliability is also something that plays a decreasing role in consumer choice, given that flights are almost always on time and are almost never cancelled. There are still sporadic security threats regarding air transport, but these threats have gradually decreased over the past 40 years, again due in most part to technological advances that have improved the screening and tracking of passengers and cargo.

Price is still a key driver of consumer choice, but access to information has made price transparency almost absolute, which has made price differences between comparable products almost extinct. As such, price has become more of a driver when choosing between different product types, and operators have learned to offer a wider array of products to cater to every need. Whether distinguishing between business and leisure travellers, or between older and younger travellers, today pricing is more reflective of what has become the most precious of commodities: time.

- Business people still value their time above all else and are therefore willing to pay a premium for the fastest available transport options.
- Amongst leisure passengers, technological advances and the elimination of security, customs, and immigration delays have fuelled a large increase in the demand for international and cross-cultural travel.
- Older travellers are seeking greater comfort and convenience, as well as a slower pace of travel. As pension ages have steadily climbed, some retirees have had to become more price conscious than others, but many view the journey as part of the experience as opposed to just a means of getting to their final destination. And for this they are prepared to pay extra.
- For pre-adolescent travellers, priorities have not changed substantially over the past 40 years. The method and the medium may have changed, but these consumers still basically just want to be entertained. Many air carriers have already moved away from investing in in-flight entertainment systems because the majority of pre-adolescents have all of the entertainment they need on their LIMPs.



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- For adolescents, entertainment is also still a high priority, but entertainment that is more about being social than individual. Some operators now offer “adolescent only” sections on their larger aircraft, to enable adolescents the opportunity to meet, play games, and even establish friendships with people of their own age. For these adolescents, this is continuing the shift away from air travel just being a means of getting to their destination; it is making the travel itself an important part of the whole trip.
  - This trend is also the case for young adults, as more and more operators offer the opportunity for them to use their journey to meet and socialize with members of the opposite sex. This has become particularly popular amongst young adults who are travelling in a group, as they are now able to ‘get the party started’ on the aircraft instead of having to wait until they reach their destination.
  - Customers from what used to be called developing economies are trying air transport services for the first time in ever-increasing numbers. Often, their first trips are for VFR purposes, but rising living standards normally lead them into the tourism market, some faster than others. These customers tend to seek the lowest cost transport options. The nearly ubiquitous presence of news and information from around the world makes these passengers more cosmopolitan than their counterparts from developed countries a half-century earlier and, as a result, turns them into international travellers more quickly than ever before.
  - Those customers from developed economies are demanding more and more authenticity and customization. For them, just travelling by air is not enough, they want a personal and unique experience. Having visited every continent and scores of different countries, these passengers are increasingly looking for something ‘extra’, something ‘special’. Week-long ‘Aircations’ (cruises in the sky) have become popular. Space travel is becoming more reasonably priced, although stays in ‘Spatels’ (space hotels) are still reserved for the relatively well off and week-long stays in Space Spas are only for the truly wealthy.
  - One demand that has become consistently high among every type of traveller is customer service. With almost no price differentials between comparable products, operators have been forced to achieve ever greater levels of customer service. In fact, customer service has become effectively ‘atomized’, from mass, to niche, to the individual. And customer surveys have demonstrated that, even though competition is fierce and the difference between customer service levels are minimal, even minimal differences pay dividends to the operators that get customer service right.
  - Ethical consumerism continues to be a growing trend. Once upon a time, environmental concerns had an increasing influence over consumer choices. Whilst aviation’s contribution to climate change has largely been addressed, this kind of ethical consumerism was the start of the trend that now focuses on such issues as the preservation of local cultures and livelihoods. In addition, with widespread economic development across the planet the definition of ‘rights’ has been expanded to include things like annual vacations and minimum lifestyle standards.



“ We must get the entire  
air transport value  
chain working together ”

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# Section 3. Infrastructure

## The future of infrastructure

Vision 2050 participants were presented with a 'thought piece' on the Future of Infrastructure, produced with the assistance of Ashley Smout, CEO Airways New Zealand, and Paul Griffiths, CEO Dubai Airports. This thought piece is included below and formed the basis of the discussions in Singapore. The discussions were separated into two areas: Air Navigation Service Providers and Airports.

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### 3.1 Discussion highlights

#### 3.1.1 ANSPs

It was agreed that the organization of airspace according to functionality, rather than sovereignty, would be a preferable and technologically feasible future development for ANSP infrastructure. It was also agreed that the concept of 'air traffic enablement' would eventually be preferable to the traditional concept of 'air traffic management' as we strive towards highly efficient "perfect" flights. However, the discussions also acknowledged the political obstacles that will stand in the way of these becoming reality.

Political procrastination over the transfer of European airspace management from 39 national authorities to one single central entity was raised as a prime example of governments' reluctance to concede sovereignty over air traffic control. On the face of it, aviation infrastructure efficiency is not an obvious vote-winner and governments even fear the loss of jobs and influence in peripheral regions if air traffic management is centralized.

It was questioned whether a large enough number of governments would therefore be any more willing to hand over airspace management to commercial enterprises. Moreover, it was suggested that an ICAO-set global interoperability standard would be similarly politically difficult to implement, given that the UN civil aviation agency has little influence over the military authorities that still control vast areas of global airspace.

"Big Brother"-style security solutions were considered to be less problematic to implement, if the advantages and necessity for such a system were adequately explained to the travelling public. Indeed, greater emphasis on the improvement of the passenger experience, safety, and environmental benefits were viewed by many to be the key to generating the political will needed to achieve the envisaged infrastructure of the future.

#### 3.1.2 Airports

The idea of all players across the air transport value chain working together to facilitate a smoother, improved passenger experience was well received by delegates. It was suggested that a more heterogeneous airport ownership model in 2050, with the prospect of airline-owned hubs, could already do much to create a more integrated value chain.

Co-operation on services such as duty-free could be one such revenue-sharing opportunity. It was also suggested that airports could unbundle their fees for airlines and that the potential exists for ground transport to be more fully integrated into the air travel process.

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As a major cost in both time and money to both airlines and airports, security was pinpointed as a crucial area for greater collaboration between governments, airports, and airlines. As such, it was agreed that a more cohesive travel process could open up many opportunities for the industry as a whole. Furthermore, it was proposed that the airport terminal concept itself could be streamlined to provide a far more compact and efficient stage in the air travel experience.

## 3.2 Vision 2050 thought piece: the future of infrastructure

Produced with the assistance of

Ashley Smout, CEO Airways New Zealand, and Paul Griffiths, CEO Dubai Airports

### 3.2.1 2050: the dawn of a new age for air travel

Traffic has grown from 2.4 billion to 16 billion passengers in the last 40 years and its distribution has changed dramatically. Governments and investors alike recognized the importance of air transport as a driver of economic development and social integration, and have worked collaboratively to ensure that at least some of the additional capacity needed to cater to such an increase has been put in place. Technologically advanced aircraft operating on advanced renewable energy sources and capable of carrying anywhere from 2 to 2000 passengers connect intercontinental traffic through a dozen global gateways feeding them to 50-75 regional hubs which redistribute onwards to local airports.

However, in the ATM world continued concerns about sovereignty, regulatory reform, and the availability of financial capital for investment purposes continue to delay some upgrades to prevent some countries from joining a more centrally and cooperatively managed global system. On the ground, ongoing concerns about the financial and environmental sustainability of needed airport capacity enhancements have prevented some countries from keeping pace with the growth in demand for air transport services. Those major airports located in countries with more sympathetic and supportive regulators have achieved far greater levels of success and are showing the way for others seeking to keep up competitively.

Air traffic navigation systems, both on board aircraft and in the supporting infrastructure below, offer far more efficient flying with virtual corridors maintaining close but safe separation of flights. In regions where the right investments have been made, flights are conflict-free and trajectory-based, with no infrastructure-induced delays ever – often arriving within plus or minus two seconds between any city-pairs throughout the world. These “perfect flights” occur all day, every day, minimizing energy consumption and providing an uninterrupted journey profile from start to finish. Only significant weather events and natural disasters continue to cause delays. The “old” air traffic management systems have merged into a global interconnected network, much like the internet (now in its eighth edition), routing traffic via the quickest and most convenient routings. Flight times have reduced significantly in the past 40 years.

“Big Brother” has arrived. Not the feared self-aware, unstoppable machine from the annals of science fiction, but a global database storing secure information about the profile and biometrics of every traveller on the planet. This is not to strip individuals of their privacy but a powerful enabler of seamless movement from place to place, making security checks, immigration formalities, customs procedures, and even the process of arranging travel that existed at the turn of the decade seem prehistoric practice. Now the traveller is able to recall their preferences and arrange – and pay for – their travel as they go. They are recognized at various points on their journey through discreet biometric systems. Data security standards have also improved exponentially to meet these new requirements.

Flights are no longer always based on published schedules but on a demand-based response system that amalgamates the various components of the transportation system into the most efficient use of aircraft and other resources which operate a continuous schedule – where permitted, people move from

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place to place quickly and efficiently using a seamless multi-modal transportation system that constantly optimizes supply to demand. Passengers also routinely and effortlessly change their itineraries, whether due to external drivers, such as a change in plans, or because new opportunities become available.

### 3.2.2 The drivers for change

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Air transport is recognized by all governments on a global basis as vital infrastructure that is key to the demands for assured and hassle-free connectivity. Governments continue to “own” their airspace but their role is regulation on a collective basis. All service provision is in the hands of performance-driven commercial enterprises that also ensure financing for the enabling technologies and infrastructure.

Customer expectations of what technology can do to reduce travel times and to increase safety are at a high level and are met unflinchingly.

Large systems integrating companies compete at the customer (passenger) interface to provide the optimum, most cost-efficient service on a branded basis while more detailed service provision (ANS, airport terminal management, aircraft provision, and maintenance, etc.) are conducted on a franchised or outsourced basis. Investors receive a solid, fair and consistent return from these aviation infrastructure companies, who receive 50% of their revenue from the actual service delivery and 50% from meeting performance and efficiency criteria. Benchmarking, performance targets, and continuous improvement are the norm. Failure to meet the minimum levels of performance would result in intervention from regulators to remove concessions – but this almost never happens.

But some harsh realities continue to exist in terms of politics, human control of technology, weather, and the environment:

- Maintaining respect for national sovereignty and national defence are still key policy priorities for states and at times still cause tensions between developed and developing states. However, for the most part these tensions are addressed effectively through the International Civil Aviation Organization, which assists states to ensure optimal use of airspace while allowing civil and military operations to co-exist.
- A healthy fear of “Big Brother” and overriding concern for safety mean that human management and intervention continue at all levels (aircraft, air navigation, airports, etc.), except for all-cargo flights.
- Weather continues to have a strong impact on operations but weather predictions and adaptive measures are now highly successful sciences, allowing performance to be maintained.
- Environmental protection is an assumed fundamental requirement, with no return possible to the fossil fuels and emissions of only 40 years ago, although the last of the 4th generation of jet aircraft are still working their way through the natural life cycle.

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### 3.2.3 Air traffic enablement

Air traffic “management” is all about enabling rather than detailed intervention or control. Systems engineers watch over a range of integrated computer systems that deliver information to and from aircraft in a collaborative decision-making regime, guaranteeing the perfect flight every time from air-bridge to air-bridge. The role of the engineers is to maintain system integrity and provide a safety net in the event of any system malfunction, or an unforeseen event. Industrial action is a thing of the past – these air traffic enabling engineers are professional stakeholders in a world of regulated automation.

Information management is key and operates on a system-wide basis. Information (e.g., traffic, routings, and weather) is processed and sent from the ground to highly sophisticated on-board information management systems on the aircraft. The exchange and collaboration of this information enables better overall network solutions, self-separation, reduced flight times, and increased safety. This information management system also ensures that all relevant information is provided to all stakeholders involved in the provision of effective and efficient end-to-end services.

A global interoperability standard, set by the International Civil Aviation Organization (ICAO), ensures free flight in the airspace of just over 90% of the world's 207 sovereignties. This standard forms the basis for the Single Global Sky above 20,000 feet, supported by 12 Regional Flow Management Units (RFMUs), which are responsible for managing the flow of air traffic and individual flights through the airspace in their regions. The lower airspace is operated on a concession basis by commercial enterprises, with royalties/dividends being returned to the countries whose airspace is being used. Charges to airspace users as a percentage of operating costs have been reduced significantly over recent decades as the fivefold increase in traffic since 2010 is handled by half the number of 'enablers', a tenfold improvement.

The separation of aircraft in flight is managed by a network of computers. These computers receive detailed flight plans and surveillance information from the aircraft, and transmit any trajectory changes to the aircraft via digital data links. They automatically maximize the capacity of different airspace levels to effectively handle the growing diversity of aircraft sizes (wake vortex) and speeds. The number of flight levels has increased greatly, both by reducing the vertical separation minima to 500 feet and by introducing new flight levels at higher altitudes for newer aircraft suitably built to operate in the thinner atmosphere. Computers also transmit traffic information to aircraft for self-separation. In addition, aircraft communicate in pairs and by broadcast to create a digital point-to-point self-organizing network. They are told to pass ahead/behind/over/under, to follow in trail, and to merge into a stream. The air traffic managers who replaced their air traffic controller predecessors 25 to 30 years earlier are now slowly being replaced by the systems engineers mentioned above.

Mankind has still not learned how to control weather patterns, although progress is being made, for example in slowing down or speeding up the approach of weather fronts. On ground computers receive data from aircraft in detail in real time. Terrestrial data communications supply a 48- to 72-hour forecast with uncertainty values, a 14- to 20-hour forecast for tactical planning en-route, and a fine-detail current and one-hour future forecast for planning final arrival at terminal. Aircraft share weather data in real time between each other rather than through an external commercial agency.

Flight trajectory and intent data, planned or modified, are transported via mobile digital ground and satellite technologies. There are multiple self-organizing backup systems for both communications mediums in order to provide the necessary integrity, availability, and accuracy.

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Required Navigation Performance (RNP) routes (i.e., optimum navigational routes) are spatially separated, laterally, and vertically, in lower high-density airspace. In higher-level airspace, aircraft operate in free-flight mode. Time separation is assured by RFMUs managing:

- The aircraft on the ground
- Tactical take-off timing and en-route speed control (via ground-based or air-to-air computers)
- Tactical merging or passing the aircraft in flight.

Non-passenger (e.g., all cargo) long-haul flights by Unmanned Aerial Vehicles (UAV) are internationally co-ordinated by the RFMUs and operate within shared airspace during low-demand periods. Disrupted journeys are managed by using landing zones that are available near fully-utilized airports. UAV operations have fail-safe, go-to options that incorporate additional security protocols designed to withstand cyber attacks, but passenger-carrying aircraft still have pilots, despite the high levels of automation and decision-making.

### 3.2.4 Airports

Airports mirror this shift. They too operate on a different economic and operational mode from 2010. As customer information has become a global resource for the industry, integration along the entire length of the supply chain has become possible so that airlines, airports, retailers, tourism organizations, and the hospitality sector are able to tailor their product exactly in line with customer demand and expectation. This not only heightens service levels but improves efficiency, boosting revenue, and decreasing cost.

The problem of high fixed cost perishable inventory that dogged the industry for its first 100 years is now a thing of the past, as real-time systems are managing the present and predicting the future with astonishing levels of accuracy. Now airlines, airports, retailers, security, and border control authorities are able to carry out all of the hitherto cumbersome administrative functions behind the scenes, invisibly and efficiently, leaving the customer free to concentrate on enjoying the seamless product experience that is now the custom during the entire journey.

The central system which facilitates this exchange of information also deals with the costs and revenues, too. The costs of the supply chain are allocated in real time and the revenues are collected from the customer based on the cost of the actual journey taken and the services provided. Gone are the arguments about who should pay for what – everything is now aggregated as a total journey cost, optimized by the global system and passed on to the customer, whose pre-specified preferences dictate the journey experience required and therefore the cost. The system also manages any en-route itinerary changes no matter how sudden or unplanned.

The major service challenge of airports for almost two decades centred on the ground transport interchange. The solution was the devolution of the terminal. Instead of massing thousands of people together in one vast building, crowds have been engineered out of the experience by a combination of removing processes and dealing with baggage and other formalities before departure from home, the office, or a hotel.

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Airport design has now moved into a series of smaller aircraft 'pit stops', where the aircraft arrives, passengers depart, the aircraft is serviced and departing passengers enplane all with a 30-minute window even for the largest aircraft. Ground service equipment is a thing of the past as everything is engineered into the drive-through 'pit stop' removing the need for fleets of vehicles swarming around the aircraft, which simply starts its engines and taxis straight off when ready to go. The global air traffic management system now pre-clears the entire journey from gate to gate (or "pit-to-pit" / "bay-to-bay") so that there are no delays on the ground, or in the air.

High-speed (350 kph) rail systems connect airports with major centres of population and have largely replaced air travel for journeys less than 500 miles. Baggage is dealt with before starting the journey and is delivered at the destination rail station on arrival or to its ultimate destination dependent on the passenger's preference. Baggage systems are aligned with the passenger so that bags appear from the baggage handling system at the point of arrival at exactly the same time as the customer, if this is the customer's preference.

The rail systems interface with all other modes of transport at other points in the journey and every passenger arrives at and departs from the airport by rail, at multiple underground stations which are located at the right concourse. Elevators and escalators quickly connect passengers between the drive-through pits and the ground transport links. Smart tickets embedded into mobile communications devices are valid for all modes of transport and prompt customers exactly where and when to go and guide them right up to the aircraft door, automatically sequencing the boarding process to eliminate boarding delays at the gate. Changes to passenger routings are handled in real time.

Concourse design is optimized to provide convenient and fast connections between planes, minimal walking distances, and a wide choice of retail, dining and service options, matched exactly to the demographic of travellers in the concourse. The concourse is a high-quality environment which now truly has something for everyone. Virtual reality experiences market onward destinations, augmenting travel and tourism, while yielding new sources of advertising and retail revenue. Theatres, theme parks, and museums similarly promote local tourism and culture. All fulfillment of in-flight retail services is now carried out on the ground at the airport or final destination, eliminating the need to carry inventory or purchases in-flight.

Security and customs/immigration processes for passenger and luggage screening are not only more efficient but are also almost invisible to the passenger. The LIMPs mentioned in the customer paper ensure that every passenger in any part of an airport is immediately recognized. These processes are now partially completed well in advance of the passenger journey through profiling that categorizes passengers and packages by levels of potential risk. The remaining processes are conducted using stand-off technologies that complete the screening processes without interrupting the passenger's journey through the airport (except for when these stand-off technologies reveal the need for closer inspection).

Airports now have no central terminal system and have multiple concourses, all served by individual stations linked directly to the external rail system. Concourses each follow a standard global design to make the processes and systems common wherever aircraft and their passengers travel. Gates have been replaced by loading bays through which aircraft taxi on arrival and from which they are serviced prior to departure. This reduces costs and aircraft turnaround times, making travel faster, more familiar, and convenient – and more affordable while also increasing capacity. However, these advances have only been realized in airports that have been built or expanded in the last ten years.

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Major changes have also been required airside to overcome a doubling of traffic numbers every 12 to 15 years. In a still-growing number of countries, the construction of additional runway capacity continues to be the critical path obstacle to accommodating this growth, although advances in technology have partially compensated by enabling smaller (150-250 passenger) aircraft to take off and land on shorter runways (STOL) of about 5,000 feet.

Sustainable design is common at all major airports. Energy is now provided exclusively from sustainable sources such as solar, geothermal, and wind, which now provide energy for efficient lighting, air conditioning and all other requirements for power at drastically reduced costs. All aspects of waste are now minimized at source and any remaining material is captured and recycled.

Cargo traffic has also undergone a revolution and not only through the use of UAVs. The differing demand patterns for freight have driven the separation of cargo and passenger transportation networks, each optimized around their own demand-based resource allocation systems and allowing passenger aircraft to be designed to accommodate more people. Cargo traffic is similarly streamlined through multi-modal hubs with the seamless and secure transfer, customization and onward movement of freight between air, rail, road, and sea.

These changes were only possible by the establishment, sharing, and commitment to a vision that was purely customer-centric. This vision in turn generated the political and financial will to create the significant amount of new capacity needed to turn the vision into reality. Only such a massive worldwide enterprise of collaboration and integration, enabled by smart process technology, facilitated such a wholesale leap in the sustainability – both economically and environmentally – of the entire global transportation system.



“ New technology must  
be built on a strong  
business case ”

# Section 4. Technology

## Powering the future

Vision 2050 participants were presented with a 'thought piece' on Powering the Future, produced with the assistance of Professor Edward M. Greitzer, MIT. This thought piece is included below and formed the basis of the discussions in Singapore.

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#### 4.1 Discussion highlights

Those discussions gave rise to agreement that future technological innovation has the potential to help airlines reduce costs, increase speed, mitigate their environmental impact, expand capacity, and introduce more flexibility to their product. However, delegates had difficulty in reaching a consensus on which of these opportunities should be prioritized.

While faster, more powerful aircraft may seem attractive, it was pointed out that fuel burn invariably increases with speed, therefore negatively impacting airlines' efforts to reduce costs and emissions. The added value of faster flights would be also much reduced if new aircraft risk get stuck behind older models in outdated air traffic management systems. The advantage of ordering larger aircraft with the capacity to carry 2,000+ passengers was another point of debate. As suggested in the earlier discussions on future customer needs, the airline passenger demographic is likely not only to expand but also diversify. Airlines will require the flexibility to cater for a wider variety of customer demands, not just carry more passengers. It was therefore agreed that future technological development should focus on a radical change in aircraft seating configuration.

Since the basic silhouette of aircraft has changed little in the last 50 years, advancements in aeronautical engineering have been virtually imperceptible to air travellers. It was however conceded that if significant new airframe efficiencies are to be found, they will only come from radically new airframe designs.

Reducing the current aircraft lifecycle was mooted as one possible way to incentivize manufacturers and airlines to accelerate the introduction of new aircraft models. Just as stricter environmental targets have advanced technological developments in the past, some delegates suggested greater government intervention to encourage innovation. Another proposal was differential charging according to carbon emissions and noise pollution levels.

The debate revealed that a major source of uncertainty regarding the ability of technology to power the future lies with the airlines themselves. While there is some agreement that aircraft configuration needs to evolve, airlines need to feel satisfied that the technological solutions to achieve this are supported by a strong business case.

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## 4.2 Thought piece: powering the future

### 4.2.1 Introduction

In the past 40 years the world population has increased from 6.9 billion to 8.9 billion and the airline industry has progressed from carrying 2.4 billion passengers in 2010 to 16 billion passengers in 2050. The global fleet now numbers 100,000 and there are eight major aircraft manufacturers. The growth in competition amongst the major airframe and engine manufacturers has accelerated the pace at which new technologies are incorporated and brought to market. This acceleration has also reduced the life cycle and production run of each new model of aircraft. These developments, in turn, have forced the major manufacturers to drive efficiencies in the production processes, incorporating far greater levels of automation and robotics to remain competitive and keep the prices of new aircraft models manageable.

Telecommunications technology has also improved to the point where it can replace some work-related air travel. However, telecommunications has not fully replaced the need for face-to-face meetings; nor has it replaced the desire to connect directly with friends and family or to visit new countries and cultures. In fact, because we can connect more easily to so many people through social media, we have a greater desire to go and see people face-to-face.

Flexibility, albeit within a standardized regulatory framework, is the theme of air travel in 2050, with consumers being able to select from fast (supersonic) travel, luxury travel, or inexpensive leisure travel on massively larger aircraft. Even spaceflights have become more widespread as the price has reduced with economies of scale.

The diverse and ever-expanding array of airline business models and consumer needs, often driven by varying regional needs, have resulted in a much wider variety of aircraft sizes, types, and flight speeds being present in the global system, and the system can “deal with it”. The variety of markets served and the dynamic nature of traffic demand has driven value to business models and equipment that can react quickly or be re-customized to meet new or seasonal needs. The only constant is change, so get comfortable with it!

As the demand for air transport has grown, and with safety as the predominant requirement, we have dramatically changed the way aircraft are designed, operated, and powered, in order to ensure that air transport remained possible, efficient, comfortable, affordable, and environmentally sustainable. Aircraft are now 70% more fuel efficient than in 2010 and the landing and take-off (LTO) oxides of nitrogen (NO<sub>x</sub>) have been cut by roughly 75% from a baseline aircraft (B737-800) of that time frame. From a noise perspective the aircraft are essentially imperceptible outside of the airport and the domestic aircraft can take off from runways of 5,000-foot length.

Some of the new technologies that have enabled these improvements are outlined below in more depth.

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## 4.2.2 Changes in aircraft configuration

Compared to 2010, the difference in technology most visible to the eye is in aircraft configuration. While the tube and wing configuration had been dominant in civil aviation from the inception of the jet age, two other configurations have now come to the fore. The first of these incorporates a “double bubble” fuselage cross-section configuration, so named because the fuselage is basically two tubes side by side. The second is a “blended wing body”, an aircraft with a triangular hybrid wing body, made possible by advanced composites technology that blends into efficient supercritical wings.

The double-bubble was initially targeted at the B737 or A320 aircraft size, and it has been very effective in that market, offering not only fuel burn advantages, but also decreased runway length and the ability to use smaller airports. The aircraft fuselage is shorter and wider than that of a 737, with two parallel tubes in the fuselage, which allow two aisles, a time saver for passenger loading and unloading. The aircraft flies roughly 10% slower than the 737 so the wings require less sweepback. The lower speed also allows other changes that result in a lighter, more efficient aircraft.

The hybrid wing body offers large volume for a given aircraft size, and was initially introduced for cargo application. The performance of this configuration scales better for a large aircraft size and it has also appeared as a large-scale, long-range passenger aircraft, accommodating 400+ passengers in a multi-class configuration with cargo, and a range of at least 7,000 nautical miles.

Both configurations have innovative engine placements that offer substantial reductions in fuel burn due to their ability to ingest and energize the slowly moving air near the fuselage, a process which is inherently more fuel efficient than podded inlets. The double-bubble configuration has three engines, placed above the aircraft, between the vertical tails, providing shielding from engine noise, and the hybrid wing body has embedded engines at the rear of the fuselage.

Surface contours, coatings and flow-control devices have aided aerodynamic efficiency, including laminar flow for sections of fuselage/wing/nacelles to reduce drag. Electronics has been integrated into the designs of new materials, enabling “intelligent” materials to continuously monitor their state of health, so maintenance needs are automatically predicted and the work scheduled well in advance. Electro-mechanics have largely replaced traditional hydraulic/pneumatics.

Supersonic aircraft are also in use for special applications, such as business jets where speed is the traveller’s priority, but they do not have the same level of market presence of the above two configurations.

## 4.2.3 Improved efficiency engines and engine architectures

Engine specific fuel consumption has improved by 30% since 2010. High-performance ceramics and improved flow designs are in wide usage, including the high-efficiency, small core components that are implied by the large increases in fan bypass ratio and the major decreases in aircraft drag. The engine on-wing-time has been extended to be comparable with the useful life of the aircraft, through greater reliability. Modular designs have improved maintenance and reduced upgrade expense. Geared turbofans are now widespread, and open rotor designs are also seen. In addition, the pace of efficiency improvements has resulted in many more operators renewing their fleets more regularly to ensure that they are always using the latest, most-efficient technology. With older aircraft less in demand, due to the competitive disadvantages of operating them, a large aircraft recycling industry has emerged and reduced the overall cost of aircraft production while also overcoming shortages in scarce input materials, such as titanium.

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#### 4.2.4 The aircraft are different on the inside as well as on the outside

Nanotechnology has revolutionized materials to allow new optimized structures that are half the weight they were 40 years ago. Transparency-on-demand structures negate the need for windows, with open-skies views from the flight deck and passenger areas, at reduced weight and cost, providing 360-degree views. Aircraft are now “self supporting”, eliminating most ground-support equipment, greatly cutting ramp operations.

Plant-based fibre products are also being used to drive weight savings and increase opportunities to recycle. Virtually all aircraft interior materials are now made of recycled components. Cabin interiors are also lightweight and “self freshening” so they always appear to be new, thanks to nanotechnology. Such technologies have also been applied to ovens, trash compactors, toilets, and water systems.

Aircraft are rarely now fitted with in-flight entertainment systems; passengers bring on board their own personal devices that seamlessly interface with firewalled aircraft data systems, which act as a gateway to the 2050 “data cloud.” Flight deck automation and self-optimizing “smart systems” enable the pilot to act as flight manager most of the time. Keeping current on flight controls skills is the biggest driver to “hand flying” time and most training is done in simulators.

#### 4.2.5 How quiet/clean can you go?

As mentioned, LTO oxides of nitrogen (NO<sub>x</sub>) have been cut by 75% since 2010. Carbon dioxide (CO<sub>2</sub>) has been reduced proportional to improvements in fuel efficiency. Carbon monoxide (CO) emissions have all but disappeared. Noise control technology is now integrated during the design phase, not as an “add-on”, with aircraft quieter than road/train traffic around airports. “Active” noise control allows quiet zones to be created for special mitigation of noise. However, there is a growing concern about a new type of pollution; ‘visual pollution’ resulting from the sheer number of aircraft in operation.

#### 4.2.6 You still need energy dense, liquid hydrocarbon fuel

The earth’s crude oil reserves have become more expensive and more difficult to extract, not just from a technical viewpoint but also politically. Fortunately, synthetic fuel is now widely available and widely used in all modes of transportation vehicles. A wide variety of feedstock types are used to create high-quality “drop-in” fuels. Bio-content in aviation fuel has become increasingly commonplace over the past 40 years and currently accounts for 80% of all commercial aviation jet fuel as traditional jet kerosene is slowly phased out. A key feature in this has been an emphasis on biofuels with major lifecycle carbon benefits. This, coupled with the aircraft and engine improvements, has meant an effective reduction in total aviation CO<sub>2</sub> emissions to substantially less than half of pre-2005 levels, even though air traffic has greatly increased. A continued emphasis on “ethical consumption” has made carbon offsetting the norm for passengers, as in other aspects of their lives, thereby further reducing aviation’s total net carbon emissions.

Some aircraft systems are now partially powered by solar sources that enhance the onboard “smart hybrid” electrical grid. The majority of batteries and power generators have been replaced by fuel cells that use hydrogen, plus oxygen from the atmosphere, to make electricity. Tests are also currently under way to examine how nanotechnology could be used in the design and manufacturing of the next generation of solar cells and batteries, which would in turn be even more energy efficient than today.

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### 4.2.7 Increased aircraft operating capability from information sharing

By switching from (legacy) ground-based systems to satellite-based network information sharing and navigation, pilots and controllers have been provided with a common and complete situational picture, giving both more precise control and also increased flexibility. This has also enabled relief in the workload of air traffic controllers and increased the airspace capacity by reducing separation minimums and allowing for more direct routes. Advances in automation have enabled further efficiencies through automatically controlled aircraft. While these could produce pilotless aircraft through the application of Unmanned Aerial Vehicle (UAV) technologies, such aircraft are currently only used for all-cargo operations.

The enhanced information sharing, which has allowed in-flight aircraft to reduce their separation margins and even fly in formation much as birds do, is also driving further energy savings. As a related benefit, runway capacities have been enhanced by innovative procedures for reducing the effects of wake vortices on following aircraft. Also the trend towards use of secondary airports, which can offload traffic from heavily used primary airports, in a multi-airport metroplex system around major metropolitan areas has increased.

### 4.2.8 Any other business

Technology has made the security and customs/immigration processes for passenger and luggage screening not only more efficient but also almost invisible to the passenger. These processes are now partially completed well in advance of the passenger journey through profiling that categorizes passengers and packages by levels of potential risk. The remaining processes are conducted using stand-off technologies that complete the screening processes without interrupting the passenger's journey through the airport (except for when these stand-off technologies reveal the need for closer inspection).

Technology has also been applied to passengers and their luggage. PDAs and other hand-held or worn devices now enable passengers themselves to track their luggage at every stage of a journey, virtually eliminating the problem of mishandled baggage. Following the emergence of a new business model in the 2020s, companies now provide overnight door-to-door pick-up and delivery of baggage at surprisingly low cost, thereby relieving the passenger of this burden and making the airport process for the passenger far more efficient. Meanwhile, these same PDAs/other similar devices allow airlines, airports, and security agencies to track the whereabouts of the passengers themselves throughout the journey, ensuring that passengers no longer accidentally miss their flights.

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