FIFTH EDITION

MANAGING AIRPORTS

AN INTERNATIONAL PERSPECTIVE

ANNE GRAHAM

ROUTLEDGE

Managing Airports

Managing Airports presents a comprehensive and cutting-edge insight into today's international airport industry. Approaching management topics from a strategic and commercial perspective, rather than from an operational and technical one, the book provides an innovative insight into the processes behind running a successful airport. This fifth edition has been fully revised and updated to reflect the many important developments in the management of airports. It features:

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Managing Airports

An international perspective

Fifth edition

Anne Graham

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Preface

When the first edition of this book was published in 2001, the airport industry had received relatively little attention in the published literature and had been very much overshadowed by the airline sector. Hence this was the motivation for writing this book. Shortly after publication, the airport sector had to cope with the unparalleled consequences of the events of 9/11, the Iraq War, the outbreak of SARS and the continuing threat of terrorism. These issues were consequently considered in the book's second edition, which was published in 2003. Five years on, the third edition in 2008 concluded that 9/11 had been a significant turning point for the industry and since then it had been operating in a much more unstable environment. This was not just due to security concerns, but also because of changing airline structures and increased environmental pressures. Another five years passed and the world experienced a severe global economic crisis, political unrest and a number of natural disasters. So again, this was the backdrop for the fourth edition of this book. As I now write this fifth edition amidst heightened fears of terrorist attacks, unpredicted political change and its consequences, the occurrence of extreme weather events and advances in technology (enabling a realization of the unimaginable), the only certainty seems to be that the world, and with it the airport industry, will continue to face a future of many uncertainties.

Whilst in general considerably more has now been written about the airport industry, there is still limited coverage in one place of all the important managerial and business aspects of running an airport and how these link together. Therefore, the aim of this book, as in previous editions, is to provide a comprehensive appreciation of the key management issues facing modern-day airport operators. As well as providing an up-to date review of all the latest developments and trends, the discussions concerning certain developments, such as the passenger experience, security and technological innovations, have been expanded. Previously uncovered topics such as self-connection, beacon technology, climate change adaptation – to name but a few – have now been included. At the same time, other themes such as airport privatisation, competition and economic regulation have been revisited, given the changing airport–airline relationship and external environment.

Airports are now complex businesses requiring a range of competencies and skills. The emphasis here is on the economic, commercial and planning areas at a strategic level. An approach has been adopted reflecting the very international nature of most of the industry. The book uses material from a wide range of airports and has a very practical focus. New case studies have been provided, not only to cover new topics, but also to reflect the shift of economic power and corresponding traffic growth to emerging economies and other challenges that face more mature markets. The book provides an overview of all the key management challenges facing airports, and so by necessity the scope has to be very far-reaching. The book will enable the reader to acquire a broad and up-to-date insight into the workings of the industry which will meet the needs of anyone who wishes to work, or is already working, in the airport sector.

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Abbreviations

AA2000	Aéroportuertos Argentinas 2000
AAHK	Airport Authority Hong Kong
AAI	Airport Authority of India
ACCC	Australian Competition and Consumer Commission
A-CDM	Airport-Collaborative Decision Making
ACI	Airports Council International
ACL	Airport Coordination Limited
ACROS	Airport Climate Risk Operational Screening
ACSA	Airports Company South Africa
AdP	Aéroports de Paris
AENA	Aeropuertos Espanoles y Navegacion Aerea
AGI	Airports Group International
AIF	Airport Improvement Fund
AIP	Airport Improvement Program
AOT	Airports of Thailand
APD	Air Passenger Duty
API	Advanced Passenger Information
ARI	Aer Rianta International
ASAS	Airport Surface Access Strategy
ASQ	Airport Service Quality
ATC	Air Traffic Control
ATF	Airport Transport Forum
ATRS	Air Transport Research Society
ATM	Air Transport Movement
ATU	Airport Throughput Unit
BA	British Airways
BAA	British Airports Authority (only prior to 1987; from 1987 the company was known only as BAA, and then in 2012 it changed its name to Heathrow Ltd)
BCIA	Beijing Capital International airport
BOT	Build, Operate, Transfer
BSCA	Brussels South Charleroi Airport
CAA	Civil Aviation Authority
CAAC	Civil Aviation Administration of China
CAPEX	Capital Expenditure
CBA	Cost Benefit Analysis
CDA	Continuous Descent Approach

CDG	Charles de Gaulle
CGE	Computable General Equilibrium
CIP	Centralised Image Processing
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
CPH	Copenhagen Airport A/S
CPI	Consumer Price Index
CSR	Corporate Responsibility Strategy
CUSS	Common-Use Self-Service
CUTE	Common Use Terminal Equipment
DAA	Dublin Airport Authority (up until 2014)
DB	Deutsche Bahn
DDF	Dubai Duty Free
DEA	Data Envelopment Analysis
DGAC	French Civil Aviation Authority
DHS	Department of Homeland Security
DIAL	Delhi International Airport Private Limited
DMU	Decision-Making Unit
EBIT	Earnings Before Interest and Tax
EBITDA	Earnings Before Interest, Tax, Depreciation and Amortisation
EC	European Commission
ECAC	European Civil Aviation Conference
EEA	European Economic Area
EIA	Economic Impact Analysis
ETS	Emissions Trading Scheme
EU	European Union
EV	Enterprise Value
FAA	Federal Aviation Administration
FAC	Federal Airports Corporation
F&B	Food and Beverage
FIDS	Flight Information Display System
GA	General Aviation
GAO	General Accounting office
GDP	Gross Domestic Product
GIP	Global Infrastructure Partners
GRI	Global Reporting Initiative
GVA	Gross Value Added
HTA	Hochtief AirPort
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IDP	International Departing Passenger
IPO	Initial Public Offering
ISO	International Organization for Standardization

KPIs	Key Performance Indicators
L&T	Larsen and Toubro
LAGs	Liquids, Aerosols and Gels
LCC	Low-Cost Carrier
LCT	Low-Cost Terminal
LOS	Level of Service
LTO	Landing and Take-off
MAG	Manchester Airport Group
MAP	Macquarie Airports
MAS	Multi-Airport System
MBMs	Market-Based Options or Measures
MCT	Minimum Connect Time
MIAL	Mumbai International Airport Private Limited
MII	Majority in Interest
MLIT	Ministry of Land, Infrastructure, Transport and Tourism
MPPA	Million Passengers Per Annum
NFC	Near Field Communication
NPAIS	National Plan of Integrated Airport Systems
NPR	Noise Preferential Route
NRI	Non-Resident Indian
NO_x	Nitrogen Oxide
OAG	Official Airline Guide
O&D	Origin and Destination
OFT	Office of Fair Trading
PFC	Passenger Facility Charge
PNR	Noise Route
POS	Point of Sale
PPP	Public–Private Partnership
PRM	People with Reduced Mobility
PSC	Passenger Service Charge
PSO	Public Service Obligation
QC	Quota Count
QSI	Quality Service Index
QSM	Quality Survey Monitor
RAB	Regulated Asset Base
RDF	Route Development Fund
RFID	Radio Frequency Identification
ROCE	Return on Capital Employed
ROIC	Return on Invested Capital
ROR	Rate of Return
RPI	Retail Price Index
SARS	Severe Acute Respiratory Syndrome
SDR	Special Drawing Right
SESAR	Single European Sky Air Traffic Management

SMP	Substantial Market Power
STEBs	Standard Tamper Evident Bags
TFP	Total Factor Productivity
TSA	Transportation Security Administration
UK	United Kingdom
UNWTO	United Nations World Tourism Organization
US	United States
UAE	United Arab Emirates
VFP	Variable Factor Productivity
VFR	Visiting Friends and Relatives
WEB	Wider Economic Benefit
WEI	Wider Ecnomic Impact
WACC	Weighted Average Cost of Capital
WLU	Work Load Unit
YVRAS	Vancouver Airport Services

1 Introduction

Airports are an essential part of the air transport system. They provide all the infrastructure needed to enable passengers and freight to transfer from surface to air modes of transport and to allow airlines to take off and land. The basic airport infrastructure consists of runways, taxiways, apron space, gates, passenger and freight terminals, and ground transport interchanges. Airports bring together a wide range of facilities and services in order to fulfil their role within the air transport industry. These services include air traffic control (ATC), security, and fire and rescue in the airfield. Handling facilities are provided so that passengers, their baggage and freight can be transferred successfully between aircraft and terminals, and processed within the terminal. Airports also offer a wide variety of commercial facilities ranging from shops and restaurants to hotels, conference services and business parks.

As well as playing a crucial role within the air transport sector, airports have a strategic importance to the regions they serve. In a number of countries they are increasingly becoming integrated within the overall transport system by establishing links to high-speed rail and key road networks. Airports can bring greater wealth, provide substantial employment opportunities and encourage economic development – and can be a lifeline to isolated communities. However, they do have a very significant effect, both on the environment in which they are located and on the quality of life of residents living nearby. Growing awareness of general environmental issues has heightened environmental concerns about airports.

The focus of this book is on management issues facing airport operators. These operators vary considerably in their ownership, management structure and style, degree of autonomy, and funding. Typically, airport operators themselves provide only a small proportion of an airport's facilities and services. The rest of these activities are undertaken by airlines, handling agents, government agencies, concessionaires and other specialist organisations. The way in which operators choose to provide the diverse range of airport facilities can have a major impact on their economic and operational performance and on their relationship with their customers.

Each airport operator will thus have a unique identity, but all have to assume overall control and responsibility at the airport. Each will be faced with the challenging task of coordinating all the services to enable the airport system to work efficiently. The providers of services are just some of the airport stakeholders that operators need to consider. Others include shareholders, airport users, employees, local residents, environmental lobbyists and government bodies. A complex situation exists, with many of these groups having different interests and possibly holding conflicting views about the strategic role of the airport. All the stakeholder relationships are important, but the development of a good relationship with the airlines is critical as ultimately this will largely determine the air services on offer at the airport.

Globally the airport industry is dominated by the regions of Europe, Asia/Pacific and North America in terms of passenger numbers and cargo tonnes (Figures 1.1 and 1.2).

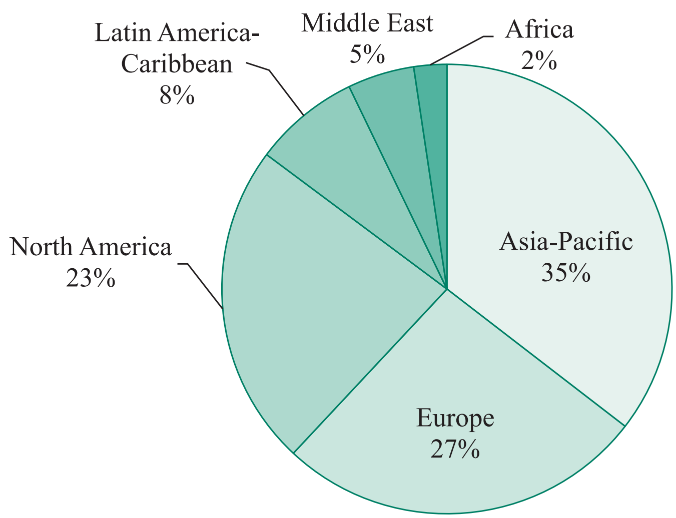

Figure 1.1
Airport passengers by world region, 2016
Source: ACI

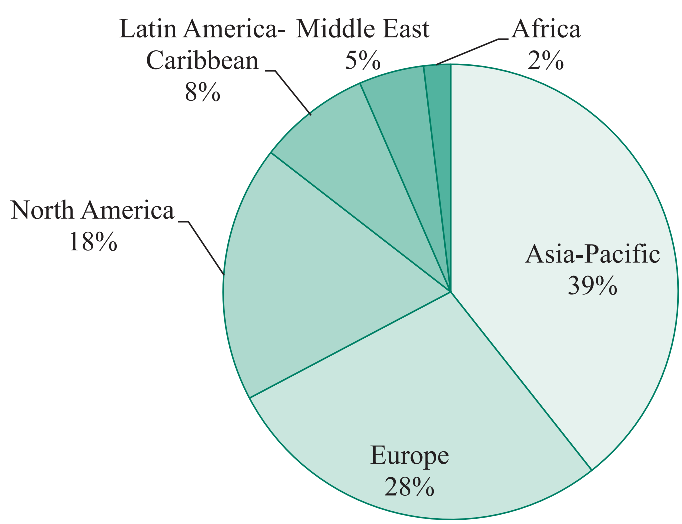

Figure 1.2
Airport cargo tonnes by world region, 2016
Source: ACI

In total, Airports Council International (ACI) airports handled 7,700 million passengers, 110 million cargo tonnes and 92 million aircraft movements in 2016.

The importance of these three global regions is reflected in the individual traffic figures of the various airports (Figures 1.3–1.5). Out of the 20 largest global airports, six are US airports, nine are Asia Pacific/Middle Eastern airports and five are European (Figure 1.3).

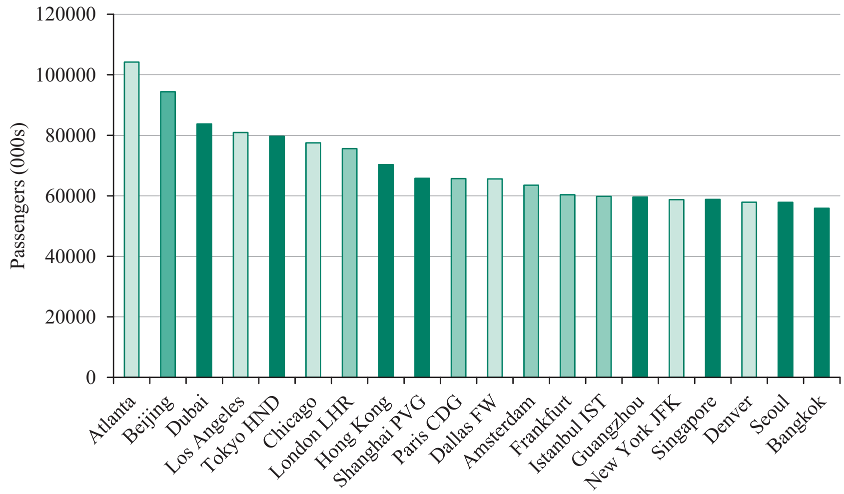

Figure 1.3
The world's 20 largest airports by total passengers, 2016
Source: ACI

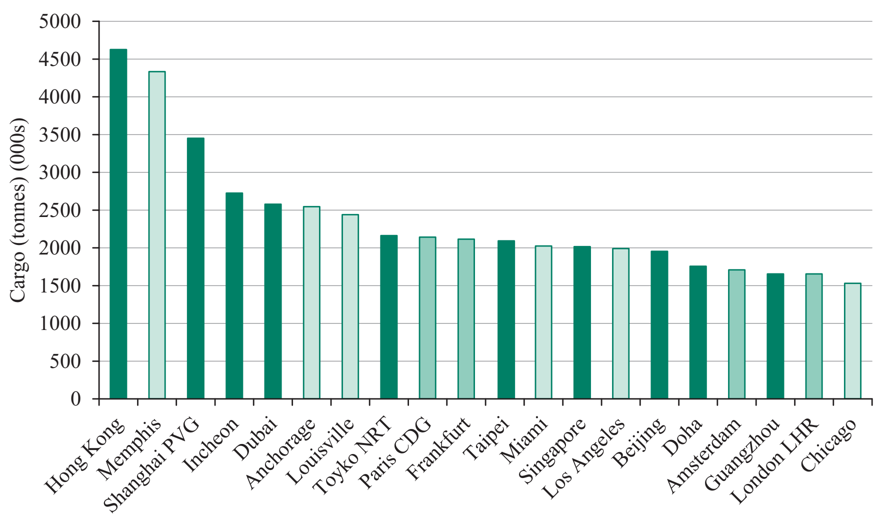

Figure 1.4
The world's 20 largest airports by cargo tonnes, 2016
Source: ACI

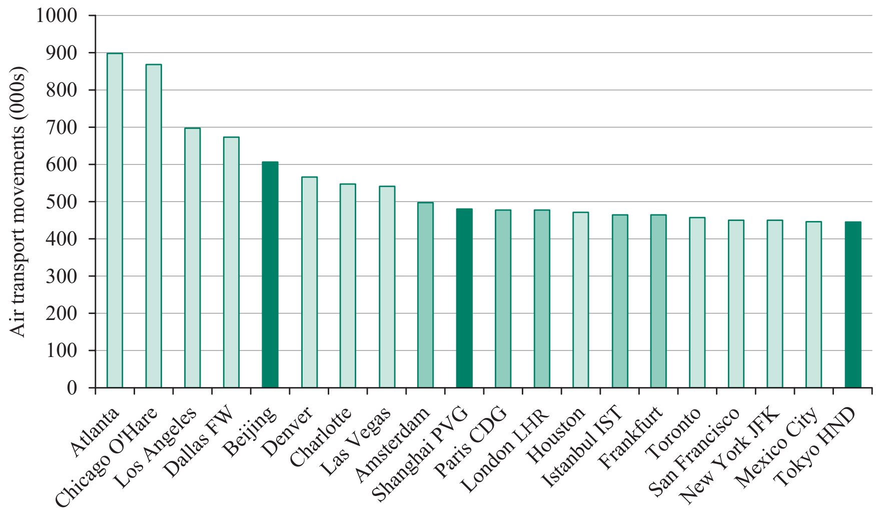

Figure 1.5
The world's 20 largest airports by aircraft movements, 2016
Source: ACI

Not all the major cargo airports coincide with the major passenger airports. Memphis is the world's second largest cargo airport because FedEx is based there. Similarly, UPS has its base at Louisville. In terms of aircraft movements, North American airports tend to have comparatively high numbers because the average size of aircraft is smaller due to competitive pressures and the dominance of domestic traffic. The larger than average aircraft size in Asia means that none of the busiest airports in terms of movements are situated in this region, except for Beijing and Shanghai.

The aviation industry had been growing virtually continuously since the Second World War, with periodic fluctuations due to economic recessions or other external factors such as the Gulf War in 1991. However, this growth was dramatically halted due to the events of 9/11 in 2001 combined with a global economic downturn. Since then, the airport industry has experienced a number of volatile years, with further incidents including the outbreaks of SARS (2003) and swine flu (2009), the Eyjafjallajökull ash cloud (2010), the Japanese earthquake (2011) and the Arab Spring uprisings (2010–12). These events have had various impacts in different world regions, as illustrated by Figure 1.6. For example, the influence of SARS in the Asia/Pacific region in 2003 can be seen clearly, as can the effect of the social and political unrest due to the Arab Spring uprisings in the African region in 2011. Of major significance almost everywhere was the global credit crunch and economic recession, which had a devastating impact on traffic in 2008 and 2009. Traffic growth returned for all regions in 2010 and 2011 (except Africa), and has continued to rise, but with a considerable variation within different regions.

In 1999, North America had 47 per cent of the global market share of passenger numbers, followed by Europe with 30 per cent. Traffic in Asia/Pacific accounted for just 15 per cent of the total. Since then the share of traffic in this region has increased dramatically,

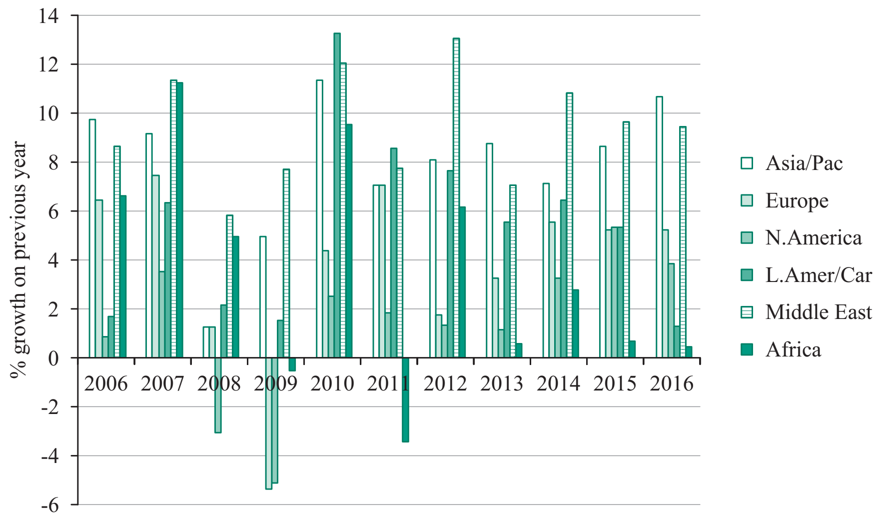

Figure 1.6
Airport passenger growth by main region 2006–16
Source: ACI

particularly in China, where Beijing was the second largest airport in the world in 2016 with nearly 94 million passengers – having been in only ninth position with around 50 million passengers 10 years earlier. In addition, the Middle East area has seen very significant increases in traffic volumes, particular at Dubai airport, which handled over 84 million passengers in 2016 compared with fewer than 30 million in 2006.

The growth in demand for air transport has had very significant economic and environmental consequences for both the airline and airport industries. Moreover, since the 1970s there have been major regulatory and structural developments, which have profoundly affected the way in which the two industries operate. Initially most change was experienced within the airline sector as a consequence of airline deregulation, privatisation and globalisation trends. The pace of change was slower in the airport industry, but now this sector, too, has developed into a fundamentally different business. The trend towards airline deregulation began in 1978 with the deregulation of the US domestic market. Many more markets were subsequently liberalised or deregulated, initially as the result of the adoption of more liberal bilateral air service agreements. In the European Union (EU), deregulation was achieved with a multilateral policy that evolved over a number of years with the introduction of the three deregulation packages in 1987, 1990 and 1993. The 1993 package, which did not become fully operational until 1997, was the most significant and had the most far-reaching impact. This European deregulation allowed a large low-cost carrier (LCC) industry to develop, which has had major consequences for many airports. This deregulation trend has continued in other parts of the world, a very significant milestone being the introduction of the EU–US open aviation area in 2008.

At the same time the airline industry was being deregulated, airline ownership patterns changed. Most carriers, with the notable exception of those in the United States, traditionally were state owned and often were subsidised by their government owners. However, this situation has changed substantially as an increasing number of governments have opted for partially or totally private sector airline ownership, primarily to reduce the burden on public sector expenditure and to encourage greater operating efficiency. The other most significant development within the airline industry, partly due to deregulation and privatisation trends, has been the globalisation of the industry and the emergence of transnational airlines. Three major alliance groupings – Star, oneworld and Sky Team – have emerged with global networks. They dominate the airline business, accounting for over half of all traffic. Airline joint ventures and mergers have followed and are becoming increasingly popular.

The airports found themselves caught up in this environment of change. Radical restructuring occurred, which in many ways mirrored that which had fundamentally changed the airline industry. Three key developments have been witnessed within the airport sector, as follows.

1 Airport commercialisation. The transformation of an airport from a public utility to a commercial enterprise and the adoption of a more business-like management philosophy.
2 Airport privatisation. The transfer of the management of an airport, and in many cases the ownership as well, to the private sector by a variety of methods. These include share flotations, the adoption of strategic partnerships and the introduction of private management contracts.
3 Airport ownership diversification. The emergence of a number of different types of new investors and operators of airports, such as financial investors and infrastructure companies, some of which have interests in a number of airports around the world.

This book discusses the implications of the development of the airport sector, which has moved from an industry characterised by public sector ownership and national requirements, into a new era of airport management where the private sector and international airport companies play a major role. Airports are now complex enterprises that require a wide range of business competencies and skills – just as any other industry. Airports no longer see their purpose simply as providers of infrastructure, but rather as providing facilities to meet the needs of their users.

Chapter 2 describes the changes in ownership and management models that have taken place, and reviews the current structure of the airport industry. These developments have had a major impact on airport economics and have significantly increased the need to benchmark performance, which is considered in Chapter 3. These airport industry trends, occurring at the same time as deregulation within the airline industry, have also meant that the traditional airline–airport relationship has been changed irreversibly. Chapter 4 looks at this, focusing primarily on airport charging, regulation and slots issues.

As the airport sector evolves, it has begun to focus on serving the needs of different types of customer rather than offering a more generic product that appeals to all. This is discussed in Chapter 5, as are regulatory and technological developments that are occurring in essential passenger processes such as security, border control and check-in. The consequences of these developments are assessed in Chapter 6, which considers the 'passenger experience' and the challenges in achieving overall passenger satisfaction, which has become a major concern for many airports.

A key consequence of airport commercialisation and privatisation trends is that airport operators are devoting much more time and effort to building up the non-aeronautical or commercial areas of the business. Chapter 7 looks in detail at this area of operation. Airport competition, hardly considered a relevant issue by many airports just two decades ago, is also becoming increasingly important. Marketing, which for so long has been a basic business competence in most other industries, but largely ignored in the past by many airports, is now a firmly accepted management practice at airports. This is discussed in Chapter 8.

The remaining chapters take a broader view of the airport business and consider the role airports play in the environment and surrounding communities. This needs to be clearly understood if future growth in the airport industry is to continue. Chapter 9 discusses the economic and social impacts of airports and how they can act as catalysts for business and tourism development. Chapter 10 goes on to consider the environmental impacts and ways in which airports are attempting to minimise the adverse effects. Finally, Chapter 11 brings together the key issues in order to make predictions for the coming years and to assess the future prospects for the industry.

2 The structure of the airport industry

Traditional airport ownership and management

The aim of this chapter is to discuss the structure of the airport industry, particularly in terms of the ownership and governance models that are used. It traces the development of the airport sector as it has moved from an industry characterised by public sector ownership and national requirements into a changed era of airport management, where the private sector and international companies play a significant role.

Virtually all airports were traditionally owned by the public sector. European airports serving major cities such as Paris, London, Dublin, Stockholm, Copenhagen, Madrid and Geneva were all owned by national governments, as were many other airports outside Europe, such as those in Tokyo, Singapore, Bangkok, Sydney and Johannesburg. Elsewhere, local governments, at either a regional or a municipal level, were the airport owners. This was the situation with most US airports. Regional airports in the United Kingdom also followed this pattern. Manchester airport, for example, was owned by a consortium of local authorities, with 55 per cent ownership resting with Manchester City Council and the remaining 45 per cent split evenly among eight councils of other nearby towns. In Germany, Dusseldorf airport was jointly owned by the governments of North Rhine, Westphalia state and the city of Dusseldorf, while the joint owners of Hanover airport were the governments of the state of Lower Saxony and the city of Hanover.

With a number of airports, there may have been both local and national government interest. For example, Frankfurt airport was jointly owned by the state of Hesse (45 per cent), the city of Frankfurt (29 per cent) and the federal government (26 per cent). Similarly, Amsterdam was owned by the national government (76 per cent) and the municipalities of Amsterdam (22 per cent) and Rotterdam (2 per cent). Vienna airport was another example, owned by the Republic of Austria (50 per cent), the Province of Lower Austria (25 per cent) and the city of Vienna (25 per cent). Basel–Mulhouse or EuroAirport, situated on the border between Switzerland and France, was (and still is) a unique airport being jointly owned by the national governments of both Switzerland and France.

It was only in the 1990s that there started to be a significant presence of privately (or partially privately) owned airports. Before this, the only privately owned airports were small general aviation (GA) or aeroclub airports and so the influence of the private sector on the airport industry was very limited. Thus public ownership, at a local and/or national level, used to be the norm. However, the way in which the government owners chose to operate or manage the airports varied quite significantly and had a major impact on the airport's degree of independence and autonomy. The strictest form of control existed when the airport was operated directly by a government department, typically the Civil Aviation Authority (CAA), Ministry of Transport or, in a few cases, the military. This was the common practice for airports in areas such as Asia, the Middle East, Africa and South America. In Canada, the National Department of Transport directly operated the 150 commercial Canadian airports. Within Europe, Greece was a good example of a country where airports were effectively run by the CAA.

In other cases, semi-autonomous bodies or companies, but still under public ownership, operated the airports. In some instances these organisations managed more than one airport, as was the situation in Europe with the British Airports Authority (BAA) and Aer Rianta Irish Airports. There were also airport authorities or companies that operated just one major airport. This was the case at Amsterdam airport and many of the German airports. In the United States, airport authorities also existed for some airports, such as the Minneapolis–Saint Paul Metropolitan Airports Commission. In a few cases there were multipurpose transport authorities, such as the Port Authority of New York and New Jersey or Massport in Boston, which operated other transport facilities as well as airports.

There were also a few examples of airports being operated on a concession basis for the central government. At the larger Italian airports (e.g. Venice, Milan), companies with public (usually local) shareholdings and perhaps some minority private shareholdings as well held the operating concession for a long-term period, such as 60 years at Milan airport. The concession could cover management of the total airport and handling services (e.g. Milan, Turin) or just some of the services such as terminal management and handling (e.g. Palermo). At French regional airports, the concessions were given to the local chambers of commerce with the national government retaining some control over the airfield facilities. At Zurich airport, the Zurich Airport Authority, which was owned by the Canton of Zurich, was responsible for the planning and overall operation of the airport and the airfield infrastructure, while a mixed public–private company, FIG, managed and constructed the terminal infrastructure.

Moves towards commercialisation

These publicly owned and often strictly controlled airports were historically regarded as public utilities with public service obligations (PSOs) (Doganis, 1992). Consequently commercial and financial management practices were not given top priority. In the 1970s and 1980s, however, as the air transport industry grew and matured, and as the first steps towards airline privatisation and deregulation took place, views about airport management began to change. Many airports gradually started to be considered much more as commercial enterprises and a more business-like management philosophy was adopted. Thus 'commercialisation' of the airport industry began to take place. The pace of change varied considerably in different parts of the world, with Europe generally leading the way. By contrast, airports in areas such as Africa and South America generally held on to more traditional attitudes towards airports and experienced less change.

Moves towards commercialisation were reflected in a number of different, interrelated developments. First, various airports loosened their links with their government owners. This was achieved with the establishment of more independent airport authorities or, in some cases, by corporatisation, which involved setting up an airport company with public sector shareholders. Such developments generally gave the airports more commercial and operational freedom, and sometimes opened the door to private sector investment and partnerships.

There had always been a number of airports, such as Amsterdam and Frankfurt, which had been run by airport corporations or companies. However, changing attitudes led to many more airport authorities and companies being established. For example, in 1972 the International Airports Authority of India was established to manage the country's four international airports, while in 1986 the domestic airports came under the control of the National Airports Authority. These two authorities merged in 1995. In Indonesia, two organisations, Angkasa Pura I and II, in charge of the airports in the east and west of the country, respectively, became public enterprises in 1987 and limited liability companies in 1993. Other examples included the Polish Airport State Enterprise established in 1987; the Federal Airport Corporation of Australia set up in 1988; Aeropuertos Espanoles y Navegacion Aerea (AENA) in Spain and the Kenya Airports Authority, both formed in 1991; and Avinor in Norway in 2003.

In some cases, such as Copenhagen airport (1991), the South African airports (1994) and Narita airport (2004), the establishment of an airport corporation was undertaken primarily as an interim step towards airport privatisation. Likewise legislation was passed in 2005 which enabled a number of the larger 12 French regional airports to become companies, with the aim of future possible private involvement.

Canada is an interesting example where the management of many of the country's major airports, previously under the direct central control of Transport Canada, was passed over by way of long-term leases to individual non-profit-making authorities in the 1990s. The aim behind this was to improve efficiency and integrate each airport more closely with the local economy. The first airport authorities were set up for Montreal's two airports, Vancouver, Calgary and Edmonton in 1992. By 2000, control of over 100 Canadian airports had been transferred to local organisations (Caves and Gosling, 1999). In China too, the central government began a process of handing over airports to local government control in 1988 with Xiamen airport, and by 2004 all airports, with the exception of Beijing and those in Tibet, were operated by local government airport corporations (Zhang and Yuen, 2008).

Greater attention began to be paid to the commercial aspects of running an airport, such as financial management, non-aeronautical revenue generation and airport marketing. The operational aspects of the airport had traditionally overshadowed other areas, and most airport directors and senior management were operational specialists. However, the commercial functions of an airport were gradually recognised as being equally important and, as a result, the resources and staff numbers employed in these areas were expanded. Relatively underused practices, such as benchmarking financial performance and quality management techniques, also began to be accepted – albeit rather slowly at the start – by a growing number of airports as essential management tools. In some airports, the typical functional organisation structure, with different departments for finance, operations, administration and so on, was replaced with departments or business units focused more on customers' needs, such as airline or passenger services.

For example, way back the late 1980s Vienna airport set up business units or customer divisions separately for airlines and passengers, and supported these with service divisions (construction, maintenance and technical service, safety and security, finance and accounting) and central offices (legal affairs, communications and environment, human resources). The business units were required to make profits, while the service units were there to provide services in the most cost-effective manner. Management practices, with greater emphasis on private sector practices in the areas of business and strategic planning and cost control, were introduced. A comprehensive management information system was launched, and training programmes focusing on customer orientation and effective business practices were set up.

One of the most visible indications of moves towards commercialisation and an increased focus on treating the airport as a business was greater reliance being placed on non-aeronautical or commercial revenues. Aeronautical revenues, such as landing and passenger fees from the airlines, traditionally had been by far the most important source. For a few airports, notably in Europe, non-aeronautical sources overtook aeronautical sources as being the most important revenue. For instance, this occurred at Amsterdam airport in 1984. This development was primarily the result of greater space being allocated to retail and other non-aeronautical facilities, the quality being improved and the range of commercial activities being expanded.

The airport industry historically had played a rather passive role towards marketing and responded to customer needs only when necessary. A more business-like approach to airport management, coupled with a more commercially driven and competitive airline industry, encouraged airports to play a much more proactive role. In the United Kingdom, for example, many airports set up marketing departments, started to use pricing tactics and promotional campaigns to attract new customers, and began to undertake market research (Humphreys, 1999).

In the past, because of government controls, it was sometimes very difficult to obtain financial accounts that gave a true indication of an airport's financial and economic performance. Often an airport would adopt public accounting practices specific to the country and would use public sector rather than more standard commercial procedures. This meant that comparisons with other organisations could not easily be made. Moreover, some airports were not considered as separate accounting units. This meant that the airport's costs and revenues were treated as just one item within the government department's overall financial accounts, and rarely were matched together to assess the profitability of the airport. In certain cases no separate balance sheet existed for the airport.

However, an increasing number of airports started adopting more commercial accounting practices in the 1970s and 1980s. This was often a direct result of the loosening of government links with the establishment of an airport authority or corporation. For instance, in the United Kingdom in 1987, all the major regional airports became public limited companies. This meant that the airports adopted commercial private sector accounting procedures. One example of this was that for the first time they showed depreciation as a measure of cost of capital. Similarly, when Geneva airport became an independent authority in 1994, it began to show a balance sheet and asset values in its annual accounts, which had previously been omitted.

Why privatisation?

While the 1970s and 1980s were dominated by airport commercialisation, the 1990s was the decade when airport privatisation became a reality. But what is meant by 'airport privatisation'? It is a vague term that can have various meanings. In its broadest sense, it is usually associated with the transfer of economic activity or control from the public to the private sector. This involves the transfer of management to private hands, but not always ownership.

The theoretical arguments for and against privatisation of publicly owned organisations are well known. They have been fiercely debated over the years and are well documented (e.g. Beesley, 1997; Parker and Saal, 2003). Supporters of privatisation argue that it will reduce the need for public sector investment and provide access to the commercial markets. It will limit government control and interference and may increase an organisation's ability to diversify. It may bring about improved efficiency, greater competition and wider share ownership, and provide greater incentives for management and employees to perform well and be commercially focused. Moreover, governments may gain financially from converting fixed public assets into cash and subjecting the privatised firms to paying company taxes. On the other hand, opponents argue that privatisation may create a private monopoly that overcharges, delivers poor standards of service, invests inadequately and gives insufficient consideration to externalities such as controlling environmental impacts and maintaining social justice. Less favourable employment conditions may be adopted, with redundancies occurring, and compromises may be made with health and safety.

A number of developments within the air transport industry in the 1980s and 1990s specifically strengthened the case for airport privatisation in some countries (Freathy and O'Connell, 1998). First, the demand for air transport continued to grow and was predicted to do so well into the future. In some markets, notably Europe and North America, deregulation encouraged growth and meant that the existing airport capacity could not cope with this growth. Airport privatisation was seen as a way of injecting additional finance into the airport system to pay for the needed future investment. Moreover, one of the major traditional sources of airport financing, namely public sector funds, became increasingly scarce in the modern-day global economic climate as governments strove to reduce their public sector spending or to shift their focus onto non-revenue-earning activities that appeared to be more worthy, such as health and education. Rikhy *et al.* (2014) summarised the reasons for airport privatisation as: developing traffic demand or meeting such demand; providing broader economic development; receiving cash to deleverage the federal and municipal government's or airport's balance sheets; financing large-scale airport infrastructure; reducing or transferring risks; transferring technology and operational expertise; sharing best practices; and bringing efficiency to the design and operations.

From one viewpoint, airport privatisation can be seen as just an evolutionary stage of airport development. Airports have evolved from public sector utilities to commercial enterprises, and privatisation can be considered as commercialisation taken to its limits. Increased commercialisation has brought about healthy profits and market-oriented management. Airports have shown that they have the proven ability to meet private sector requirements. At the same time, the changes within the airline industry have inevitably had a major impact on the airport sector. The transformation from a predominantly publicly owned, state-controlled and highly regulated airline industry to a global competitive business with much more commercial freedom has forced many airports to have a much more customer-focused outlook when coping with their airline customers.

The increasing number of airport privatisations that are taking place throughout the world demonstrate the growing acceptance of this process as a method of tackling some of the challenges that many airports face in the twenty-first century. However, airport ownership and control is always likely to be a controversial area. For many countries, transferring airports, which are considered to be vital national or regional assets, to the private sector remains a politically sensitive policy. The arguably inherently monopolistic position of some airports will also continue to be of concern to politicians and airport users. The fear is that priority will be given to shareholders or investors, and that user and community needs will be neglected. To some opponents, the privatisation of airports, which is in effect the air transport 'infrastructure', does not make sense. It can be argued that, unlike the situation with the airlines (air transport 'operators', competition among which can more easily be encouraged), airports have a greater tendency to be natural monopolies that cannot be duplicated, even though the extent of competition within the industry has increased dramatically in recent years. In reality, views about privatisation vary considerably in different regions of the world, in different countries and even between local and central government bodies in individual countries. As a result, commercialisation has by no means always led to privatisation, and there are a number of examples of airports (such as Amsterdam in the Netherlands and Changi Singapore airport) that are run on a very commercial basis but remain controlled by the public sector.

The privatisation timetable

The first major airport privatisation took place in the United Kingdom in 1987. This was the total flotation of shares of BAA, which at that time owned three London airports (Heathrow, Gatwick and Stansted) and four Scottish airports (Aberdeen, Edinburgh, Glasgow and Prestwick). This successful privatisation opened up the debate at many other airports as to whether they too should be privatised. However, in the next few years only a handful of airports were actually privatised. In the United Kingdom, this included Liverpool airport, which was partially privatised in 1990; East Midlands, totally privatised in 1993; and Belfast International, which was subject to a management buyout in 1994. Elsewhere in Europe and in other continents there was little evidence of definite moves towards privatisation, with the notable exceptions of Vienna and Copenhagen airports. In 1992, 27 per cent of shares in Vienna airport were floated, followed by a secondary offering of a further 21 per cent in 1996. Similarly, at Copenhagen airport there were share flotations of 25 per cent in 1994 and a further 24 per cent in 1995.

The year 1996 appeared to be a turning point for the airport industry, and the following few years saw airport privatisation becoming a much more popular option in many areas of the world. In that year, for instance, Bournemouth and Cardiff airports were privatised in the United Kingdom, and private involvement in the new Athens airport at Spata was agreed. Airports as diverse as Dusseldorf, Sanford Orlando, Naples, Rome, Birmingham, Bristol, Melbourne, Brisbane and Perth were partially or totally privatised in 1997. Further privatisations took place in 1998 in Australia as well as in South Africa, Argentina, and other destinations such as Luton, Stockholm Skavsta, Auckland, Wellington and Hanover. In 1999 and 2000, a number of airports in central and southern American countries, such as Mexico, the Dominican Republic, Chile, Costa Rica and Cuba, were privatised. There were also share flotations for Malaysian Airports, Beijing Capital International Airport (BCIA) and Zurich airport. The first partially private financed Indian airport was opened in Cochin, Kerala in southern India, having been financed 26 per cent from the state of Kerala and the rest from non-resident Indians (NRIs), financial institutions, and airport service providers.

In 2001, privatisation occurred at airports as varied as Frankfurt, Newcastle, Seeb and Salahah in Oman, and Sharm El Sheikh in Egypt. However, by the end of the year the events of 9/11, coupled with an economic downturn and airline failures in some regions, meant that airport privatisation temporarily became a less attractive option, and various privatisations at airports such as Milan, Brussels and Sydney were postponed or cancelled. As the air transport industry continued to be affected by external events such as the Iraq War and SARS, very few new privatisations took place in 2002 and 2003 – with the notable exceptions of Sydney and Malta. But by 2004 there were signs that airport privatisation was back on the agenda for a number of airports, for example with the successful privatisation of Brussels, and with agreements being reached to develop two greenfield airport sites in India, namely Bengaluru and Hyderabad, partially through private investment. Further privatisations followed in 2005, for instance in Cyprus (Larnaca and Paphos), Budapest and Venice. In 2006, a number of other airports, such as Paris, Kosice in Slovakia, Varna and Burgas in Bulgaria, and the regional airports in Peru, were partially or fully privatised. In the same year, private involvement at the main Indian airports of Delhi and Mumbai was agreed. In 2007–08, airport privatisation activity took place at Xi'an airport in China, in Pisa, Leeds-Bradford, the Macedonian airports of Skopje and Ohrid (although with a start date postponed until 2010), Antalya and Amman.

However, in 2009 this second burst of privatisation activity was again virtually brought to a halt primarily because of the onset of the credit crunch and the global economic recession. A few active privatisation projects for airports such as Prague and Chicago Midway were postponed or cancelled. A very quiet period followed in the next couple of years, with only a handful of airport privatisations, for example at St Petersburg, Pristina, Male and Brussels Charleroi airports. There were also a few secondary sales, such as at the airports of Gatwick and Bristol. Prices for airports fell considerably in these years, but so did the availability of investment funds.

The economic climate has generally improved in the last few years although it remains somewhat unsettled. The number of airport privatisations has increased again but is still below that of the pre-financial crisis era, and there have been more secondary sales. In the UK, Stansted and Edinburgh airport have changed owners and Manchester airport has been partially privatised. In France, Toulouse, Nice and Lyon airports have been privatised. In some parts of Europe, which have been suffering from the Eurozone crisis, governments have viewed privatisation as a way to restore health to struggling public sector finances such as in Greece (Arvantis and Papatheodorou, 2015). For example, in Portugal ANA (which runs Lisbon, Porto, Faro, Santa Maria, Ponta Delgada, Horta and Flores airports) was privatised in 2013, as were 14 regional airports in Greece in 2015. In addition, around a third of SEA, the Milan airport company, and 49 per cent of the Spanish airport company AENA, were recently sold to private investors. However, by far the largest privatisation project in this region is related to the new Istanbul airport, which was agreed in 2013. Future possible candidates for privatisation include Athens airport, more regional airports in Greece, Italy and France, and airports in Lithuania, the Ukraine, Serbia, Bulgaria and Poland (Clark, 2016; Grad, 2017).

There has been relatively little recent activity in the United States except Puerto Rico's Luis Muñoz Marín airport (San Juan), which was privatised in 2013, and the confirmation of a new private terminal at La Guardia airport in New York. In Canada, the 'not-for-profit' industry structure has always been the subject of some criticism and there has been some discussion about privatising the eight largest airports (Vancouver, Montreal, Toronto, Edmonton, Calgary, Ottawa, Winnipeg and Halifax).

In Central/South America there have been three tranches of privatisation in Brazil (2012, 2014, 2017) with more planned in the future. There have been privatisation projects at Cuzco's new Chinchero airport in Peru and Santiago airport in Chile. Possible countries for privatisation in the future include Jamaica, Bermuda, St Lucia, Paraguay, Ecuador and Mexico (at Mexico City). In Asia, the most significant recent privatisation has been with Kansai airport in Japan in 2016 but there has also been new private involvement with the Airports Corporation of Vietnam, at Hanthawaddy airport near Yangon in Myanmar, and at Mactan Cebu airport in the Philippines. Japan, the Philippines and India are likely to see more privatisation in the future. In the Middle East, a region so far relatively untouched by privatisation, there may be private sector involvement in Oman, Saudi Arabia, Iran and Jordan in the future. Meanwhile, in Africa, in spite of strong growth in some countries and a pressing need for airport modernisation and expansion, privatisation projects have been relatively scarce, with ongoing difficulties associated with attracting suitable investors. Nevertheless, Mozambique, Tanzania and Nigeria have been identified as countries which may introduce some private sector involvement in the future (Coombs, 2016; Grad, 2017).

Types of privatisation

While it is accepted that privatisation is a trend within the airport industry, it is very difficult to define, precisely because, as discussed above, it is a vague term that describes a range of different alternatives. To some it is the transfer of ownership to private organisations; to others it may be simply the transfer of management. The latter situation may be defined as private participation or private involvement, rather than privatisation, but in this discussion the term privatisation is used. This means there have been a number of different approaches to classifying privatisation models and the broader governance options that are now available to airports (e.g. Carney and Mew, 2003; Gillen, 2011; ACI, 2017). Here privatisation models are divided into five types:

- share flotation
- trade sale
- concession*
- project finance/ build, operate, transfer (BOT)*
- management contract

(*These models are often called public–private partnerships)

The selection of the most appropriate type of privatisation involves a complex decision-making process that ultimately will depend on the government's objectives in seeking privatisation. For example, is the type of privatisation required to lessen the burden on public sector finances, generate funds from the airport sale, increase share ownership or encourage greater efficiency, competition or management expertise within the airport sector? In reaching a decision, factors such as the extent of control which the government wishes to maintain; the quality and expertise of the current airport operators; further investment requirements; and the financial robustness of the airports under consideration all have to be taken into account. As a result, in 2012 the International Civil Aviation Organization (ICAO) produced a manual on privatisation for the first time to help with the privatisation decisions and processes (ICAO, 2012).

The extent of government control and whether ownership is handed over to the private sector is always a controversial decision (Brutsch, 2013). There is also the choice of partial privatisation, which has tended to be the more popular option, for example in Europe, where 25 per cent of airports are owned by mixed public–private shareholders compared with just 16 per cent that are fully privatised (ACI Europe, 2016). The reason for this is clear. Many governments feel pressure to retain at least some stake in their airports, as these are generally considered to be strategic and vital national or regional assets that have both economic benefits and environmental costs to the communities they serve, as well as perhaps playing an important military role. This issue can become particularly sensitive if foreign private management is involved. Thus the size of the public stake in the airport will be dependent on weighing up the required influence over strategic planning decisions balanced against the obligations and risks of ownership and the benefits to be gained by devolving operational and financial responsibilities to the private sector. The private and public sectors are likely to have different objectives, and conflicts with government policy and its role as a regulator may also have to be considered. In general, when there is a model with both public and private sector involvement, it is typically defined as a public–private partnership (PPP or 3Ps) – although narrower, more specific definitions of PPPs also exist. Concession and project finance privatisation arrangements are commonly classified as PPPs, as sometimes are management contracts.

Share flotation

The first option is a share flotation or an initial public offering (IPO) with the airport company's share capital being issued and subsequently traded on the stock market. Management will usually be given options to acquire shares. To date, the only 100 per cent share flotation that has taken place was with the former company BAA in 1987. Other partially floated airport companies include Vienna airport (Flughafen Wien AG), Copenhagen Airport A/S (CPH) (now de-listed), Zurich, Auckland airport, Malaysia Airports (an organisation owning 37 airports in the country), Airports of Thailand (AOT) (owning six Thai airports), Fraport (owning Frankfurt and other airports), Aéroports de Paris (AdP), Rome (now de-listed), Florence, Venice, Pisa, Hainan Meilan and BCIA. The BCIA flotation was interesting as it was the first airport where a share flotation came after an initial trade sale to a strategic partner, namely AdP. With this 'cornerstone' approach, AdP originally bought 10 per cent of the airport, ABN Amro Ventures bought another 8 per cent and institutional and retail investors a further 17 per cent – leaving the Chinese government with a 65 per cent share. A number of other Chinese airports (Shanghai, Shenzhen, Xiamen and Guangzhou) were also listed on the domestic stock exchanges. Table 2.1 shows that while share flotations were relatively popular in the early days of privatisation, in more recent years there have been very few. Exceptions are AENA where there was an IPO of 28 per cent of share in 2015 (in addition to 21 per cent of the equity going to three pre-agreed consortia (Ferrovial Aeropuertos, Corporacion Financiera Alba, and the UK-based Children's Investment Fund). There has also been the partial small IPO (3.47 per cent) of the Airports Corporation of Vietnam in 2015 to finance future airport investment.

With a share flotation, the government owner will give up total or partial ownership, while transferring the economic risks and effective control to the new shareholders. The stock markets have traditionally viewed purchases of shares in airport companies in a favourable light, with positive factors such as strong growth prospects, limited competition because of high barriers to entry and minimal threats of substitutes, and potential commercial opportunities influencing their views. However, opinions can be less positive in times of economic uncertainty and stock market volatility as the recent global economic problems have demonstrated.

Total or partial privatisation of this type will eliminate, or certainly reduce, the need for state involvement in the financing of airport investment. The proceeds from such a privatisation could be used for funding future investment at the airport, as with the IPO of 27 per cent at Vienna airport, or can go directly to the government, as with BAA. Even when total privatisation takes place, a degree of government influence can theoretically be maintained by issuing a golden share to the government so that in extreme cases national interests can be protected. To prevent domination by any individual shareholder, limits can be placed on the maximum shareholding. For instance, the UK government had a golden share in BAA which gave it the right of veto over undesirable takeovers deemed to be against national interests, and capped the amount of shares that any one shareholder could hold at 15 per cent. However, in 2003 the European Court of Justice declared this type of shareholding to be illegal because it prevents capital movements within the EU. This consequently meant that BAA was subject to a takeover by the Spanish company

Table 2.1 Examples of airport privatisation through share flotations

Airport	Date	Share of airport sold (per cent)
UK: BAA	1987	100
Austria: Vienna	1992	27
Denmark: Copenhagen	1994	25
Italy: Rome	1997	46
Slovenia: Ljubljana	1997	37
New Zealand: Auckland	1998	52
Malaysia: Malaysia Airports	1999	18
China: BCIA	2000	35
Switzerland: Zürich	2000	22
Italy: Florence	2000	39
Germany: Fraport	2001	29
China: Hainan Meilan	2002	20
Thailand: AOT	2004	30
Italy: Venice	2004	30
France: AdP	2005	28
Italy: Pisa	2006	33
Spain: AENA	2015	49
Vietnam: Airports Corporation of Vietnam	2015	3

Note: The table shows only the first sale made; there may have been further sales. A number of other Chinese airports (Shanghai, Shenzhen, Xiamen, Guangzhou) have been listed on the domestic Chinese stock exchanges.

Source: Compiled by author from various sources

Ferrovial. There was a similar situation with Copenhagen, which resulted in a major shareholding being acquired in 2005 by the Australian company Macquarie Airports (MAP).

In order to be floated on the stock market, the airport company will be required to have a track record of minimum profits to make the airport attractive enough to investors. Airports not performing well would clearly find it hard to be successfully privatised in this way. Fully developed capital markets also need to be in existence, which may not be the situation in certain regions, for example in Africa. The airport company will have to get used to daily scrutiny of its financial performance by its shareholders and other investors and, as a consequence, may find it hard not to become preoccupied with the share price. The existing management will usually be able to remain in control of the company as the investors will tend to have a relatively passive role. Moreover, issuing shares to employees may give them an incentive and make them feel more involved in the affairs of the airport company.

Trade sale

With this option, some parts of the airport or the entire airport will be sold to a trade partner or consortium of investors, usually through a public tender. The winning operator, as well as being capable of bringing additional investment at the airport, will usually possess the construction, operations, financial and commercial development expertise to deal with all the complexities of the airport business. Typically it will be a consortium that comprises airport management specialists, domestic and foreign banks, and engineering or construction firms whose combined expertise will be attractive enough to draw in private capital. Restrictions can be imposed on the maximum stake held by each individual owner, or by overseas interests, or by owners of competing airports.

The first significant trade sale was in 1990 when 76 per cent of Liverpool airport in the UK, previously owned by local government, was sold to British Aerospace (Table 2.2). Subsequently a number of other UK airports, including East Midlands, Cardiff, Bournemouth, Leeds-Bradford, Exeter/Devon and Southend, were sold off totally to a trade partner. In the case of Birmingham, Newcastle and Humberside airports, a strategic partner was brought in through a partial sale. Elsewhere in Europe, Brussels, Hanover, Dusseldorf, Hamburg, Kosice, Charleroi, Naples and Milan airports have also been partially privatised through a trade sale. AdP has a 25 per cent share of Liege airport in Belgium, which it has developed as an alternative venue for freight activities. Outside Europe, 20 per cent of the Airports Company South Africa (ACSA) was sold to a strategic partner. The ACSA owns and manages nine South African airports including the three major international airports of Johannesburg, Durban and Cape Town. Two-thirds of Wellington airport in New Zealand was sold through a trade sale, as was a quarter of Xi'an airport in China. Airports which have been leased on long-term arrangements to strategic partners or consortia can also be included in this category – as effectively all control will be transferred from the publicly owned airport to the trade partner. The most notable example here is the Australian airports, the majority of which have been sold on long-term leases (50 years with a further possible option of 49 years) to different consortia. The privatisations at Budapest, Naples, Malta, San Juan airport in Puerto Rico and the French regional airports are other examples.

In many of these cases, the strategic partner is an established airport operator, or the purchasing consortium will contain a member with airport management experience. A number of governments insist on having an airport operator in the consortium. For example, BAA was the strategic partner in the Naples airport sale, and Vienna airport belonged to the consortium that bought part of Malta airport. With most of the Australian airport sales there was an airport interest within the successful consortia. Many of the airports

Table 2.2 Examples of airport privatisation through trade sales

Airport	Date	Share of airport sold (per cent)	Main buyer
UK: Liverpool	1990	76	British Aerospace
UK: Prestwick	1992	100	British Aerospace
UK: East Midlands	1993	100	National Express
UK: Southend	1994	100	Regional Airports Ltd
UK: Cardiff	1995	100	TBI
UK: Bournemouth	1995	100	National Express
UK: Belfast International	1996	100	TBI
UK: Birmingham	1997	51	Aer Rianta/Natwest Ventures (40 per cent)/other investors (11 per cent)
UK: Bristol	1997	51	Firstbus
UK: Liverpool	1997	76	Peel Holdings
UK: Kent International	1997	100	Wiggins
Italy: Naples	1997	65	BAA
Australia: Brisbane, Melbourne, Perth	1997	100	Various
US: Sanford Orlando	1997	100	TBI
Germany: Dusseldorf	1998	50	Hochtief/Aer Rianta
Sweden: Skavsta	1998	90	TBI
South Africa: ACSA	1998	20	ADRI South Africa consortium (Aeroporti di Roma had 69 per cent share)
Germany: Hanover	1998	30	Fraport
New Zealand: Wellington	1998	66	Infratil
Australia: 15 remaining major Australian airports (except Sydney)	1998	100	Various
UK: Humberside	1999	83	Manchester airport
US: Stewart International	1999	100	National Express

Airport	Date	Share of airport sold (per cent)	Main buyer
Belgium: Liege	1999	25	AdP
Italy: Rome	2000	51	Leonardo consortium
Italy: Turin	2000	41	Benetton Group consortium
Germany: Hamburg	2000	36	Hochtief/Aer Rianta
UK: Newcastle	2001	49	Copenhagen airport
Australia: Sydney	2002	100	Macquarie/Hochtief consortium
Malta	2002	40	Vienna airport consortium
Belgium: Brussels	2004	70	Macquarie Airports consortium
Hungary: Budapest	2005	75	BAA
Germany: Luebeck	2005	75	Infratil
UK: Exeter and Devon	2006	100	Balfour Beatty consortium
Slovakia: Kosice	2006	66	TwoOne Vienna consortium
UK: Leeds Bradford	2007	100	Bridgepoint
China: Xi'an	2007	25	Fraport
Belgium: Charleroi	2009	28	SAVE (Venice airport) consortium
Italy: SEA Milan	2011	30	F2i
UK: Manchester Airport Group (MAG)	2013	36	IFM Investors
US: San Juan, Puerto Rico	2013	100	Aerostar Airport Holdings (Aeropuerto de Cancún S.A. de C.V. /Highstar Capital)
France: Toulouse	2015	49.9	Hi-Speed Group/Friedmann Pacific Asset Management
France: Nice	2016	60	Atlantia/EDF
France: Lyon	2016	60	Vinci/Caisse des Dépôts and Crédit Agricole Assurances

Note: The table shows only the first sale made. In some cases there are now different owners.

Source: Compiled by author from various sources

participating in these airport privatisations were not actually privatised themselves, which leads to further complications in the definition of a 'private' airport. For example, the former Aer Rianta Irish Airports, which was a public corporation (now Dublin Airport Authority (DAA)), was successfully involved in the partial privatisation of Birmingham, Hamburg and Dusseldorf airports. Similarly, the government-owned Schiphol group, which owns Amsterdam airports, has a few interests in other airports around the world. Privatisation has been discussed for both these airport operators but has not yet occurred.

Trade sales usually enable the airport to be sold at a higher price than with an IPO. This is because with this type of privatisation there can be more confidence in the airport performing well in the future, as a new management team can be brought in, whereas with an IPO operations will be more reliant on existing management and hence more uncertain. Financial and operational structures can be changed with a trade sale, which is more difficult with an IPO. Moreover, trade buyers will undertake detailed due diligence of the airport and so the risks associated with the purchase will be lower, which again may increase the pre-sale price.

Concession

With this type of arrangement, an airport management company or consortium will purchase a concession or lease to operate the 'privatised' airport for a defined period, commonly between 20 and 30 years, again usually through a tendering process. As with the trade sale, restrictions can be placed on the maximum involvement of certain organisations in the consortium. A concession approach tends to be quite complex, having high transactions costs (including legal and investment advice) and needing to be carefully designed and implemented to ensure the private contracts achieve the government policy objectives. This in turn may limit the airport operator's flexibility. A number of concession models exist; some of the most popular ones are rehabilitate, operate and transfer or rehabilitate, lease or rent and transfer.

Financial terms will vary, but typically there may be an initial payment based on the assessed stream of cash flow from the business and/or payment of an annual fee throughout the term of the agreement and/or a revenue or profit-sharing mechanism. In addition, the agreement may set standards of service and may also identify required expansion work or a demand upper limit that will trigger capacity expansion. Unlike the share flotation and trade sale models, the government maintains ownership of the airport. Therefore, these types of agreement are popular with governments that recognise they need the finance, expertise and know-how of the private operators but do not want to hand over permanent ownership.

A key feature of the concession agreement will be the allocation of risk between the airport operator and the government. The risks associated with operating and financing the airport and traffic will be handed over to the airport operator, which will generally be best able to assess and manage these risks, while other risks, such as those arising from planning delays, terrorism, force majeure, or changes in externally imposed safety or security regulations, may be retained by the government. The precise details related to such risks will vary. For example, the airport operator will tend to take the risks associated with traffic developing out of competing airports, although in some cases, as with the new second airport at Mumbai in India, the concessionaire of the current Mumbai airport has the right of first refusal to operate the new airport as long as it matches the top bid. Elsewhere, if a national carrier fails, the government may bear the risk and pay the concessionaire compensation payments due to the decline in revenues. The contract will also contain details about the regulatory regime and personnel issues. In addition, as it is never feasible to foresee all future developments, there will normally be some form of adjustment mechanism to balance the requirements of the stakeholders and also default/termination conditions and associated compensation payments (World Bank, 2017a; Stiller, 2010; Cruz and Marques, 2011).

One of the earliest concession arrangements was agreed in 1997 for the three main airports of Bolivia: La Paz, Santa Cruz and Cochabamba (Table 2.3). Airports Group International (AGI), the former airport management company (acquired by TBI and then later by Abertis), was awarded the 30-year concession, during which time it agreed to pay an annual fee of 21 per cent of gross revenues. The agreement did not specify a set level of investment, but called for continuous maintenance of the airports up to a certain standard, which ensured there was a progressive investment programme adapted to the traffic growth. A notable further example is the 30-year concession for the 33 Argentinian airports, which was awarded to the consortium Aéroportuertos Argentinas 2000 (AA2000), which had among its partners SEA (the Milan airport company) and Ogden (the airport services company). The consortium agreed to pay an annual US$171 million a year for the first five years of the agreement and to invest US$2 billion. However, this concession amount was considered by many to be totally unrealistic, and it proved impossible for AA2000 to pay it all, especially because of the severe political and economic crisis the country went through after this privatisation occurred. Eventually, in 2007 it was agreed that the fee would be changed to 15 per cent of revenues (Lipovich, 2008).

Since the privatised airport will be handed over only for a fixed period, the government owner will have a greater degree of control than with an outright sale, and will benefit financially from either an upfront payment, an annual revenue stream, or both. The fixed-term arrangement may also give the operators an incentive to improve their performance if they want to be given the concession again, and may ensure that investment in the airport is carried out in a speedier manner. For the government there will be an opportunity to introduce fresh management and new ideas when the concession term expires. However, a shortcoming of the fixed-term nature of the concession is that it may well provide weaker incentives for the operator to invest and to innovate, especially during the later stages of the concession, as there will be no guarantee that the concession will be extended and that the operator will make an adequate return on their investment. Costs may have to be inflated by the operator if it has to depreciate the assets over the period of the concession; or alternatively, if there are residual values of the assets, this may result in uncertainty and perhaps higher cost of capital and less favourable financial offers made by potential operators when bidding for the airport.

At Luton airport in the United Kingdom, a consortium originally consisting of Barclays Investment, Bechtel Enterprises and Airport Groups International was given the 30-year concession to run the airport in 1998. A concessionaire-type arrangement was chosen, rather than a flotation or trade sale, since the local government owners had promised not to relinquish total control of this publicly owned asset to private hands. This arrangement involved paying an initial annual concession fee of US$19 million, which would increase as passenger traffic grows. Barclays and Bechtel have subsequently sold off their interest in this airport. In recent years a key obstacle to further investment at the airport has been the limited period left for the airport concession arrangement, but this appears to have been resolved with a renegotiation of the contract.

The situation was rather different in Mexico, where the country's 58 airports were divided into four groups: the North-Central Group (GACN – known as OMA from 2007), the Pacific Group (GAP), the Southeast Group (ASUR), and the Mexico City Group (AICM) (Rico, 2008). Each of these groups had at least one large airport (e.g. Mexico City, Cancun, Acapulco) which would make it desirable to private investors, but they also had some smaller airports as well. The very small airports were not allocated to any of these groups as, although they were seen as essential for public need, they were not considered to be attractive investments. Concession contracts were awarded for 15 per cent for three of these four groups for an initial 15-year period with an underlying 50-year agreement. There had to be local involvement and there had to be at least one airport operator from another country within each successful consortium to bring international expertise, but only 49 per cent could be under foreign ownership. It was also planned that there would be a subsequent flotation of remaining government shares. The Mexico City group has yet to be privatised, if ever, because of uncertainty related to a new airport for the capital and other political and social issues. Many other concessions agreements have since been signed (Table 2.3) with the privatisations in Brazil and Japan being very significant recent developments. The privatisation of 14 Greek regional airports in 2015 with a 40-year concession is also another important example where the winning consortium (Fraport and the Greek business development organisation Copelouzos Group) agreed to pay an upfront fee of €1.234 billion, and an annual fixed concession fee of initially €22.9 million, a variable annual fee of on average 28.5 per cent of the operating profit and guaranteed investment of €330 million until 2020 (Fraport Greece, 2017).

Project finance/BOT

With this option, a company will usually build or redevelop and then operate an airport or specific facility, such as a terminal, for a certain length of time, typically 20–30 years. This company may be totally private or may be a PPP. At the end of this period, control will revert to the government owners. Thus this approach can be viewed as a particular type of concession agreement. Generally such an arrangement will not usually require a large upfront payment, but the operating company will bear all the costs of building or redeveloping the facility. When it is built, the company will have to cover the operating costs but will also retain most revenues (often after paying an annual fee to the government) until the facility is handed back. Thus the airport company will take full economic risk for investment and operations but it will not have to go through the normal public

Table 2.3 Examples of airport privatisation through concession agreements

Airport	Date	Length of concession (years)	Concessionaire
Columbia: Barranquilla	1997	15	AENA consortium
Columbia: Cartagena	1998	15	AENA consortium
Bolivia: La Paz, Santa Cruz, Cochabamba	1997	25	AGI
UK: Luton	1998	30	AGI/Bechtel/Barclays consortium
Mexico: South East Group	1998	15*	Copenhagen airport consortium
Mexico: Pacific Group	1999	15*	AENA consortium
Argentinean Airport System	1998	33	Aeropuertos Argentina 2000 consortium (including SEA Milan and Ogden)
Tanzania: Kilimanjaro International Airport	1998	25	Mott Macdonald consortium
Dominican Republic: 6 airports including Santo Domingo	1999	20	YVRAS†/Odgen consortium
Chile: Terminal at Santiago International Airport	1999	15	YVRAS† consortium
Uruguay: Montevideo	1999	25	YVRAS† consortium
Costa Rica: San Jose	1999	20	TBI
Columbia: Cali	2000	20	AENA consortium
Mexico: North Central Group	2000	15*	AdP consortium
Peru: Lima	2001	30	Fraport/Alterra consortium
Jamaica: Montego Bay	2003	30	YVRAS† consortium
Peru: 12 regional airports	2006	25	Ferrovial consortium
India: Delhi	2006	30	GMR/Fraport/Malaysia Airports consortium
India: Mumbai	2006	30	GVK/ACSA consortium

Airport	Date	Length of concession (years)	Concessionaire
Turkey: Antalya	2007	17	Fraport/IC Holding consortium
Turkey: Antalya Gazipasa	2009	25	TAV Airports
Maldives: Male	2010	25	GMR/MAHB
Kosovo: Pristina	2010	20	Limak/Aéroports de Lyon consortium
Russia: St Petersburg	2010	30	Fraport/VTB consortium
Croatia: Zagreb	2012	30	AdP/TAV consortium
Brazil: Brasilia, Sao Paulo	2012	20–30	Various
Portugal: ANA	2013	50	Vinci
Brazil: Rio, Belo Horizonte	2014	25–30	Various
Philippines: Mactan Cebu	2014	25	GMR/Megawide Construction Corporation
Greece: 14 regional airports	2015	40	Fraport/ Copelouzos Group
Japan: Kansai	2016	44	Vinci/Japanese ORIX Corporation/other companies from Kansai region
Brazil: Florianopolis, Fortaleza, Porto Alegre and Salvador	2017	30	Various
Japan: Kobe	2017	42	Vinci/Japanese ORIX Corporation/other companies from Kansai region

Note: The table shows only the first new operator. In some cases, there are now different operators.

*Fifteen-year contract but underlying 50-year concession.

†YVRAS changed its named to the Vantage Group in 2011.

Source: Compiled by author from various sources

sector procurement processes. There are a number of project finance privatisation methods that allocate different amounts of risk to the private sector. The most popular model is BOT when, as the name suggests, the company will build the facility, operate it for a certain length of time and then transfer management back to the government. Related models include build, lease, transfer and build, own, operate, transfer, but often all methods are referred to by the generic term BOT.

This type of arrangement is commonly used when relatively large investments are needed for totally new airports or perhaps for new passenger terminals or other major facilities. One of the first major projects of this type was terminal 3 at Toronto's Lester B. Pearson International airport, which was developed as a BOT project by Huang and Danczkay and Lockheed Air Terminals (Ashford and Moore, 1999). The former Eurohub at Birmingham airport was also built under a BOT-type arrangement by a company comprising Birmingham airport (25 per cent), British Airways (BA) (21.4 per cent), local authorities (14.3 per cent), National Car Parks (21.4 per cent), Forte (6 per cent) and John Laing Holdings (11.9 per cent). However, this terminal is now a fully owned and managed facility of Birmingham airport that is integrated with the rest of the facilities.

The Athens airport at Spata Eleftherios Venizelos was built under a 30-year BOT arrangement. The Greek government holds 55 per cent of the shares in the company Athens International Airport SA (AIA). The remaining share of 45 per cent belongs to an international consortium, led by AviaAlliance (formerly Hochtief). Another example of a BOT project was the international passenger terminal 3 at Ninoy Aquino International airport in Manila. This was the first project finance model of its kind in the Asia-Pacific region, but proved unsuccessful after a few years because of a major dispute between the government and the private consortium Philippine International Air Terminals Company, which was led by Fraport.

Another example is the 25-year BOT project which was agreed in 2007 to develop a new terminal at Queen Alia International airport in Amman in Jordan. Like many of these types of project, this required an international airport operator to have a share in the winning consortium; in this case, AdP. The consortium AIG PSC agreed to pay 54 per cent of gross revenues to the government. The most recent BOT projects include Istanbul, Cuzco, Hanthawaddy, Santiago and LaGuardia (Table 2.4). The new airport in Istanbul ('Istanbul New Airport') is a major development with the first phase, with three runways and a terminal for 90 million passengers (annual), timetabled for opening in 2018. Eventually it is planned that the airport could have a capacity of around 200 million passengers. Five investors (Cengiz, MAPA, Limak, Kolin, Kalyon) each have a 20 per cent interest in the 25-year BOT project with a bid worth €22.152 billion (iGA, 2017).

Management contract

The least radical privatisation option is a management contract where ownership remains with the government and the contractors take responsibility for the day-to-day operation of the airport, typically for a period of 5–10 years, although it may be longer. Usually the government pays an annual management fee to the contractor, typically related to the performance of the airport, or the contractor will pay the government a share of its revenues. Normally investment will remain the responsibility of the government owner and so the overall economic risk is shared between the owner and the management company. For the government owner this may be politically more acceptable, whereas for the contractor such an arrangement may be attractive in countries where greater financial exposure, through a trade sale, for example, may be seen as too great a risk.

Table 2.4 Examples of airport privatisation through project finance/BOT

Airport	Date	Length of agreement (years)	Contractor
Canada: Toronto Terminal 3	1987	Terminated	Lockheed consortium
UK: Birmingham Eurohub	1989	Terminated	Various including Birmingham airport, British Airways, National Car Parks
Greece: Athens	1996	30	Hochtief consortium
Philippines: Manila international terminal	1999	Terminated	Fraport consortium
US: New York JFK international arrivals terminal	1997	20	Schiphol consortium
Turkey: Ankara	2003	20	TAV Airports
India: Hyderabad	2004	30	Siemens/Zurich airport consortium
India: Bengaluru	2004	30	GMR/Malaysia Airports consortium
Albania: Tirana	2005	20	Hochtief consortium
Cyprus: Larnaca and Paphos	2005	25	YVRAS* consortium
Bulgaria: Varna and Burgas	2006	35	Fraport consortium
Jordan: Amman	2007	25	AdP consortium
Georgia: Tbilisi and Batumi	2007	20	TAV consortium
Tunisia: Monastir and Enfidha	2007	40	TAV consortium
Turkey: Izmir	2012	20	TAV
Saudi Arabia: Madinah	2012	25	TAV consortium
Turkey: Istanbul New Airport	2013	25	Cengiz/Kolin/Limak/Mapa/Kalyon consortium
Peru: Cuzco	2014	40	Corporación America/Andino Investment Holdings
Myanmar: Hanthawaddy Yangon	2014	30	Yongnam Holdings, Changi Airports International, JGC Corporation

Airport	Date	Length of agreement (years)	Contractor
US: New York LaGuardia Terminal B	2015	35	Various including Vantage Airport Group
Chile: Santiago	2016	20	AdP/Vinci/Astaldi

Note: The table shows only the first new operator. In some cases there are now different operators.

*YVRAS changed its named to the Vantage Airport Group in 2011.

Source: Compiled by author from various sources

An early example within Europe was Brussels, where the terminal was under a management contract to a private company, the Brussels Airport Terminal Company, from 1987. In 1998, however, this company merged with the public company operating the rest of the airport to become the Brussels International Airport Company. More common is for airport operators to have management contracts in other areas of the world. Examples of airport operators with past and current airport contracts include AENA (Cuba), Vantage Airport Group (Bahamas, Dominican Republic and Turks and Caicos Islands), AdP (Algeria, Egypt, Guinea, Madagascar, Saudi Arabia and Cambodia), Schiphol (Aruba) and Fraport (Saudi Arabia and Egypt). Such arrangements can cover all airport operations or just one aspect, such as retail. BAA, for instance, had retail contracts at Pittsburgh, Baltimore, Cleveland and Boston until these were terminated in 2010 as a result of its strategy to focus on core assets. DAA, through its subsidiary Aer Rianta International (ARI), has retail contracts at various airports in North America, the Middle East and Asia.

Regulation, competition and efficiency issues

The amount of influence that a government can exert over a private airport clearly depends on the type of privatisation model chosen. A government may hold onto a considerable amount of control if a management or private finance contract is chosen, while very little state influence may remain after an airport company has been floated on the stock market or sold to a strategic partner. In these latter cases, if the airport has substantial market power (SMP) it is often feared that the privatised airport will act like a private monopoly, and may not always operate with the best interests of the airport users in mind, by raising charges, reducing the quality of service and under-investing in facilities. Therefore, economic regulation has been introduced at a number of airports when the privatisation process has taken place. Chapter 4 explains in detail the types of regulation introduced and the rationale behind this.

There is also another competition issue that has to be taken into account if a group of airports, rather than a single individual airport, is being considered for privatisation: should the airports be sold off together as a group or should they be split up into different companies? This is particularly an issue when the airport group or system may contain a few large international airports that are profitable and a number of smaller regional or local airports that are loss-makers. This was the case with the Australian airports and also in a number of South American countries prior to privatisation. If the airport group is sold as a single entity, and if generally this group as a whole has a good financial track record, a higher sale price may be achieved primarily because of the lack of perceived competition from other airport operators. Moreover, there will be lower administration and transaction costs related to the process of privatisation. In addition, any unprofitable parts of the airport system (usually the smaller airports) will not have to remain under public ownership if the whole group is sold, and raising capital on the commercial money markets for future investments may be easier for a larger company. However, if the group does contain a number of loss-making airports this may make it less attractive to investors and the sale price may suffer accordingly. Furthermore, there may have to be special conditions built into the privatisation arrangements to ensure the new private owner does not neglect the management of the smaller airports. On the other hand, if only the profitable airports are privatised, for example with a concession arrangement, another option would be to use the concession fees to subsidise the smaller airports.

Selling off airports in a group may inhibit competition, although the extent of competition that exists between airports in a group can vary significantly depending on the local circumstances (see Chapter 8). It is a different situation when the airports have overlapping catchment areas (such as the former BAA airports in London) compared with serving totally different markets. Airlines inherently tend to be suspicious of airport groups, fearing that they will be paying charges at one airport which will finance the development of another airport, typically in some remote area which they do not use. However, in response airports often argue that they achieve economies of scale and are making the best use of resources and expertise by operating as an airport group, and that such management enables a strategic and coordinated approach to airport development. Airports can also be developed to focus on certain types of traffic, for example in London with LCCs at Stansted and network carriers' traffic at Heathrow. Many airport groups exist, and this is a common issue that needs to be addressed irrespective of whether privatisation is occurring. For example, in Europe: in Finland Finavia operates 25 airports, in Norway Avinor operates 46 airports, in Spain AENA operates 46 airports, and in Sweden Swedavia operates 10 airports (ACI Europe, 2016). Interestingly in Sweden when Swedavia took over from the previous enterprise Luftfartsverket in 2010, four smaller airports (Karlstad airport, Sundsvall Härnösand airport, Ängelholm Helsingborg airport and Örnsköldsvik airport) were sold to the local municipalities.

In Australia, the government decided on individual privatisations for the major international airports but with packages of some of the smaller ones. Restrictions were imposed to stop the same operator from having overall control at a number of airports. As regards privatisation in South America, all 33 Argentinian airports were covered under the same concession agreements, while in Mexico the airports were divided into four different groups with a mixture of small and large airports in each group. In the United Kingdom, after much debate, BAA, which was an airport group of seven airports, was privatised in 1987 as a single entity, but this remained a controversial issue and eventually led to a requirement for the group to be split up in 2009. This continues to be a subject of debate in countries that are likely to experience privatisation in the near future, and indeed was considered in Portugal prior to the recent privatisation which maintained the group structure of the main airports (Marques, 2011).

As well as affecting competition between airports, it is often argued that privatisation will lead to greater efficiency and improved financial performance. This is an area of increasing interest but with somewhat contradictory findings – although this may partly be to do with the adoption of different methodologies to assess the situation (Graham, 2011). (See Chapter 3 for a discussion concerning performance measurement at airports.) For example, Parker (1999) investigated BAA before and after its privatisation and found no significant variation in performance, as did Holvad and Graham (2004) when they considered the whole of the UK airport industry. For Australian and New Zealand airports, Domney *et al.* (2005) concluded that privatisation was actually negatively associated with profitability and that there was no statistically significant association with efficiency. Vasigh and Gorjidooz (2006) did not find a significant relationship between efficiency and airport ownership when a sample of 22 – both public and private – US/European airports were examined. Moreover, when Oum *et al.* (2003) looked at a large sample of major Asia-Pacific, European and North American airports, they again found that ownership had no significant impact, and the same conclusion was reached with Lin and Hong (2006) in their research of 20 major international airports.

In a study of 35 European airports, Vogel (2006) found that partially and fully privatised airports operated more efficiently than public ones, and Bottasso and Conti (2012) produced some evidence to suggest that private airports in the UK have lower costs. Similarly, Barros and Dieke (2007) found that private Italian airports were more efficient than public Italian airports, Gitto and Mancuso (2012) observed that private-capital inflows had a positive impact in Italy, while both Fung *et al.* (2008) and Yuen and Zhang (2009) observed that airports that had been publicly listed in China were more efficient than non-listed ones. However, Zhang and Yuen (2008) questioned whether this was more to do with the specific inherent characteristics of the listed airports. Generally, it is important to note that the fact that it tends to be the more efficient or profitable airports that are picked for privatisation could very well distort research findings.

In a global study, Oum *et al.* (2006) concluded that airports with government majority ownership were significantly less efficient than airports with a private majority ownership, although there was still no statistically significant evidence that fully state-owned airports were less efficient. Likewise, Oum *et al.* (2008) concluded that there was a high probability that airports owned/operated by a majority private firm achieved higher efficiency than those owned/operated by a mixed enterprise with government majority ownership. Therefore, both these latter studies suggested that minority private sector participation should be avoided in favour of even 100 per cent state ownership – maybe due to the conflicting objectives that may occur with such PPPs. Adler and Liebert (2014) in their study of European and Australian airports found that public airports operated less efficiently than fully private airports in relatively non-competitive conditions, but there was no impact in a competitive setting. Meanwhile, Assaf and Gillen (2012) concluded that private involvement generally had a positive impact on efficiency but it was regulation rather than ownership which was the key driver of performance.

As regards profitability and specifically measures such as return on capital employed (ROCE) or invested (see Chapter 3), ACI (2017) found average values of 5.5 per cent for fully public ownership, 6.5 per cent for fully private airports and 7.4 per cent for mixed models or PPOs. Vogel (2016) observed that such measures did not vary significantly with ownership models, although PPP airports again appeared to perform marginally better. He discussed how this may at least be partially due to different capital structures and/or costs. ACI (2014) found that in general privatised airports had higher revenues and costs per passenger, suggesting that with public airports taxpayers may be contributing to the overall financing of airport operations and expansion.

Understandably, the airlines tend to assess the success of airport privatisation in terms of service levels and cost-effectiveness rather than by financial gains. Potential risks which they feel should be addressed during airport privatization include under-investment or unnecessary investments, shifts in the regulatory till, pre-determination of charges evolution, increase in non-regulated aviation fees, prefunding of airport investment and cross-subsidisation in airport networks (IATA, 2017). Within this context a study of 12 airport privatisations in Europe, Asia and Latin America was undertaken a few years ago, and from the airlines' viewpoint some disappointing results were observed (IATA, 2005). Many of these issues are further discussed within the context of regulatory control in Chapter 4.

Privatisation examples

United Kingdom

The United Kingdom is worthy of special attention when privatisation is being considered, not only because the first major airport privatisation took place in this country, but also because subsequent privatisations have been quite varied in nature. Airport privatisation came about because of a major piece of legislation, the Airports Act introduced in 1986. The first part of the Act was concerned with the then government-owned BAA, which operated three English airports: London Heathrow, London Gatwick, London Stansted, and the four Scottish airports of Aberdeen, Edinburgh, Glasgow and Prestwick. The Act made provision for BAA to become a private company through a subsequent 100 per cent share flotation in 1997. This reflected the overall aim of the conservative Thatcher government of the time to privatise nationalised industries such as utilities and communications, and to increase share ownership among the UK population (Graham, 2008).

The second part of the Act required all airports with a turnover of more than £1 million in two of the previous three years to become companies. Prior to this Act, these airports had been run directly by their local government owners. Sixteen airports were covered by this part of the Act, ranging from Manchester airport, owned by a consortium of local authorities which at that time had a throughput of nine million passengers, to Southend airport, owned by Southend Borough Council and handling just over 100,000 passengers. The shareholders of these airport companies were initially to be the local government owners, but the shares could then be sold off to private investors if desired by the public sector owners. This was the Conservative government's ultimate aim. The Act also introduced economic regulation at these airports (discussed in Chapter 4).

BAA was floated in 1987 with £1.2 billion going to the government. This gave BAA the freedom to borrow from commercial markets and diversify into areas of operations such as hotels, property management and hospital shops, which it did in its first few years of operation (Doganis, 1992). BAA subsequently dramatically expanded the retail part of its business and became a global player in airport management through interests in airports in as diverse areas as Australia, Italy, the United States, Mauritius and Oman, although these links no longer exist as the company subsequently focused back on its core activities in the UK. Meanwhile, the new situation at the regional airports gave them considerably more opportunity to commercialise their activities. As a result the share of non-aeronautical revenue increased at the majority of these airports and more resources were devoted to commercial activities such as marketing (Humphreys, 1999).

The most significant impact of the Airports Act was the change in ownership patterns that emerged (Table 2.5). By the early 1990s, the regional airports were finding it increasingly difficult to obtain permission to borrow funds for investment, and in 1993 the government announced that there would be no further spending allocation for airports. The only alternative for airports that wished to invest was privatisation, which an increasing number of airports had no choice but to adopt. Political pressures from a Conservative central government, which was very much ideologically attracted to the transfer of public service to the private sector whenever possible, undoubtedly played a major role.

Various airports, such as East Midlands, Cardiff and Bournemouth, chose full privatisation through a trade sale to a strategic partner. Southend airport was also totally privatised, but in this case the sale was undertaken to ensure the survival of the airport rather than to give access to finance for expansion as with many of the other airports (Humphreys, 1999). Some airports, such as Newcastle and Norwich, opted for a partially privatised approach that gave them access to finance but also enabled some local public control to be maintained. Birmingham airport is an interesting example which initially overcame funding difficulties by establishing a joint venture company to build the additional Eurohub terminal with a BOT project without a change in overall ownership. This solved the short-term problem of funding, but subsequent traffic growth meant that there was once again pressure for additional investment, and this time the airport opted for a partial privatisation.

A few local authority airport owners remained strongly opposed to privatisation moves – arguing that the airport should remain in public sector hands to maintain its role as a regional public asset. Manchester was one such airport and financed the whole of its second runway project from retained profits. Its public sector status, however, meant that it was not free to expand internationally on equal terms with competing private airports. It was involved with the successful consortium in the sale of Adelaide/Parafield and Coolangatta airports in Australia, but because of its status could only act on a consultancy basis with no equity share involved. From 1999, however, this situation changed with legislation introduced to allow for the larger profitable regional airports which were still in local government hands (Manchester, Newcastle, Leeds-Bradford and Norwich) to be

Table 2.5 Ownership patterns at main* UK airports, 2017

Airport	Ownership in 2017	Private interest (per cent)	Privatisation date	Passenger numbers 2016 (000s)
Aberdeen	AGS Airports	100	1987	2,955
Belfast City	3i Investments	100	n/a	2,665
Belfast International	Airports Worldwide	100	1994	5,148
Birmingham	Local government/Ontario Teachers' Pension Plan/ Employee Share Trust	51	1997	11,645
Bournemouth	Manchester Airport Group (MAG)**	35.5	1995	668
Bristol	Ontario Teachers' Pension Plan	100	1997	7,611
Cardiff	Welsh government	0	1995	1,161
Doncaster (Robin Hood)	Peel Group	100	n/a	1,256
East Midlands	MAG	35.5	1993	4,654
Edinburgh	Global Infrastructure Partners (GIP)	100	1987	12,348
Exeter	Rigby Group	100	2007	847
Glasgow	AGS Airports	100	1987	9,327
Leeds Bradford	Bridgepoint	100	2007	3,612
Liverpool	Peel Group	100	1990	4,779
London City	Ontario Teachers' Pension Plan/Borealis	100	n/a	4,539
London Gatwick	GIP/Future Fund Board of Guardians/Abu Dhabi Investment Authority/ California Public Employees' Retirement System/the National Pension Service of Korea	100	1987	43,120

Airport	Ownership in 2017	Private interest (per cent)	Privatisation date	Passenger numbers 2016 (000s)
London Heathrow	Ferrovial/Qatar Holding/ Caisse de dépôt et placement du Québec/ Government of Singapore Investment Corporation/ Alinda Capital Partners/ China Investment Corporation/Universities Superannuation Scheme	100	1987	75,711
London Luton	AENA; Ardian	100†	1998	14,646
London Southend	Stobart Group	100	1993	875
London Stansted	MAG	35.5	1987	24,320
Manchester	MAG	35.5	2013	25,637
Newcastle	Local government /AMP Capital	49	2001	4,808
Prestwick	Scottish government	0	1987	673
Southampton	AGS Airports	100	1961	1,947

Note: The table shows the most recent owner, not necessarily the first private sector owner.

n/a = not applicable.

*Largest 25 airports by annual passengers in 2016 (excluding Isle of Man; Scottish Highlands and Islands).

**Sold to Rigby Group in 2017.

†The private investors have a 30-year concession contract. Ownership remains with the local authorities.

Source: Compiled by author from various sources

able to borrow money on the open market. This enabled Manchester to purchase 83 per cent of the nearby Humberside airport soon afterwards, and it subsequently also bought Bournemouth and East Midlands airports. MAG was then partially privatised in 2013 to enable it to purchase Stansted airport.

There are also a few other airports in the United Kingdom which have had a different history. The relatively newly developed London City airport and Belfast City airport have always been in private hands. Belfast International was privatised by means of a management buyout in 1994 and was subsequently sold to TBI in 1996. Most of the very small regional airports in the United Kingdom remain under public sector ownership. Highlands and Islands Airports Ltd, a state-owned company, operates 10 airports in Scotland with the help of a government subsidy.

Table 2.6 Group/fund ownership of UK airports, 2017

Owner	Airport
AGS Airports*	Aberdeen, Glasgow, Southampton
Global Infrastructure Partners (GIP)	Edinburgh, Gatwick
Manchester Airports Group (MAG)**	Bournemouth, East Midlands, Humberside, Stansted
Ontario Teachers Pensions Plan	Birmingham, Bristol, London City airport
Peel Group	Liverpool, Doncaster Robin Hood, Durham Tees Valley
Regional and City Airports (Rigby Group)	Blackpool***, Coventry, Exeter, Norwich (Also management contracts at City of Derry and Solent)
Stobart Group	Southend, Carlisle
Scottish government	Highlands and Islands airports, Prestwick

*Ferrovial is a major shareholder of AGS Airports and Heathrow Airport Holdings.

**Sold to Rigby Group in 2017.

**Sold to Blackpool Council in 2017.

Source: Compiled by author from various sources

Looking back to 1986 before the Airports Act, a number of the main regional airports, such as Exeter, Humberside, Liverpool, London Stansted, Norwich and Prestwick, recorded a loss. By 2005–06, all airports were in a profitable situation with the exception of Durham Tees Valley and the Highland and Islands airports. However, the poor economic situation as the result of the economic recession forced some other smaller airports (such as Leeds Bradford and Humberside) into a loss-making situation, and Coventry, Plymouth and Blackpool airports closed (although Blackpool airport has now reopened). There have also been a number of secondary sales, for example in 2012 Copenhagen sold its 49 per cent of Newcastle to AMP Capital and in 2013 Belfast International was bought by Airports Worldwide. In addition, two airports have been brought back to public ownership, namely Cardiff in Wales and Prestwick in Scotland (Halpern and Graham, 2017).

There are now a number of airport groups that manage more than one airport in the UK (Ison *et al.*, 2011), including AGS, MAG, Peel, Regional and City, and Stobart (Table 2.6). However, there have also been cases where group ownership has not gone ahead as it was viewed as anti-competitive, for example with Bristol and Exeter airports and with Belfast City and Belfast International airports. Moreover, at the time of the privatisation of BAA there were extensive debates as to whether the airports of BAA should be privatised as a group or separately (see Chapter 8). In the end there was group privatisation, but since then the airline regulatory environment has become progressively more liberal, providing more opportunities for airport competition. Consequently, there were various reviews investigating whether BAA should be split up, the most comprehensive being undertaken by the UK's competition authority, the Competition Commission between 2007 and 2009. This resulted in BAA being required to sell Gatwick, Stansted and Glasgow or Edinburgh (Competition Commission, 2009). Then in 2014, Heathrow Airport Holdings sold three out of the four remaining BAA airports (Aberdeen, Glasgow and Southampton) to focus purely on Heathrow.

France

In contrast to a number of other European airports, France has been relatively slow in allowing privatisation of any of its airports. It was not until 2004 and 2005 when legislation was passed which cleared the way for the partial privatisation of AdP in 2006. At the same time a new ownership and management structure for the larger regional airports was agreed, which has led to further privatisation.

Traditionally, French regional airports were operated as concessions by the local chambers of commerce and industry, with the national government retaining some control over the airfield facilities. A new law of 22 July 2005 divided the regional airports into two groups. First, there were the larger 12 major regional airports (eight in France – Nice, Lyon, Toulouse, Marseille, Bordeaux, Nantes, Strasbourg and Montpelier; four overseas – Pointe-à-Pitre, Fort de France, Saint Denis-Réunion and Cayenne) where a new ownership and management structure was agreed, with the ultimate aim of leading to some privatisation. The new legislation stated that the French government would remain the landowner, but companies would be created and granted a long-term airport concession of a maximum of 40 years. Initially, these companies would have only public shareholders, namely the French government (60 per cent), local authorities, and the chamber of commerce and industry, but there could be future private investors. With the remaining 151 airports, the new framework allowed for the inclusion of the local governments and private investors into the capital arrangements but they had to remain under majority public ownership (Villard, 2011).

At the larger regional airports, a number of these airport companies have been created. Whilst the global economic crisis and political events slowed down the privatisation process, three of the four largest regional airports have now been privatised (Figure 2.1). At Toulouse airport in 2015, a 49.9 per cent stake of the airport company (i.e. 49.9 of the 60 per cent owned by the French government) went unexpectedly to a foreign consortium consisting of a Hong Kong infrastructure investment company (Friedmann Pacific Asset Management) and a Chinese company (Shandong Hi-Speed Group) that specialises in investment, construction and highway operations (CAPA, 2015). Then, in 2016, the central government relinquished all of its 60 per cent share of both Nice and Lyon airports. At Lyon, there was a consortium consisting of Vinci Airports, Caisse des Dépôts and Crédit Agricole Assurances, whereas at Nice, which is the largest airport outside Paris, the consortium was made up of Atlantia and EDF. More privatisations may follow including possibly a further partial share flotation at the Paris airports, especially with the election of President Macron in 2017.

Australia and New Zealand

Between 1988 and 1997, most of Australia's airports were operated by the state-owned Federal Airports Corporation (FAC). At the beginning of 1997, the FAC operated 22 airports and

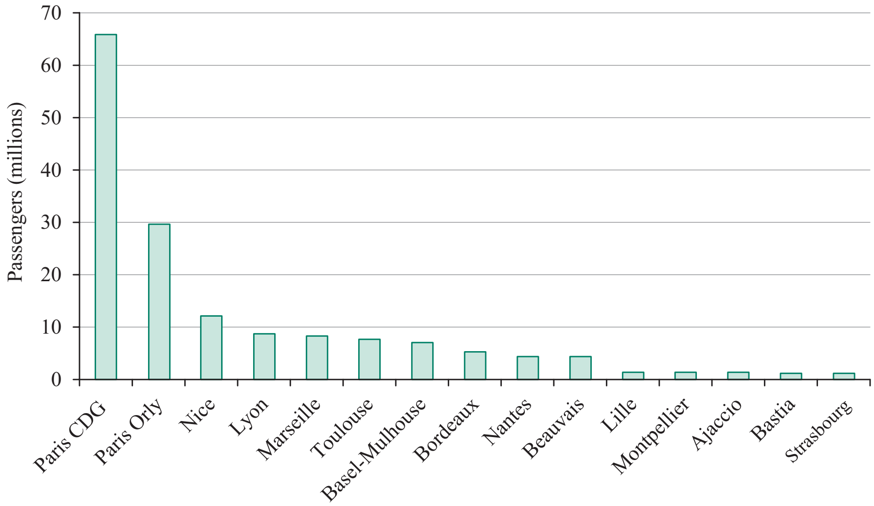

Figure 2.1
Passengers at major French airports, 2015
Source: Union des Aéroports Français

handled over 60 million passengers annually. The FAC corporate office undertook various central services and imposed a common charging policy on its airports. Discussions relating to the privatisation of the FAC began in the early 1990s, and a firm decision to privatise them was made in 1996. Considerable attention was given to whether the airports should be sold off as a system (as had happened with BAA, which was the only other airport group at that time that had been privatised) or whether they should be sold off individually. Issues relating to the national interest, efficiency and competition were fiercely debated. Political factors played a key role, particularly because government forecasts had shown that separate sales would generate more income. Eventually, it was decided that the airports would be leased off individually on long-term 50-year leases, with a further option for 49 years.

In phase 1 of the privatisation process, three airports – Melbourne, Brisbane and Perth – were sold in 1997. After Sydney, these three airports were the most profitable airports in the FAC system and they handled most of the traffic. It was the government's intention to bring competition and diversity into the airport system and so there were strict cross-ownership limits associated with the airport sales. Potential buyers had to have a majority Australian interest and airport management experience. As in the United Kingdom, the privatised airports were initially price-regulated. In addition, they were required to undertake quality-of-service monitoring and to provide evidence of this to the regulator. They also had to provide development guarantees by preparing five-yearly master plans and pledging a certain sum for investment.

A number of airport companies were interested in operating the Australian airports, including BAA, Manchester, Vienna, Amsterdam, Aer Rianta, National Express and AGI. In the end BAA (Melbourne), Amsterdam (Brisbane) and AGI (Perth) were each partners in winning consortia. The price paid for the Australian airports was particularly high (Brisbane: Australian

$1,397 million, Melbourne: Australian $1,307 million, and Perth: Australian $639 million) not only due to the fact that there were a large number of bidders, but also because high growth was being forecast and the infrastructure needs were relatively small.

It was decided that a further group of airports would be privatised in 1998. These 'phase-2' airports included Adelaide, which was the largest airport with just under four million passengers, and GA airports such as Archerfield, Parafield and Jandakot. Whereas the phase-1 airports had been relatively independent profitable entities, over half of these smaller airports were making losses and were much more reliant on the services of the FAC corporate office. Considerable preparation was therefore involved in getting the airports ready to be stand-alone entities. In spite of the fact that these airports were smaller and not in such a healthy position, again there was considerable interest in the sales, and relatively high purchase prices were paid. Some airport companies involved with the phase-1 airports, such as BAA and AGI, gained further airports under this phase-2 privatisation. Former FAC employees also gained interest in a number of airports such as Jandakot, Moorabbin, Townsville and Mount Isa. Cross-ownership restrictions prevented certain neighbouring airports coming under single ownership. Airlines were also not allowed to have greater than a 5 per cent share in any airport. Since the initial phase-1 and phase-2 privatisations, a number of these airports have also been subject to secondary sales with different investors.

Sydney Kingsford airport and the GA airports in the Sydney basin (Bankstown, Camden and Hoxton Park) were excluded from these two phases of privatisation because of unresolved issues related to noise control at Sydney Kingsford airport and continuing controversy over if, when and where a second Sydney airport would be built. In 1998, a separate state-owned entity, Sydney Airports Corporation, was established to run the four Sydney airports and Elldeson, the GA airport in Victoria which had been withdrawn from the privatisation process. In 2000, plans to develop a second Sydney airport were shelved for at least a decade, clearing the way for privatisation in 2001. However, the collapse of the Australian carrier Ansett and the events of 9/11 meant that the privatisation of Sydney airport was postponed until 2002, when it was bought for Australian $5,588 million by a consortium led by the two companies MAP and Hochtief AirPort (HTA).

Unlike in Australia, the airports in New Zealand had always been operated individually, not as a group. The road to airport privatisation began in 1985 when the government decided that the airports would become public companies owned by the government and local authorities. This happened at the three largest airports, Auckland, Wellington and Christchurch, in the late 1990s, and since then all the other major airports have moved to such a structure. The first airport to be privatised was Auckland in 1998, when the government sold its 52 per cent shareholders through an IPO. This was the first airport in the Asia-Pacific region to be floated on the stock exchange. This is still the current ownership structure of the airport, although in 2007 the airport was the subject of an attempted takeover bid by Dubai Aerospace Enterprise and the Canada Pension Plan. It is now an investor itself, having involvement in New Zealand with Queenstown airport and in Australia with Cairns and Mackay airports. Also in 1998, 66 per cent of Wellington's shares were acquired by the utility company Infratil through a trade sale. By contrast, Christchurch airport remains in public ownership, with Christchurch City having 75 per cent of the shares and the central government owning the rest. There is also some partial private ownership at some of the smaller airports, but most airports still maintain some local government ownership.

Both Australia and New Zealand are very reliant on air transport, with large distances and poor surface transport, and both countries are politically, culturally and economically fairly similar. They were relatively early in privatising their airports compared with elsewhere, and they did this at a time when other public enterprises in the two countries were being privatised. However, the nature of the airport privatisation was in some ways quite different. Moreover, different approaches to airport regulation were adopted (which are explored in Chapter 4).

United States and Canada

Since the United States has always possessed a private airline industry, it is often assumed that the airport industry must be driven primarily by private sector considerations. This is not the case. Nearly all US airports remain under local public ownership – with the pace towards privatisation being much slower than in many other parts of the world.

There are two key factors that make US airports unique when possible privatisation is being considered. First, US airports enter into legally binding contracts with their airline customers, known as airport use agreements, which detail the charging and conditions for the use of both airfield and terminal facilities. The airports, in reality, operate very closely with the airlines, and the airlines have a considerable amount of influence as regards future developments at the airports. Airline approval would be needed, therefore, if privatisation were to take place. Second, the airports are funded through a mixture of private and public funds. Most airports, and all the major ones, already have access to private financing through the commercial bond markets, where the airports have tax-exempt status due to their public ownership. Funding is also available from passenger facility charges (PFCs), which are generated by the passengers at individual airports and from grants from the Airport Improvement Program (AIP), which comes from the federal government's Aviation Trust Fund (which also funds ATC), financed primarily by a national passenger tax (see Case Study 4.2). At major airports, tax-exempt commercial bonds and PFCs make up the bulk of the investment funds, whereas at smaller airports the AIP funds are proportionally more important.

For some time, there has been a concern that these funds will not be adequate, or are not the most appropriate, to meet future airport (and ATC) investment needs. Inevitably as elsewhere where airport funding has become an issue, privatisation has also been considered as an option. In the United States, though, it is not an easy process. Way back in 1995, the privatisation of John Wayne airport in California's Orange County was discussed as part of the solution to the county's bankruptcy. However, the likelihood of litigation by the airlines – who argued that federal law prohibited the use of airport revenues (including sale proceeds) for non-airport purposes (so-called 'revenue diversion') – led to the conclusion that airport privatisation was not feasible. This key issue, namely the inability of airport owners to reap the financial benefits from the airports, is seen as one of the key obstacles to airport privatisation in the United States. Many argue that if airport revenues were diverted to other municipal purposes, costs at the airports would rise for both passengers and airlines. Also, many local politicians who hold very powerful positions do not wish to give up control of their airports. Various other issues would have to be resolved if such privatisation were to take place. For example, would private airports survive if they could not use trust fund, PFC or tax-exempt debt financing? Would they have to pay back the federal grants? At many of the airports, the use agreements with the airlines could mean that the airports could be privatised only as the agreements expire, or that privatisation would have to be limited within the bounds of the agreement.

There have been some, albeit rather limited, moves towards airport privatisation with the introduction of the airport privatisation pilot programme in October 1996. This makes provision for five (increased to 10 in 2012) airports to be exempted from some of the legal requirements that impede their sale to private entities. For example, the restrictions on prohibiting revenues to be used for non-aeronautical reasons (i.e. general municipal purposes) have been waived. Such privatisations need approval of the 65 per cent of airlines using the airport if the revenues are to be used for other purposes. Under the scheme, there must be a GA airport and only one large hub airport. GA airports may be leased or sold, but larger airports can only be leased (FAA, 2017).

There has been only limited interest in this scheme particularly because of the slow and rather complex approval procedures and the majority airline consensus rule (Table 2.7). The first airport privatised under the scheme was Stewart International airport in New York, which was given as a 99-year lease to the British company National Express. The airport transferred management in April 2000. However, the airport never received the approval of the required majority of airlines and so the lease payments still had to be used for airport purposes. Then in 2007 the airport lease was sold to the public body, the Port Authority of New York and New Jersey, as National Express no longer had an interest in operating airports. In 2009, it appeared that Chicago Midway was to become the first large hub to be privatised under this scheme. However, the winning consortium, which included the Vancouver airport operator (YVRAS, called the Vantage Group since December 2011), failed to raise sufficient funding in the tough economic conditions of 2009 and so the privatisation was postponed. Although this has been revisited, it now seems very unlikely to go ahead. Louis Armstrong New Orleans airport was also given preliminary approval under the scheme in 2009 but withdrew in 2010, as did the small airport of Gwinnett County Briscoe in 2012. There are currently active applications for Hendry County Airglades airport (for a cargo reliever airport for Miami International), Westchester County airport and the larger airport of St Louis.

Only one airport is now still privatised under the scheme, namely Luis Muñoz Marin San Juan airport in Puerto Rico. With this privatisation, the winning Aerostar consortium paid US$615 million upfront and agreed to invest US$1.2 billion in the airport over a 40-year lease term.

In spite of these developments, more radical privatisation still seems fairly remote, although this possibility continues to generate considerable interest (e.g. Enrico *et al.*,

Table 2.7 Airport participation in the US Airport Privatization Pilot Program

Airport	Application details	Status
St Louis Lambert International airport	Preliminary application accepted April 2017	Active application
Westchester County airport, White Plains, NY	Preliminary application accepted December 2016	Active application
Hendrey Country Airglades airport, Clewiston	Preliminary application approved 2010, final application is being prepared	Active application
Luis Munoz Marin International airport, San Juan, Puerto Rico	Preliminary application approved 2010, final Application approved 2013	Active privatisation
Chicago Midway International airport	Preliminary application withdrawn 2013	Inactive application
Gwinnett County Briscoe Field airport, Lawrenceville	Application withdrawn 2012	Inactive application
Louis Armstrong New Orleans International airport	Application withdrawn 2010	Inactive application
New Orleans Lakefront airport	Application terminated 2008	Inactive application
Brown Field Municipal airport, San Diego	Application withdrawn 2001	Inactive application
Niagra Falls International airport	Application withdrawn 2001	Inactive application
Rafael Hernández airport, Aguidilla, Puerto Rico	Application withdrawn 2001	Inactive application
Stewart International airport, Newburgh, NY	Application approved – privatised 2000–07, now operated by Port Authority of New York and New Jersey	Inactive privatisation

Source: Adapted from FAA (2017)

2012; Poole, 2016; Poole and Edwards, 2016). In debating the disappointing impacts of the privatisation programme, GAO (2014) concluded that the structure and financing of airports in the United States, in conjunction with the current privatisation process, reduces the incentives and value of privatisation. However, it did discuss how various public sector airport owners had engaged the private sector through a variety of partnerships ranging from management contracts to development agreements to help reduce costs, improve services, and obtain capital investment without transferring airport control. It concluded that such private sector options are likely to make more radical privatisation less likely.

Such private participation was experienced, for example, with the former company AGI that had some management contracts, although mostly at small airports – with the exception of the international terminal at Atlanta airport. Also in 1995 BAA won a 10 year management contract for Indianapolis airport. BAA also had retail management contracts at Boston and Pittsburgh, but subsequently gave these up to focus on its core activities in the UK. A few airport management contracts remain, for example at Albany, Burbank and White Plains airports. However, the fiscal and political constraints that exist at US airports has meant that even this type of private sector involvement has, in some cases, been difficult to maintain successfully. A notable example here is the airport of Harrisburg, where BAA lost a management contract after managing the airport for only three years of the 10 year agreement, primarily because the airport's administration changed. The former Wiggins (Planestation) group also withdrew its interest at Smyrna airport near Nashville, Tennessee because of administrative constraints.

There are also a few examples of PPP BOT projects, which include the 20-year BOT model for the international arrivals building at New York JFK airport, and similar models for both the domestic and international terminals of the secondary airport in Orlando, namely Orlando Sanford. Most recently, in 2016, a BOT agreement lasting until 2050 was signed for the redevelopment of New York LaGuardia's Central Terminal B. So it seems likely that such private partnership developments and other similar approaches are most likely to be the direction that US privatisation will take in the future.

As regards Canada, and as discussed earlier, in the 1990s the Canadian government transferred control and operation of its airports to local non-share, not-for-profit airport authorities which were accountable to a number of different airport stakeholders. This was seen as halfway between government control (that remained in the United States) and airport privatisation that was being experienced elsewhere. This generally led to more commercially focused management practices and considerable investment in facilities. However, the structure has also come under considerable criticism, particularly from the airport authorities and users, especially because the airports are required to make annual lease payments to the federal government which still owns the airports. These are not fixed but are set as a percentage of revenues, and represent a substantial amount. For example, Table 2.8. shows that for the five largest Canadian airports, they represented around 10 per cent of the revenues generated in 2016.

In a major review for the Canadian government of all transport modes (Transport Canada, 2015), the lease payment shortcoming (amongst many others) was acknowledged

Table 2.8 Lease rent payments at major Canadian airports, 2016

	Passengers (millions)	Operating revenues (Canadian $ millions)	Lease rent (Canadian $ millions)	Rent as percentage of revenues (%)
Toronto-Pearson	44.3	1,285.5	147.0	11.4
Vancouver	22.3	490.5	50.6	10.3
Montreal	16.6	527.2	54.8	10.4
Calgary	15.7	390.0	38.9	10.0
Edmonton	7.5	206.1	17.5	8.5

Source: Airport annual reports

and it was recommended that the best system for the future was one that was based on competition, market forces and user-pay principles. The review called for the smaller federally owned airports to be divested to local governments with some grant support, whilst for the larger airports (under the not-for-profit structure) privatisation was recommended, allowing for a share capital structure and providing access to private funding. However, no decisions have been made and it remains unclear as to whether this would be a policy favoured by the government.

India

The development of India's economy, together with a rapidly expanding middle class and a more liberal domestic and international regulatory aviation environment, has resulted in a huge growth in air travel over the past two decades. Annual passenger growth has exceeded 10 per cent in most years of this century (Table 2.9). There are many more airlines now serving domestic and international routes and there is a growing Indian LCC industry. All of this has meant that many of the airports had inadequate and ageing infrastructure and that there was a lack of internationally accepted standards to cope with this increased demand.

There are 449 airports and airfields in India. Up until comparatively recently all major commercial airports in India were managed by a state organisation, the Airport Authority of India (AAI), which was formed in 1995 with the merging of the National Airports Authority and the International Airports Authority of India. AAI manages 92 airports directly and is also responsible for 28 civil passenger enclaves at defence airfields as well as providing all the ATC services. Even before the recent traffic boom of the past few years, privatisation was being discussed in the late 1990s for the four main international airports (Delhi, Mumbai, Chennai and Kolkata) but this came to nothing – particularly because no foreign investment was allowed in airports at that time. The first actual privatisation project did

Table 2.9 Total airport traffic at Indian airports, 2002–16

Period (Apr–Mar)	Passengers (million)	Freight (000 tonnes)	Aircraft movements (000)	Passenger growth (per cent)	Freight growth (per cent)	Aircraft movements growth (per cent)
02–03	44	982	561	10.0	15.1	9.9
03–04	48.7	1,068	639	10.7	8.7	13.9
04–05	59.3	1,281	719	12.8	19.9	12.6
05–06	73.4	1,404	838	23.8	9.6	16.6
06–07	96.4	1,554	1,076	31.3	10.6	28.2
07–08	116.9	1,714	1,308	21.2	10.5	21.3
08–09	108.9	1,697	1,306	–6.9	–1.0	–0.1
09–10	123.7	1,957	1,331	13.6	15	1.8
10–11	143.4	2,348	1,393	15.9	19.8	4.7
11–12	162.3	2,280	1,545	21.2	10.5	21.3
12–13	159.4	2,191	1,479	−1.8	−3.9	−4.3
13–14	168.9	2,279	1,537	6.0	4.0	3.9
14–15	190.1	2,528	1,603	12.6	10.9	4.3
15–16	223.6	2,706	1,794	17.6	7.1	11.9

Source: Airports Authority of India

not occur with these airports, but at Cochin, Kerala in southern India, where a new airport opened in 1999 having been financed 26 per cent from the state of Kerala and the rest from NRIs, financial institutions and airport service providers.

After many bureaucratic, legal and political delays, two 30-year (with another 30-year option) BOT greenfield airport projects were set up in 2004. This was after it was agreed that the AAI could enter into joint ventures with private and foreign investors as long as 26 per cent public ownership was retained. These two airports are in the IT centres of Bengaluru and Hyderabad (Brunner, 2007). At Bengaluru the private consortium consisted of Siemens, Zurich airport and the Indian engineering and construction company Larsen and Toubro (L&T), while at Hyderabad the private investors were GMR, a large Indian infrastructure company, and Malaysia Airports Holdings Berhad. Both airports opened in 2008.

Table 2.10 Major privatisation projects at Indian airports

Airport	Privatisation date	Airport partners	Passengers 2006–07 (million)	Percentage share of AAI traffic
Cochin	1999	26 per cent State of Kerala; 74 per cent non-resident Indians, financial institutions and airport service providers.	2.6	2.7
Bengaluru	2004	26 per cent AAI/State of Karnataka; 74 per cent Siemens/Zurich airport/L&T	8.1	8.4
Hyderabad	2004	26 per cent AAI/State of Andhra Pradesh; 74 per cent GMR/Malaysia Airports	5.8	6.0
Delhi	2006	26 per cent AAI; 74 per cent GMR/Fraport/Malaysia Airports/other private investors	20.4	21.1
Mumbai	2006	26 per cent AAI; 74 per cent GVK/ACSA/other private investors	22.2	23.0

Source: Compiled by author from various sources

Then again, after many delays and a very lengthy bidding process, public–private joint venture partnerships were eventually agreed for India's two largest airports (accounting for nearly half of total Indian traffic), namely Delhi and Mumbai in 2006. These are 30-year concession agreements – again with a possibility of a further 30 years – which aim to upgrade and modernise the two airports. In both cases the AAI has a 26 per cent share in the new airport companies, Delhi International Airport Private Limited (DIAL) and Mumbai International Airport Private Limited (MIAL). The international airport operators Fraport and Malaysia Airports Holdings BhD both have a share in DIAL as well as GMR. The South African airport company ACSA has a stake in MIAL together with a large Indian infrastructure company GVK. DIAL agreed to pay 46 per cent of revenues to the government and to invest around US$2 billion on the first stage of development, which involved upgrading the existing terminal and constructing a new domestic terminal and runway. MIAL agreed to pay 39 per cent of revenues and to invest US$1.6 billion to develop the city of the airport from its current 18 million passengers to 40 million (CAPA, 2007) (Table 2.10).

Following on from these privatisations, there have been a number of discussions concerning more greenfield sites being funded through BOT arrangements (Raghunath, 2010). However, despite India's strong economy, a need for investment and the relative success of the existing privatisations, further privatisations have yet to be agreed except for the new Goa-Mopa airport, which is to be built and operated by the Indian company GMR. Modi's government, elected in 2014, did not proceed with privatisation of some of the second-tier airports such as Chennai, Jaipur, Kolkata and Ahmedabad and there remains major uncertainty concerning policies towards privatisation and economic regulation. One possible new privatisation is the long-awaited new second airport at Mumbai (Navi airport).

Brazil

After many years of economic and political problems relating to inflation and economic stagnation, Brazil's economy began to stabilise in the 1990s and foreign investments grew rapidly. It has a population of over 200 million people, making it the fifth largest country in the world and the largest in South America. The sheer size and geography of the country means that air transport is essential for the development of trade, communications and tourism. A few years ago, it was reported that there are approximately 90 million Brazilian middle-class citizens compared with just 50 million in 2003 (Lunsford, 2012; LeighFisher, 2011). All these developments meant there had been a huge increase in domestic and international traffic. Between 1997 and 2003 the annual average growth in passengers was 4 per cent, but between 2003 and 2010 this increased to just under 12 per cent per annum. Since then, in spite of hosting the football World Cup in 2014 and the summer Olympic Games in 2016, political crises in the country and economic recession have severely dampened growth in air travel demand.

Brazil has in excess of 2,000 airfields. The main 67 airports that handle over 95 per cent of the traffic have traditionally been managed by the state-owned Brazilian Airport Infrastructure Enterprise (Infraero), which was established in 1972. In 1987 this was divided into seven regional areas, each containing at least one major airport and having a separate head office. The speed of air transport growth in the first decade of the twenty-first century put very significant pressure on the existing airport capacity, resulting in delays and poor service levels, and additionally the choice to host the World Cup and Olympic Games increased the urgency to provide modernised and expanded airport infrastructure.

Traditionally, Brazil had been one of the few countries in South America where it was not considered politically acceptable to view airport privatisation as a way to finance investment. Infraero was viewed as a branch of the military and the airports were run with very little consideration of commercial goals. However, there was an ideological shift in 2010 when the government announced that it would seek concessions contracts from private sector companies to expand and modernise some of the country's airports. This was in spite of the concern expressed by the airport workers' unions and some airlines,which feared a hike in prices as occurred in Argentina and Mexico. In order to focus on the provision of adequate airport facilities, a new Ministry of Civil Aviation, separate for the first time from the Ministry of Defence, was also created.

The next significant development was a BOT privatisation that was agreed in 2011 to develop a greenfield airport in the city of Natal, in the north-east of Brazil. The winning bidder was the consortium Infra America, consisting of the Brazilian engineering firm Engevix, teamed up with Argentina's Corporacion America, which was the majority owner of AA2000, and also had interests in Montevideo, Uruguay, Guayaquil, Ecuador, Italy and Armenia. The new airport was to be built within three years and then operated for 25 years (with a possible one-off five-year extension) with an excess of US$400 million investment funds. The Brazilian government, via Infraero, was responsible for the construction of the airfield facilities but had no actual involvement in the concession agreement (CAPA, 2011)

The success of this private project, using an approach previously untested by the government and raising much more money than the government had planned (US$106 million compared with the set minimum amount of US$33 million), encouraged the further offering as concessions of the three major international airports – São Paulo Guarulhos (the main international gateway to Brazil and the largest airport in Latin America), Sao Paulo Viracopos Campinas (Sao Paulo's third airport and a major cargo hub), and Brasília (serving the capital). These three airports handled around a third of all the passenger traffic. A different concessionaire had to be chosen for each airport, although each consortium could bid for more than one airport. By relieving Infraero of the burden of investment in these major airports, it was hoped that it would be free to focus on others where work is needed to prepare for the World Cup and the Olympics. The detailed terms of the concession varied, but for all three airports the government, through Infraero, maintained a 49 per cent share in each concession and in addition has a power of veto over strategic issues, which undoubtedly has increased the risks for investors. Airlines could not have more than 1 per cent involvement in any consortium. The bid price had to be paid back in inflation-linked equal instalments, and in addition a certain share of revenues had to be given to the government.

The winning bidders were selected in February 2012 and each had a mixture of foreign and Brazilian consortium partners (Table 2.11). Interestingly, one of the winning bidding companies was the South African airport company ACSA, which had experience of handling Olympic traffic. There were a larger number of initial bids, particularly for Guarulhos and Brasilia (ten and eight, respectively, compared to four at Viracopos) (Lunsford, 2012), and at all three airports the winning bid was well in excess of the minimum bid, raising concerns again from the airlines that this would result in high fees. One-third of the investment had to be spent before the World Cup. Subsequently, two further privatisations were undertaken at Rio de Janeiro Galeão International airport and Confins Belo Horizonte in 2014.

More recently, even though the worsening economic situation and political crisis has changed the environment for privatisation, a third tranche of privatisation for four more airports (Florianopolis, Fortaleza, Porto Alegre and Salvador) was agreed in 2017. Unlike previous concessions, Infraero, which has major financial difficulties, does not have a share in the concessions. Further privatisations are planned.

Table 2.11 Major privatisation projects at Brazil airports

Airport and privatisation date	Passenger numbers (000s)	Concession conditions				Winning consortium
		Length of contract (years)	Annual revenue fee (%)	Minimum bid (R$)	Investment required (R$)	
São Paulo Guarulhos (2012)	26,849 (2010)	20	10	3.4 bn	4.6 bn	South Africa's ACSA with Brazil's Invepar and OAS Bid: R$16.2 bn
São Paulo Viracopos Campinas (2012)	5,430 (2010)	30	5	1.5 bn	8.7 bn	France's Egis with Brazil's Triunfo Participacoes Bid: R$3.8 bn
Brasília (2012)	14,347	25	2	582 mn	2.8 bn	Argentina's Corporacion America with Brazil's Engevix Bid: R$4.51 bn
Rio de Janeiro Galeão International (2014)	17,496 (2012)	25	5	4.8 bn	5.7 bn	Odebrecht and Singapore Changi airport Bid: R$19 bn
Confins Belo Horizonte (2014)	10,398 (2012)	30	5	1.1 bn	3.5 bn	CCR, Zurich airport and Munich airport Bid: R$ 1.82 bn
Fortaleza (2017)	5,706 (2016)	30	5	360 mn*	1.4 bn	Fraport Bid: R$1.51 bn
Porto Alegre (2017)	7,649 (2016)	25	5	31 mn*	1.96 bn	Fraport Bid: R$382 mn
Salvador (2017)	7,526 (2016)	30	5	310 mn*	2.35 bn	Vinci Bid: R$1.59 bn
Florianopolis (2017)	3,536 (2016)	30	5	53 mn*	961 mn	Zurich airport Bid: R$241 mn

*25 per cent of total minimum prices, payable in advance.

Sources: LeighFisher (2011); LeighFisher (2013); Bland (2017); De Almeida Valois *et al* (2016)

Japan

The geography of Japan has meant that aviation plays a key role in its economic development and in the generation of outbound and inbound tourism. There are a large number of airports for public use (in total around 100). Historically the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) classified Japan's airports according to their traffic characteristics. There were five Class 1 international airports (Toyko-Narita airport, Toyko-Haneda airport, Osaka-Kansai airport, Osaka-Itami airport, Chubu-Centrair airport); 24 Class 2 airports serving major domestic routes (19 Class 2(A) airports being managed by MLIT and five Class 2(B) being managed by local government); 53 Class 3 airports serving regional and local traffic; and 15 other airports, some of which were jointly used by the Defence Agency or the US Air Force, or were private. The airports are now identified (in the 2008 New Airport Act) as 'International' or 'Other' airports, with further classifications related to who manages them. Three of the five Class 1 airports (Narita, Kansai and Centrair) are run by limited corporations and two (Haneda and Itami) directly by the MLIT. The Class 3 airports are managed by local government (Kato *et al.*, 2011).

In comparison with typical practice in other countries, the airports are unusual in that their scope of business is limited by law, which means that the non-aeronautical facilities (such as the passenger or cargo terminal buildings and car parking) are managed by different entities from the basic aeronautical facilities (such as runways, taxiways and aprons). These commercial assets are usually run by mixed public/private corporations, primarily as a result of the shortage of available government funding for terminals when the airport industry in Japan began to expand rapidly in the 1950s and 1960s. It is only at Narita, Kansai and Centrair where there is integrated management that has responsibility for both the airfield and terminal facilities.

The long period of high and stable economic development in Japan and population growth that followed the Second World War required huge investment in existing and new airports. In 1956 the Airport Development Act was passed, and this was linked to five-yearly development plans, which were first introduced in 1967 (Shibata, 1999). The Act defined who was responsible for the airports, with central government through the MLIT being fully responsible for providing and administering the Class 1 and 2A airports and covering the development costs. However, there was subsequent special legislation concerning the international airports of Narita, Kansai and Centrair which exempted them from this general legislation. The MLIT was also responsible for providing the Class 2(B) airports, which were administered by local governments, and 55 per cent of the financial burden of the aeronautical facilities. For Class 3 airports, the MLIT shared half of the development costs with the local government, which was responsible for providing and administrating the airports (Ohta, 1999).

The aeronautical revenues generated by Haneda, Itami and the Class 2A airports go to a national government fund for airport construction and maintenance, the Kuko Seibi Tokubetsu Kaikei or the Airport Special Account (ASA) (now known as the Airport Development Account). The MLIT then distributes this money (and additional funding from general national accounts) through capital grants to the individual airports. This account was set up in 1970 to ensure there were sufficient funds to finance improvement projects which were being identified in the five-yearly airport development plans. The fund does not finance the terminals or car park operations, and so revenues from these facilities do not go into the account. The aeronautical revenues from the Class 2B and 3 airports that are managed by local government are kept by the airport operator and not given to the account. The fund does, however, finance development at these airports, and so in effect the revenues from the Class 1 and Class 2A airports are used to subsidise these smaller airports. The Airport Development Act did not allow airports to be operated by independent corporations, which is why special legislation was established in order to allow for different governance models at Narita, Kansai and Centrair. This situation was primarily in response to a shortage of account funds to finance these airports, and it consequently means that these three airports do not contribute to the fund but neither are they supported by it.

The economic development of Japan has been predominantly concentrated in the three metropolitan regions of Tokyo, Osaka and Nagoya, which is where the international airports are located. In 1966 the state-controlled New Tokyo International Airport Authority was established to finance and run Tokyo's second airport, Narita, which opened in 1978 despite fierce and prolonged opposition by the local community. Then in 2004 a new 100 per cent public entity, the Narita International Airport Corporation, took over the responsibility of owning and managing Narita. Up until fairly recently, the other Tokyo airport, Haneda, which is nearer to Tokyo city centre, handled almost exclusively domestic traffic, with Narita taking the international traffic. In the Osaka region, Kansai International airport, which is built on an artificial island of reclaimed land in the sea, was opened in 1994 to overcome capacity shortages at Itami airport. Itami, which is closer to the city centre of Osaka, receives only domestic traffic. In 2005, Centrair airport opened to serve the Chubu region of Japan which had previously relied on the congested Nagoya airport. Like Kansai airport, it was owned by a company that unusually operated both the airfield and terminal buildings.

One of the major long-running issues relates to this method of financing the Japanese airports, which has encouraged an unbalanced and inefficient system (Yoshida and Fujimoto, 2004; Barros *et al.,* 2010). The pooling and redistributing of funds means that the incentives for individual airports to strive for greater efficiency are weakened. Moreover, it has been argued that the allocation of the funds from the airport account has often been determined on a basis of political rather than economic need, and has led to significant overinvestment at a number of regional airports. There has been a belief that every prefecture has the right to have at least one airport, even if there is no actual need demonstrated. This has undoubtedly contributed to the poor financial health of the airports. Kato *et al.* (2011) concluded that only airports serving more than 5.2 million passengers are profitable. It is also the case that the Class 1/2A airports cross-subsidise the Class 2B/3 airports (with only the former group contributing to the fund but with both benefiting from it), and this in turn is a contributing factor to the overinvestment at the smaller airports and underinvestment at the larger airports. As a result of growing dissatisfaction with this policy, the Airport Development Act was revised in 2008 (now just called the Airport Act) to focus more on improving the utilisation and efficiency of existing airports rather than on development of the regional airports (Barros *et al.*, 2010).

Another key issue is the inability of most airports to benefit from commercial revenues due to the facilities associated with these activities being operated by different entities. This lack of an integrated management model hinders efficiency and means that airports miss out on this additional source of income, which can potentially be used to cross-subsidise aeronautical operations and lower airport charges. There has been continual concern that these high charges, combined with capacity constraints particularly in the Tokyo area, make the international airports very uncompetitive compared with other East and South East Asian rivals. Japan has been moving progressively to a more deregulated airline environment in recent years, but the airport situation appears to be impeding this development. The capacity problems at the major airports are compounded by the fact there is very little available land and that land prices are high. There also tends to be strong opposition to any airport expansion from local residents and landowners, and there are high costs associated with noise-protection measures.

The airports serving Tokyo (Narita and Haneda) are particularly problematic as they both have been operating to capacity for many years, partly because of limited operating hours due to environmental pressures and partly because of fierce resistance to any expansion plans. This lack of capacity, and the dual airport system that historically inhibited international–domestic transfers (with Narita being the international airport and Haneda being the domestic one), increased demands on the government to re-internationalise Haneda. As a result, a dedicated international terminal was opened in 2010 at the same time as the completion of a fourth runway. Another challenging airport was Kansai, where traffic had not been nearly as high as expected. Some domestic routes from Itami were shifted to Kansai to try and improve the situation, but at the same time the competition from the Shinkansen (bullet train) was strengthened. In addition, traffic was thought to have been deterred by the very expensive airport charges due to the high airport costs. This was partly due to the fact that the artificial island that the airport was built on was sinking at a far greater rate than was expected, and the airport had to introduce costly measures to handle the effects of this and to cope with further sinking that may occur in the future. This, combined with the original high construction costs of the airport and the costs of a second runway that opened in 2007, meant the airport company had huge debt and interest payments and had to rely heavily on injections of public money to survive. Meanwhile, the neighbouring domestic airport of Itami, which remained open although it was originally planned to be closed when Kansai was built, continued to be profitable (Kato *et al.*, 2011).

The past few years have been a very challenging time for the Japanese airport industry (Graham *et al.*, 2014). Poor economic conditions in Japan, coupled with a declining population and the collapse in January 2010 of JAL and its subsequent reorganisation and shrinking of the network, all resulted in a decline in traffic. These problems were compounded by the effects of the devastating earthquake of March 2011. These developments influenced the decision in May 2011 of the National Diet of Japan to pass legislation to allow for a new Kansai International Airport Corporation to be set up by April 2012 to integrate the management of the two airports in the Osaka area. This wholly government-owned airport company owned the runways of both airports, the land assets of Itami airport and the terminal facilities of Kansai, inheriting about 400 billion yen's worth of Kansai's interest-bearing debts. Then in 2016 this corporation was privatised with a 44-year concession. The French operator Vinci Airports and the local Japanese financial services group Orix Corporation each have 40 per cent of the concession, with the remaining 20 per cent split among banks, institutional investors and others. It is hoped that these changes will allow the airport to compete more effectively with the congested Tokyo airports as an international hub and, through having greater pricing and management freedom, will be able to become a major international airport for Asian cargo operations and for LCC operators to attract inbound tourism.

This privatisation of Kansai airport has been a landmark development in Japan which is likely to be followed by other privatisations. Indeed, in 2011 the MLIT also proposed that many of the other airports could be managed as long-term concessions for 30–50 years, with the aim of producing more flexible airport charges, a growth in non-aeronautical revenues and a more efficient management – at the same time as reducing the financial burden for the public sector. In 2016 Sendai airport, handling around three million passengers, was privatised with a 65-year contract with the private operator being a joint venture of six firms including railway operator Tokyu Corporation, construction company Maeda Corporation and trading house Toyota Tsusho Corporation. In 2017, Vinci and Orix were also awarded the 42-year concession to run Kobe airport, which means that these two operators will be involved with all three of Japan's airports in the Kansai region. There are also plans to privatise Japan's fourth largest airport, Fukuoka, by 2019, and other likely airports for privatisation include Shin Chitose, Shizuoka, Hiroshima and Takamatsu. It has been argued (e.g. by Miyoshi, 2015) that this new privatisation trend offers significant opportunities for the Japanese air transport industry.

China

Chinese airports have had to cope with a rapidly growing number of Chinese residents who can now afford to fly, coupled with increasing numbers of inbound international leisure and business travellers. In 1994 there were 79 million passengers, by 2006 this had risen to 332 million, and by 2016 this had reached 1,016 million. There are now 216 airports for scheduled traffic. China's airports were historically owned and run by the Civil Aviation Administration of China (CAAC), which also operated all airline and ATC services. Then, in the late 1980s, liberalisation of the aviation industry began with the setting up of six operationally and financially independent airlines spun off from the old CAAC, the encouragement of non-CAAC airlines and the separation of airline and airport operations.

At this time, the huge traffic growth that was being experienced started to put pressure on the airport infrastructure. As a consequence, the CAAC agreed to use Xiamen airport as a test case to transfer to local government control in 1988 to encourage local investment in airports. This decentralisation policy continued with a number of airports, such as China's third airport, Shanghai Hongqiao, being transferred to local control. In addition, all new airports had to be managed at a local level. This localisation programme was completed in 2004 when all airports, with the exception of Beijing and those in politically sensitive Tibet, had been transferred to local ownership. However, more recently there has been somewhat of a shift in terms of development policy, with control over the airports being transferred back to the CAAC as part of the National Airport Allocation Plan for 2006–20. This has the aim of improving the efficiency of airport investment, and avoiding excess capacity in already developed areas (Gibbons and Wu, 2017).

This localisation programme meant that the central government started to phase out its subsidisation of these airports. This made it financially difficult for many of these airports particularly because of the country's relatively undeveloped capital markets. Therefore, some airports began to look for foreign investment, especially as from 2002 up to 49 per cent of this had been allowed at Chinese airports. This resulted, for instance, in Copenhagen taking a share of Haikou Meilan airport in 2002 (sold in 2007). Meanwhile, domestically the Airport Authority Hong Kong (AAHK) took a 35 per cent share of Hangzhou Xiaoshan airport in 2005, a 55 per cent share of Zhuhai airport in 2006 and in 2009, and a joint venture was agreed at Shanghai Hongqiao airport. These investments remain today. Another significant player is now the HNA Group, which has a major shareholding in Haikou Meilan airport. This is a large company with interests not only in the air transport sector but also in the hotel, logistics, real estate and tourism industries, amongst others. It manages 12 other smaller Chinese airports and has recently become an investor in international airports, such as Rio and Frankfurt-Hahn.

From the late 1990s the government encouraged the floating of state-owned airlines and airports on stock markets with the primary objective of encouraging improvements in corporate governance that would improve performance. Six airports were subsequently listed on the domestic or international Hong Kong stock market but with the public sector still having majority control (Zhang and Yuen, 2008) (Table 2.12).

During the same period a number of mergers and acquisitions of airport operators took place. As a result, Capital Airports Holding Company, the parent company of BCIA, now controls over 30 Chinese airports in nine provinces. Elsewhere the Shaaxi Airport Management Group merged with the Ningxia Airport Company in 2004 and the Qinghai Airport Company in 2006 to become the China West Airport Group. This group now manages 12 airports in four provinces.

The result of these developments is that airport management has become more commercially focused and ownership in China has become much more diversified. A few airports remain under central government ownership but the majority of airports are now owned by municipalities or provincial governments. Some are operated by airport groups with cross-region ownership and a few airports also have minority domestic and foreign private ownership (such as Fraport), even though some other foreign investors, such as AdP and Copenhagen, have subsequently decided to exit the Chinese market. A real challenge remains in efficiently providing sufficient infrastructure for the growing market. Funding remains largely an internal affair which can be contrasted with many Chinese funds and organisations which have been very active recently in global airport investments.

Table 2.12 China's listed airports

Airport	Year of listing	Stock exchange	Government share at time of listing in 2003 (per cent)	Passenger traffic in 2003 (million)	Passenger traffic in 2016 (million)
Xiamen International airport	1996	Shanghai	75	4.3	37.0
Shenzhen International airport	1998	Shenzhen	64	10.8	42.0
Shanghai Hongqiao International airport	1998	Shanghai	63	9.7	40.5
Beijing Capital International airport	2000	Hong Kong	65	24.3	94.3
Haikou Meilan International airport	2002	Hong Kong	52	6.0	18.8
Guangzhou Baiyun International airport	2003	Shanghai	60	15.0	59.7

Sources: Yang *et al.* (2008); Civil Aviation Administration of China (CAAC)

Airport operators and investors

Airport privatisation has attracted a variety of different investors and companies that have become interested in making airport purchases or managing airports. In the early stages of privatisation in the 1990s, many potential investors were well established airport companies that welcomed the opportunity to expand beyond previously well-defined national barriers. Many of these companies, for example BAA, AdP, Aer Rianta (now the DAA), Schiphol (owner of Amsterdam airport) and Fraport (owner of Frankfurt airport), had already been active in providing consultancy services and running management contracts at other airports, and it was a natural evolution of the business to become more heavily involved in other airports. AdP had built a reputation in the management of engineering and construction projects in countries such as China, Vietnam, Cyprus, the Philippines, Indonesia and Lebanon. Fraport had been involved with ground handling contracts and baggage systems in areas as diverse as Spain, the United States and Kenya. Aer Rianta had specialised mostly in retail contracts.

So privatisation increased the opportunities for international expansion for airport companies, particularly because in many cases the potential buyers had to provide evidence of airport management expertise. By 2000, BAA had airport interests in Italy, the United States, Australia and Mauritius. The Schiphol Group had involvement in other airports in the Netherlands, Australia and the United States. Other European airports or airport groups with international interests included Rome, Milan, Copenhagen, Vienna, Zurich and AENA. Some of the European airports, such as Rome, Milan, Schiphol and Fraport, also had involvement with other airports in their own country. Outside Europe, international airport companies were less involved, the notable exception being Vancouver Airport Services (YVRAS) (a subsidiary of Vancouver airport, now called Vantage), that had interests in a number of South and Central American airports and Sharm El Sheikh airport in Egypt (although the latter was subsequently cancelled by the Egyptian government).

Some airport operators, such as AdP, Fraport (Case Study 2.1), Zurich and the Vantage Airport Group, have continued to expand their involvement in other airports and have been joined by more recent players such as Changi Singapore airport (corporatised in 2009), Incheon Seoul and Malaysia Airport Holdings Berhad. This reflects the growing importance of Asia within the global airport industry and the increased interest in privatisation in the area. Others have reduced their involvement, such as the DAA, which has sold its share in Hamburg and Birmingham airports, and the former company BAA, which disposed of all its international interests to focus on its core UK activities. Schiphol airport seems to be focusing on its existing investments at JFK, New York and Brisbane. Copenhagen sold its stake in China's Hainan Meilan airport in 2007, the ASUR airports in Mexico in 2010 and Newcastle in 2012. A few new airport operators have also emerged, a prime example being TAV, which is now the largest airport operator in Turkey, and which was formally founded in 1997 (Case Study 2.2).

There were also a number of property, utility, infrastructure and construction organisations that saw some potential synergies with airport operations and took advantage of the early airport privatisations. An early example was the property developer TBI, which developed its involvement in the airport sector in the mid- to late 1990s by acquiring interests in the United Kingdom in Cardiff (1995) and Belfast International (1996), Orlando Sanford International airport in the United States (1997) and Stockholm Skavsta airport in Sweden (1998). In 1999 it took the decision to concentrate on its airport business and so disposed of all property interests except the Cardiff Hilton Hotel. It subsequently took over AGI and acquired extra interests in Australia, Bolivia, the United States, Canada and Luton (although a number of these have now been disposed of). In 2005 it was taken over by the Spanish infrastructure company Abertis, with the company expanding further in 2007 with the acquisition of Desarrollo de Concesiones Aéroportuarias (DCA), which had stakes in 15 airports in Mexico, Jamaica, Chile and Columbia. However, the company has now pulled out of all its airports to refocus on its toll roads and other surface transport interests.

Another UK property developer was the Peel Group, which acquired Liverpool airport in 1997 and Durham Tees Valley in 2003, and subsequently went on to develop Robin Hood Doncaster airport, which was previously a military base. However, it experienced financial difficulties in recent years, and for four years Vantage had a major shareholding in the company. Then there is the New Zealand utility company Infratil, which became involved with airports when it purchased two-thirds of Wellington airport in 1998. It then went on to purchase Prestwick and London Manston airport in the United Kingdom, and acquired a shareholding in Perth and North Territory airports in Australia. Unlike many of the other investors, it has specialised in managing relatively small airports. It also used to own 90 per cent of Luebeck airport in Germany until 2009, when it sold its shares back to the City of Luebeck as a result of passenger growth not being as high as expected. It now focuses its airport involvement on Wellington.

The Spanish infrastructure company Ferrovial emerged somewhat later as a major player within the airport industry. In the early 2000s it acquired interests in Bristol airport and Belfast City airport in the United Kingdom, Niagara Falls airport in the United States and Antofagasta airport in Chile. However, it was its purchase of BAA in 2006 which transformed Ferrovial into one of the world's largest airport operators (in terms of passenger numbers), although it has subsequently reduced its shareholding in Heathrow to 25 per cent. In addition, it now owns 50 per cent of the company AGS Airports which operates Glasgow, Aberdeen and Southampton airports. In the past there has also been interest from transport companies, most notably National Express, which had stakes in East Midlands airport, Bournemouth airport (and Stewart International airport) until 2001 when it sold its UK airports to concentrate on other transport activities. UK transport operators Firstgroup and Stagecoach also owned one UK airport each in the late 1990s but then sold these airports. This shows that perhaps the synergies from airport operations which these transport operators had hoped for were not as significant as was first thought.

Meanwhile, a number of construction companies showed an interest in operating airports, partly because this can provide them with an opportunity for involvement in some major construction projects. In France, the company Vinci has become an important participant in airport privatisation, particularly in light of its recent acquisitions in Portugal, Chile, Japan and France (Case Study 2.3). In Germany, Hochtief was an international construction services company which for many years had been involved in the planning, constructing and financing of airports before being active in any privatisation developments. This changed in 1996 when it led the consortium that won the BOT project contract for the new Athens airport. Then in 1997, in response to the growing number of privatisation opportunities, Hochtief founded the fully owned subsidiary HTA. HTA's next airport involvement came in 1998, when it formed a consortium with the former Irish airport operator Aer Rianta to buy 50 per cent of Dusseldorf airport through a trade sale. This was followed by the purchase of another German airport, Hamburg airport in 2000, when again it teamed up with Aer Rianta to buy 49 per cent of the airport. In 2002 it was part of the successful Southern Cross Airports Consortium which bought Sydney airport, in 2005 it led a consortium which won a BOT contract at Tirana airport in Albania and in 2007 it bought a 37 per cent interest in the secondary sale of BAA's shareholdings in Budapest airport. However, Hochtief sold HTA (renamed AviAlliance) in 2013 to Canada's Public Sector Pension Investment Board with this company maintaining a portfolio of Athens, Budapest, Dusseldorf, Hamburg and Tirana airports, and additionally Luis Muñoz Marín International airport in San Juan, Puerto Rico since 2017.

Elsewhere, in India there are two large infrastructure companies that have become involved with airports. One is the GMR group, which has interests in energy, highways and urban infrastructure as well as airports. The other is GVK, which has involvement in the hospitality, services and manufacturing sectors. GMR participated in the privatisation projects at the Indian airports of Delhi and Hyderabad as well as in the new greenfield airport Mopa in Goa, at Mactan Cebu airport in the Philippines, and was involved in Istanbul's Sabina Gokcen airport between 2008 and 2014, while GVK has involvement with airports in Mumbai, and Bali and Yogyakarta in Indonesia.

An area of considerable debate is whether airlines should buy and operate airports. In the United States, airlines already partially or totally lease terminals, and in Australia some of the domestic terminals are leased to Qantas. This means the airlines get exclusive rights to parts of the terminal. Elsewhere, however, such practice is not very common. An unusual, albeit somewhat dated, example was the Birmingham Eurohub, which was partially financed by BA. Also in 2004 the travel company TUI took over the management of Coventry airport, which was one of its bases in the UK, to ensure there was adequate infrastructure, but then pulled out when it met obstacles to its expansion plans. Existing arrangements include Lufthansa's joint venture partnership with Munich airport's second terminal, which opened in 2003, and the satellite terminal, which opened in 2016. The airport company has a 60 per cent shareholding while Lufthansa has a 40 per cent shareholding. Also, Lufthansa now has an 8 per cent stake in the Fraport. The main reason given for this purchase was to enable Lufthansa to intensify its partnership with Fraport and to strengthen its position at Frankfurt, which is its major hub. Other varied examples include Bangkok Airways building and operating three small Thai airports (Samui, Sukhothai, Trat) serving tourist destinations. In China, airlines such as Hainan Airlines, Sichuan Airlines and Shandong have made investments in airports, and in Russia, Aeroflot owns a small share of Moscow Sheremetyeveo airport.

If an individual airline or alliance grouping wanted to buy a substantial share of an airport to obtain more control over the facilities and develop a stronger brand presence, there may be a number of regulatory and competition issues that need to be considered to ensure this does not lead to discriminatory practices. In some cases there may be limits to airline ownership when an airport is privatised. LCCs have expressed an interest in running their own facilities in order to keep the service simple and keep costs down. For example, easyJet, in its early years when it was developing services out of London Luton airport, unsuccessfully tried to buy the airport when it was up for sale. It also expressed interest in being involved with Gatwick's secondary sale (as did Virgin Atlantic). Ryanair has also been unsuccessful in gaining approval to build its own low-cost terminal (LCT) at Dublin, which it has demanded in the past; though it has made substantial investment in facilities at Bremen. In 2016, the Kuwait government gave the go-ahead for Jazeera, a Kuwait-based LCC, to build a dedicated terminal.

Finally, there are the financial investors, such as investment banks, pension funds, hedge funds, sovereign wealth and private equity funds, who were relatively late in becoming directly involved with airport sales compared with other organisations (although they always participated in the financing of privatisation deals), but now play a major role by being able to raise substantial amounts of capital to purchase stakes, and often controlling interests, in airports. They have been the fastest growth investment segment for a number of years now, in Europe and elsewhere (Condie, 2015).

One such investor was the Macquarie Group, a very large Australian company offering a wide range of international banking, financial, advisory and investment services. It developed a very broad range of infrastructure, real estate and private equity investment funds in Australia and other countries. The group's first involvement with airport privatisation was in the United Kingdom when the private equity investment fund Macquarie Airports Group acquired shares in Birmingham and Bristol airports. Then in 2002 the special purpose investment fund (MAp) was founded and listed on the stock exchange, and became independent from the Macquarie Airports Group in 2009. The first major involvement of MAp was with Sydney airport in 2002, followed by Rome airport in 2003, Brussels airport in 2004 and Copenhagen airport in 2005.

MAp grew very quickly to become the second largest private owner–operator after BAA/Ferrovial, and the first major financial investor to have a major involvement in airport privatisation. However, in 2007 MAp chose to withdraw from its involvement in Birmingham airport to focus on other activities; and to withdraw from Rome airport primarily because of disagreement with the other main investor Leonardo about future investments at the airport. Also in 2007 MAp made a minority strategic investment in the Japan Airport Terminal (a private company that owns, manages and operates the three passenger terminals at Haneda airport and operates retail and catering businesses at Narita and Kansai airports), but this was subsequently sold back in 2009 primarily as a result of concern expressed by the Japanese government regarding this foreign ownership. Consequently, in 2011 MAp disposed of its interests in Brussels (39 per cent) and Copenhagen (31 per cent) with a share swap with Ontario Teachers' Pension Plan and their 11 per cent stake in Sydney airport. MAp is now focusing entirely on its operation of Sydney airport and has subsequently changed its name to Sydney Airport Holdings.

As a result of this, Ontario Teachers' Pension Plan is a major airport investor with interests not only at Brussels and Copenhagen but also Bristol and Birmingham and London City airport since 2016. Another example is Hastings Funds Management, which is particularly active in Australia. Elsewhere the infrastructure fund investor Global Infrastructure Partners (GIP) was established in 2006 with the investment bank Credit Suisse and the US company General Electric acting as joint founding investors. In 2009 a GIP-led consortium bought Gatwick airport and in 2012 it acquired Edinburgh airport as well.

CASE STUDY 2.1
FRAPORT – OPERATING AS A GLOBAL AIRPORT COMPANY

Fraport operates Frankfurt airport, Europe's fourth largest airport, handling more than 60 million passengers in 2016. Formerly Flughafen Frankfurt/Main AG, Fraport was listed on the stock exchange in July 2001 when 29 per cent of the company was sold to private investors and currently this private share is 37 per cent. Fraport has always been active in providing airport services, particularly ground handling, on a consultancy or management contract basis, but over the past decade or so has sought to build up its involvement in owning or managing other airports.

One of its first investments was in 1998 when it acquired a 30 per cent shareholding in nearby Hanover airport. It also had a 51 per cent share in Saarbrücken airport operating company, but it disposed of this in 2007. In addition, it owned 65 per cent of the low-cost airport Frankfurt Hahn, but withdrew from its involvement in 2009 primarily because of the poor financial performance of the airport. Globally, it has been expanding operations by becoming involved with airport privatisations in Lima, Delhi, Varna and Burgas, Antalya and St Petersburg. It addition, it was the first foreign investor to become involved with an unlisted Chinese airport, namely Xi'an in 2007 (Table 2.12). It also had a 25 per cent share in the BOT project for the international terminal at Manila, which was cancelled in 2005 and has been the subject of a long dispute between Fraport and the Philippines government. There have been recent new privatisations in Ljubljana (Slovenia), Greece and Brazil (Table 2.13).

Table 2.13 Fraport's international activities

	Fraport's share of airport operator (per cent)	Date of initial involvement	Passenger numbers 2016 (000s)
Hanover	30	1998	5,409
Lima	100	2001	18,845
Delhi	10	2006	55,631
Varna and Burgas	60	2006	4,568
Antalya	51	2007	19,028
Xi'an	24.5	2007	36,997
Pulkova St Petersburg	35.5*	2010	13,265
Ljubljana	100	2015	1,404
14 Greek regional airports	73.4	2017	25,300
Fortaleza and Porto Alegre	100	2017	13,355

*25 per cent from October 2016.

Source: Compiled by author from various sources

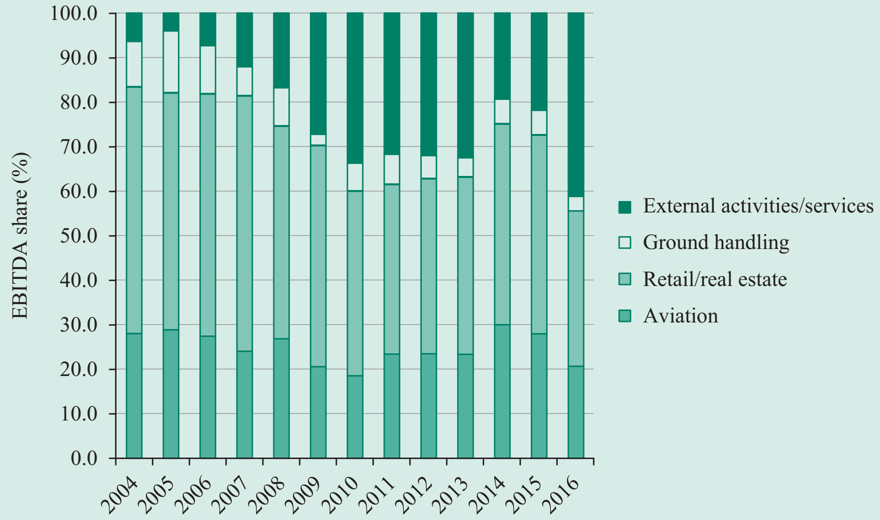

Figure 2.2
EBITDA share of Fraport's business segments (%)
Sources: Fraport annual reports

These airport operations, in addition to management contracts, are part of Fraport's External Activities and Services business segment, which also covers other subsidiaries, joint ventures, associated companies and investments including the facility management, corporate infrastructure management and information and telecommunication service units and US airport retail space developments. In 2016, Fraport generated €552 million from this business segment, with an earnings before interest, taxes, depreciation and amortisation (EBITDA) value of €433 million (though compensation payments from the Manila project and the sale of some of its involvement with the St Petersburg project boosted this figure). Generally, over recent years, earnings from this segment have grown in importance while the other business segments – aviation, retail, real estate and ground handling – have been declining (Figure 2.2).

CASE STUDY 2.2
TAV AIRPORTS – PROVIDING INTEGRATED AIRPORT SERVICES FOR EASTERN EUROPE, NORTH AFRICA AND CENTRAL ASIA

TAV Airports Holding was founded in Turkey in 1997 as a joint venture between the Tepe and Akfen Groups. Its first involvement in airports was the BOT project international terminal at Istanbul Atatürk Airport, which was completed in 2000.

In 2006, the company was restructured into TAV Airports and TAV Construction, and in 2007, TAV Airports was floated on the Istanbul Stock Exchange. TAV Construction has consequently been involved in a number of projects at airports in countries such as the United Arab Emirates (UAE), Oman, Egypt, Qatar, Libya and Bahrain, and with airports that are operated by TAV Airports. In addition, TAV Airports focuses on specific areas of airport operations with a number of different service companies that, for instance, cover duty-free sales (ATU), food and beverage (F&B) services (BTA), ground handling (HAVAS), information technology (TAV IT), security (TAV Security) and specialist operations (TAV O&M). TAV is therefore able to offer help with developing an integrated airport product, which is viewed as essential in many emerging markets.

Over the past decade TAV Airports has been steadily expanding its business. In 2004, it took control of the construction and operation of the domestic and international terminals at Ankara Esenboga airport, and in 2005 the international terminal at Izmir Adnan Menderes airport. In the same year it took responsibility for operating the domestic as well as the international terminal at Istanbul Ataturk and was awarded the tender for operations of Tbilisi and Batumi airports in Georgia. Then in 2007 it was awarded the tender for operations of Antalya's second airport Gazipasa in Turkey and Monastir Habib Bourguiba International airport and the Enfidha airport in Tunisia, followed by being the successful bidder for Skopje Alexander the Great airport and Ohrid St Paul the Apostle International airport in Macedonia in 2010, and Bodrum in 2014. In 2011, TAV Airports led a consortium that was selected for a 25-year BOT project at Medinah airport in Saudi Arabia and in 2017 it added Qassim and Hail airports to its Saudi Arabian portfolio. This now means that TAV Airports operates a number of different airport concessions in Turkey, Eastern Europe, the Middle East and North Africa, which in total handled more than 104 million passengers in 2016 (Table 2.14).

Table 2.14 TAV airports: portfolio of airports

	Passengers 2016 (mns)	Revenues 2016 (mn €s)	EBITDA 2016 (mn €s)	Concession (C) or BOT (B)	TAV Airports ownership of airport operator (per cent)	Termination date
Istanbul Ataturk	60.1	500.9	244.9	C	100	2021
Ankara Esenboga	13	55.7	28.6	B	100	2023
Georgia	2.6	62.8	47.1	B	76–80	2027
Macedonia	1.8	26.6	11.6	B+C	100	2030
Izmir	12	66.5	39.7	B+C	100	2032

	Passengers 2016 (mns)	Revenues 2016 (mn €s)	EBITDA 2016 (mn €s)	Concession (C) or BOT (B)	TAV Airports ownership of airport operator (per cent)	Termination date
Antalya Gazipaşa	0.7	4.5	0.9	C	100	2034
Bodrum	3.2	24.4	13.2	C	100	2035
Medinah*	6.6	59.8	26.8	B+C	33	2037
Zagreb	2.8	n/a	n/a	B+C	15	2042
Tunisia	1.6	24.3	–3.7	B+C	67	2047

*In 2017, the Saudi Arabian airports of Qassin and Hail were added with 30-year contracts.

Source: Compiled by author from various sources

In 2012 AdP (through its wholly owned subsidiary Aéroports de Paris Management) announced that it would be buying a 38 per cent share of TAV Airports and a 49 per cent share of TAV Construction. In 2017, it announced that it would increase its stake to 46 per cent of TAV airport but sell is shareholding in TAV Construction. The stated benefits of such involvement were the leverage of respective skills and the geographic footprint to boost international developments, in particular outside Turkey; the sharing of best practice; the fostering of ambitious career paths for the two groups; and further growth of the assets base through a more systematic cross-selling between AdP and TAV.

CASE STUDY 2.3
VINCI – AIRPORT MANAGEMENT AMONGST A GLOBAL CONCESSION AND CONSTRUCTION SERVICES PORFOLIO

Vinci is a global company offering concession and construction services in over 100 countries. It was founded in France in 2000 following the merger of two very long established countries. One of its major divisions is Vinci Airports which is involved with financing, building and operating 35 airports that handled 132 million passengers in 2016. It is one of world's five leading airport operators. It participates with a number of airport management contracts, primarily in France and various concession projects in Europe, South America and Asia (Table 2.15). It has expanded its operations considerably in the last few years, especially with 10 new airports in 2016, with its revenues rising from €650 million in 2012 to €1,055 million in 2016.

Table 2.15 Vinci airports: portfolio of airports

	Traffic (millions) 2016	Agreement date	End of agreement
Dominican Republic (6 airports)	4.6	2016	2030
Chile: Santiago airport	19.2	2015	2035
Portugal: ANA	44.1	2013	2063
France: Lyon	9.6	2016	2047
France Nantes	4.8	2011	2065
France: 11 airports < 1 mn	Various	Various	Various
Japan: Kansai/Osaka	25.2/15.0	2016	2060
Cambodia: 3 airports	7.0	1995	2040
Kobe	2.4*	2017	2060
Brazil: Salvador	7.5	2017	2047

*2015.

Source: Vinci Airports (2017)

Consequences of privatisation and internationalisation of the airport industry

Impacts of privatisation

It is evident that the structure of the airport industry has changed substantially over the past 30 years and that the private sector is now playing a very significant role in managing airports. According to ACI (2017), there were 614 airports in the world in 2016 with private sector participation. Eighty six per cent of world airports are under public ownership, with 14 per cent having some private sector involvement. However, these 14 per cent of world airports handle 41 per cent of the global traffic, because it tends to be the larger airports that are privatised. Indeed, around half of the top 100 airport operators (by revenue, in 2015) (see Table 3.1) have some amount of private sector involvement. Some of these private airport firms are listed on domestic or international stock exchanges either as a result of privatisation through an IPO (e.g. AENA, AdP, Fraport, Zurich) or because they have always been a private company (e.g. Japan Airport Terminal, TAV Airports and GMR Airports).

Within Europe, the continent that first witnessed privatisation, private ownership is more common, with around 30 per cent of airports having some private interest (but representing 75 per cent of all passengers) (Figures 2.3 and 2.4). Elsewhere private involvement accounts for 26 per cent of airports in Latin America, 12 per cent in Asia-Pacific, and with all other world regions each representing less than 5 per cent. The corresponding passenger shares in these major regions are 60, 45 and 13 per cent, respectively. Many of the airport privatisations have been partial. For example, in Europe there are 79 fully private airports but 126 with mixed ownership (ACI Europe, 2016). In developing countries, or low-/middle-income countries as defined by the World Bank, 144 countries have been involved in private participation in their airports, amounting to around US$104 billion investment commitment between 1990 and 2016 (World Bank, 2017b). With higher future growth rates predicted in such countries, which will encourage future privatisation, it is likely that the European relative share of privatised airports will decrease in the future.

Overall, according to ACI (2017), the concession/private finance or PPP model is the most popular worldwide, accounting for 41 per cent of all privatised airports and 38 per cent of passengers at the airports. Share flotations, trade sales and management contracts account for 24, 23 and 8 per cent of the airports, respectively (Figures 2.5 and 2.6). China has the most listed airports, either on the domestic or Hong Kong stock exchanges, while the United Kingdom has experienced the most individual trade sales. In Europe, concession/private finance projects have not been that common, with the airports of Luton, Pristina, Zagreb, Larnaca/Paphos, Greece and Portugal being some notable exceptions. By contrast, in emerging economies such PPPs are by far the most popular privatisation approach and it is likely that this will remain the situation in the future (CAPA, 2016).

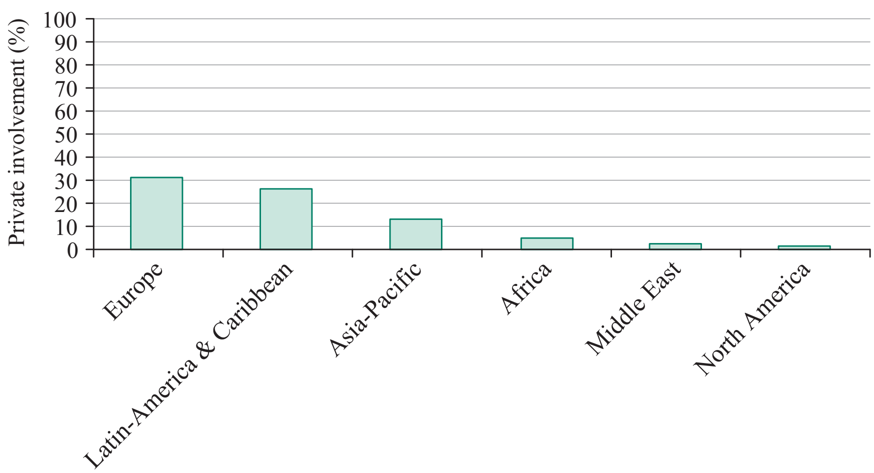

Figure 2.3
Percentage of airports with some private sector involvement by region, 2016
Source: Adapted from ACI (2017)

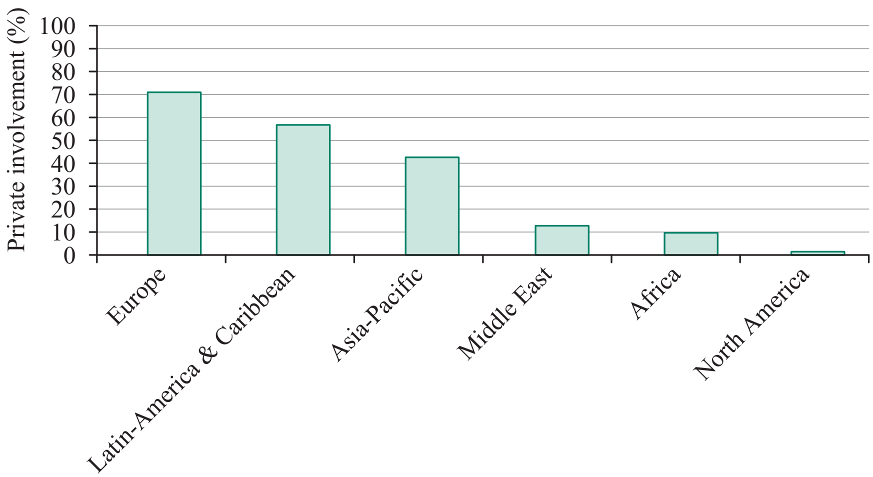

Figure 2.4
Percentage of passengers at airports with some private sector involvement by region, 2016
Source: Adapted from ACI (2017)

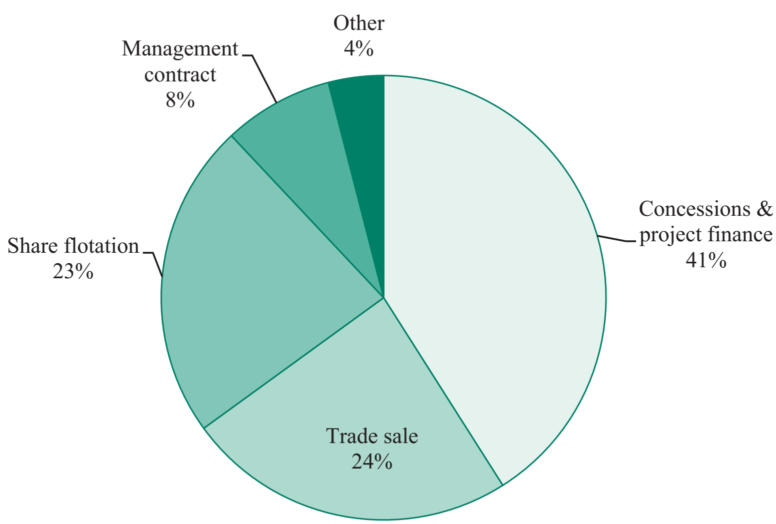

Figure 2.5
Percentage of airports by privatisation model, 2016
Source: Adapted from ACI (2017)

In a study of academic papers that considered privatisation over the past two decades, Graham (2011) found that the two most important drivers of privatisation were the aim to make improvements in efficiency and performance, coupled with a need for greater investment. Other popular objectives included improvements in quality, financial benefits to the government, less state interference, and the encouragement of better management or diversification. While in some developed countries, such as the UK, privatisation

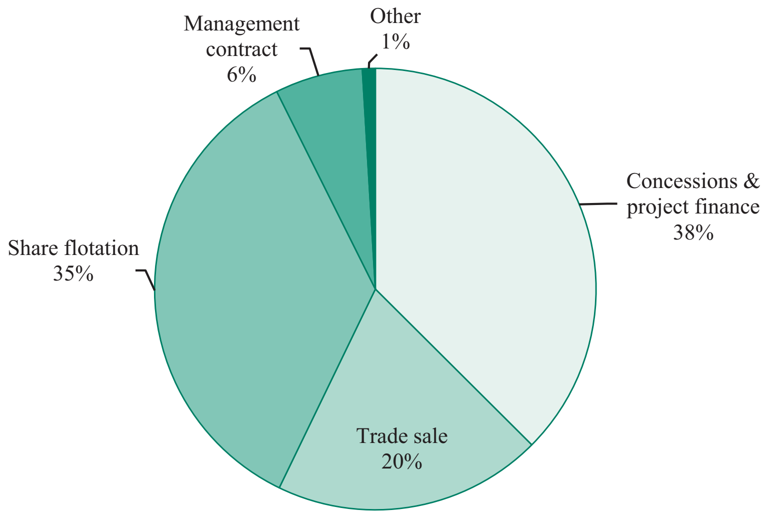

Figure 2.6
Percentage of passengers at airports by privatisation model, 2016
Source: Adapted from ACI (2017)

had been viewed in more ideological terms as reducing state control and inducing greater efficiency, in less developed countries practical considerations, such as the need for investment or management expertise, appeared to be more dominant. Overall, there certainly seems to be a change in the way airport privatisation is viewed. With most recent privatisations that have taken place, the ideological justifications have tended to be downplayed or are non-existent, with the objectives focused entirely on the need for funding and, maybe in addition, the acquisition of management and operational expertise. This may be, in part, a result of the majority of recent privatisations taking place in emerging economies where there is a substantial need for new investment.

As airport privatisation has evolved, matured and become truly global, it can be argued that there are clear and different types of private involvement, with different motivations for each transaction, often in terms of attracting different types of investors. IPOs and trade sales can be primarily seen as processes to raise public capital or fund new investment, whereas concessions/BOTs or PPPs are driven primarily to attract new investment and operational expertise to enhance and develop new infrastructure. There has also been the development of the secondary market driven by a number of reasons such as owners leaving the aviation sector (e.g., Abertis and Hochtief in 2013), shareholders wishing to raise new capital, debt for equity swaps, closed-end infrastructure funds needing to sell, and owners seeking to create value by deploying capital elsewhere. The driving force for these secondary deals is almost entirely financial and typically attracts infrastructure, sovereign wealth and pension funds.

The number of airport privatisations grew over the years, as generally airports were seen as attractive organisations to investors for a number of reasons. First, it appeared that the airport industry had strong growth potential. Many of the airports, particularly the major ones, faced limited competition from other airports and from other modes of transport. There were very high barriers to entry within the industry due to the large capital investment needed and the difficulties in finding appropriate, convenient locations where airport development is allowed. In the mid-2000s the success of many past airport privatisations, coupled with high predicted growth patterns and the need for capital investment at many airports, resulted in more and more investors and companies being interested in becoming potential purchasers, and the competition intensified. Also, this is when an active secondary market developed, and there were a number of examples of privatised airports (such as Rome, Copenhagen, BAA, Budapest, Bournemouth, Prestwick and Birmingham) where there were further changes in ownership. Inevitably, this led to the purchase prices being pushed up, particularly where financial investors were involved who were able to accept a much more highly leveraged debt structure.

Potential buyers typically will consider the price of the airport (enterprise value, EV) in relation to profit (EBITDA or earnings before interest and tax, EBIT) when deciding whether to invest (Graham and Morrell, 2017). For earlier IPO privatisations such as BAA, Vienna, Copenhagen and Auckland, the EV/EBITDA multiples were in the region of five to ten (×5 to ×10). This rose to between ×10 and ×20 for some of the early partial and total trade sales of airports such as Bristol, Cardiff, Wellington, Hamburg and the major airports in Australia and South Africa before 9/11. With the subsequent partial IPOs of Fraport and AdP the multiples fall back to around ×10–11, but with the revival of interest in airport privatisation in the mid-2000s, and the emergence of international fund managers as major investors, the values rose rapidly to around an all-time high of ×30 for the airport privatisation of Budapest and Leeds Bradford (Aviation Strategy, 2015a).

However, the financial crisis of 2008 onwards put a halt to these high values, with the exception of the Brazilian privatisations (which were considered to be very attractive to local infrastructure firms new to the airport business especially because of the high forecast growth rates). The economic recession caused traffic to fall at many airports and passenger growth was no longer seen as a guarantee. Capital funds were hard to obtain and overall investors became much more cautious. Recent transactions have risen up again to around ×15 but not as high as the overheated values prior to the financial crisis (although a notable exception is London City airport and its re-sale in 2016 with a value of about ×30). For instance, the multiple for the AENA IPO in 2015 was around ×12 and for Toulouse was around ×18. However, it must be noted, as previously discussed, that generally trade sales enable the airport to be sold at a higher price than with an IPO. This is because with a trade sale there will be more control over the financial, operational and management structures post-privatisation and the detailed due diligence process will help reduce the risks. Indeed, in 2015 the multiples for the listed European airport groups were around ×11, compared to the recent trade and private transactions of other airports at the ×15–18 level (Aviation Strategy, 2015b).

Overall, the pressure on public finance in many parts of the world means that governments are likely to be less able to provide direct funding for airports in the future. At the same time, obtaining a viable return on any investment has become that much more challenging in the increased uncertain financial world, so long-term transport infrastructure projects, such as airport investments which have been well tested in recent years, seem likely to be a relatively attractive option in the future.

However, not all these privatisations have been successful. There are a number of different reasons, such as conflicts that have arisen between governments and the new private operator and the enforcement of the terms of privatisation agreements, problems related to the selection of the most suitable investor, or inappropriate/unrealistic estimations of passenger airline demand and the financial situation. For example, Fraport was involved with a privatisation project at Manila airport in the Philippines which led to a complex and extended dispute with the Philippine government. In Berlin, there were several separate attempts to use private investors to develop a new airport to serve the city until this approach was abandoned following a number of legal challenges between bidders and complaints from local residents. In Toronto, the privatisation of terminals 1 and 2 was cancelled after the contract had been awarded to a consortium, as it was criticised as not maximising the public interest and consequently large compensation payments had to be made. In Argentina, the new airport operator overestimated the profits that could be generated from the airports, which eventually meant the privatisation agreement had to be renegotiated. In the Maldives, the privatisation contract for Male airport which was given to a GMR consortium was cancelled, causing concern with the Indian government.

Smaller airports particularly are being viewed as less attractive in this new economic climate and there seems to be a widening gulf between the small and large airports. Traditionally privatisation of such assets has been more difficult as the transaction costs represent a substantial share of the transaction, and because of the perceived greater risk associated with the lower traffic volume and often the dependence on a few dominant airlines. However, the emergence of the LCC sector, and experience at airports where these airlines have either negotiated a hard deal or left and moved on to another airport, has made investors even more cautious in becoming involved with such airports. Group ownership of smaller airports, as in Greece with Fraport, may be seen as the more attractive option. A few airports, such as Frankfurt Hahn in Germany, Cardiff in Wales, Prestwick in Scotland and three in Bolivia, have even gone back to total public ownership, although it was announced in 2017 that Hahn was to be sold again primarily to the Chinese conglomerate HNA.

Internationalisation of the airport industry

Taking a longer-term view of airport privatisation, undoubtedly the emergence of new international airport operators has major implications for the airport industry. In particular with the increased number of potential airport investors, there has been considerable debate as to which type of investor is likely to be the most successful and most appropriate for the long-term development of the airport industry. The traditional airport companies have core skills and competencies related to both the operational and business aspects of managing an airport, which they have already gained through airport management in the home country, and which have been used to grow their business. In the early stages of privatisation, purchasing other airports was viewed by some as a natural progression for airport companies that had gone through the processes of commercialisation and then privatisation. Once privatisation had proved successful, it seemed quite logical that the commercially minded airports might next seek to acquire other interests to expand and add value to their company. For such airport companies there may be distinct advantages in expanding internationally if their own core infrastructure (e.g. terminal or runway) is physically or environmentally constrained, or serves a relatively small catchment area. Financial growth in the home market may be hindered by a regulatory system which may limit the amount of revenue generated from aeronautical sources. In addition, international expansion may provide the much needed finance for development in the home market and may safeguard the success of the core business.

However, it is not just the privatised or partially privatised airports (such as AdP, Fraport and Zurich) which sought to become international companies. There are also companies such as Changi Singapore that are not responsible to private shareholders, but are just as keen to acquire other airports. The motivation for such expansion is not always totally clear – although it is true that such airports, too, are increasingly under greater pressure to perform well. In the early stages of airport privatisation for some airports there was definitely an element of fear of being left behind in the race to become international airport operators. However, internationalisation strategies for airport companies have changed since these early 'gold rush' years in the late 1990s. In the early and mid-2000s, a more volatile aviation industry, coupled with more experience of international operations, meant that generally airports became more cautious in their approach, and a number of companies reassessed their international expansion ambitions. There began to be far more focus on considering whether the investment would make strategic sense or really add value. This resulted in a number of airports pulling out from some of their international projects. For example, Aéroporti de Roma sold its share in the Airports Company of South Africa in 2005, and AdP disposed of its share of BCIA in 2007. Similarly, Copenhagen airport sold its interest in Hainan Meilan in 2007.

The successful airport companies are the ones that have become competent in bid and project management, and in developing new skills in change management and business development to cope with the opportunities arising from the new investments. Some of the utility, property and construction companies that had a number of these skills began airport operations primarily because of the synergies which existed with their businesses. Koch and Budde (2005) argued that some of the most important success factors for international airport companies are likely to be the availability of capital resources, personnel resources and know-how (operational expertise, international know-how, an efficient organisational structure), a management approach with a focus on value creation, international experience and established credibility.

In most cases a consortium of different organisations will be involved with airport privatisations. These consortia need to bring together the appropriate mix of operational expertise, capital and local experience (Feldman, 2008). It may be difficult to get the different entities to work successfully together, particularly if the government is still a major shareholder, which will usually add more complexity and may involve coping with conflicting objectives of private and public bodies. Having a local partner in the consortium may help it to understand the local language and culture, handle the local press and politicians, and be familiar, for example, with other local labour relations issues or environmental legislation. On the other hand, global partners are likely to bring knowledge of global customers (e.g. airlines alliances), international suppliers and the global financial markets. In turn, this may mean they will be able to obtain favourable long-term financing. As a consequence, it will often be stipulated during the privatisation process that there has to be both local and foreign interests within the consortium. Sometimes there may even be a mixture of local and central government involvement, as with the Indian airport privatisations.

For all airport privatisations, a number of important considerations need to be taken into account to minimise the risk to any specific project. As well as having the appropriate local partner, the financial structure related to the consortium partners and their exact roles need to be considered in detail, as do any cultural differences or communication problems between the consortium partners and local staff. All this means that the contractual framework and choice of consortium partners is very important. There will also be political risks over which the investor may have very limited control. For example, even if a government has relinquished all effective control of an airport to a private operator, a change in the air transport regulatory system or the introduction of more stringent environmental legislation, or different planning regulations, could have a fundamental impact on how the airport operates. Also, the extent of any political instability and the general political and legal situation need to be considered, as well as the government's relationship with the other stakeholders, such as the airlines and the border control and immigration agencies. These risks and others may be reduced, but not eliminated totally, by carrying out a comprehensive due-diligence assessment of all areas of the airport business, which is the usual procedure for privatisation models such as trade sales, concessions and project finance models.

Benefits of multi-airport operations

As with many other industries, growing the business through mergers and acquisitions can produce higher returns and increased shareholder value. Also, risks may be reduced by going global, thereby placing less relevance on any one national economy and lessening exposure to downturns in individual economies. There has been a significant trend towards consolidation in the airline industry, and on the surface it may appear as if this trend is simply being replicated in the airport industry. However, there do not seem to be such obvious synergies in controlling a global group of airports as there are with airlines, particularly when the airports are operating in different regulatory environments. While airline alliances are being driven primarily by a need to expand networks and increase market accessibility, most of the potential benefits of operating a group of airports appear to come from shared knowledge, expertise and financial resources rather than marketing opportunities. In other words, this trend appears to have been driven more by increased profit opportunities that investing in new airports can bring, rather than by strategic industry-specific considerations of investors.

Airport groups potentially can reduce costs through bulk buying and joint purchasing in some areas. For example, cost reductions could be achieved with joint purchasing of equipment such as ramp buses and fire engines, and through negotiation of more favourable insurance policies. Costs could also be saved by having a single head office and through centralising many functions such as accounting and information technology. Joint training programmes could be arranged, and there may be cost advantages through combined marketing. Standard commercial contracts could be agreed with core partners at the airports. In addition, the advantages of size could help the airport company keep up to date with technology developments and the latest airport management tools and techniques around the world. However, since the airport location is fixed and cannot be moved, a number of costs will remain influenced primarily by local conditions.

One of the major advantages of internationalisation or globalisation for airlines and other companies is that of being able to sell one common product or one global brand to the customer. For international airport companies, branding could involve the use of similar signposting, colour schemes and interior design for the entire airport. Examples of this have existed for many years with national airport groups. For instance, BAA traditionally used a common and constant yellow and black brand image for its UK airports. The merits of branding within the airport industry are, however, very questionable (see Chapter 8). Most passengers, particularly leisure passengers who travel infrequently, would probably not be aware of any common branding and would find it very difficult to define any distinguishing features of a certain airport brand.

For many airport groups, the individual airports will serve different markets and will not have any potential to compete with each other, for example Schiphol's involvement with Brisbane airport or Fraport's involvement with Lima. However, there are clearly many more advantages to multi-airport groups if the airports are sufficiently close to compete, as common group operation may reduce airport competition and enable the operator to gain market dominance (Forsyth *et al.*, 2011). This has meant that some privatisations of competing airports have not been allowed to go ahead – in the UK (as mentioned above) but also elsewhere, as with Vienna airport proposing to operate Bratislava airport. Other advantages of general group operation in the same country, such as investment and traffic coordination, may also exist.

There could potentially be benefits for an individual airline or airline alliance in operating out of more than one airport which is owned by an international airport company. For example, standard contracts could be agreed for the whole airport network, quantity discounts on charging could be negotiated, and there could be common agreements on the use of gates and other facilities. This was the idea behind the Wiggins Group's expansion into airports: the company's overall objective was to develop a global network of over 20 regional airports under its so-called PlaneStation concept. Wiggins believed that the power of the PlaneStation brand would significantly benefit the airports within this network and would bring the resources needed to improve their performance, which had previously been unavailable under individual, public ownership. Wiggins therefore had a very different strategy from most of the other emerging global airport companies, which tended to buy up airports that already were successful or appeared to have great potential. Wiggins claimed that common standards and processes at all the network airports, along with a single administrative system, provided the potential for improving the quality and effectiveness of the facilities offered to the airline operators and logistic organisations that planned to operate from a number of airports in the network. There would also be scope for the building of close relationships with airlines and other operators with, for example, risk sharing, simplified negotiation and common tariffs. However, Wiggins/Planestation went out of business in 2005 primarily because of the financial failure of its main airline at Manston airport, the LCC EUjet, in which the airport company had invested when the financial problems of the airline became evident. As a result such a strategy has never really been tested.

Emergence of airport alliances and sister airport groups

The main driving force behind the internationalisation of the airport industry has been airport privatisation, which has enabled a growing number of airports to be purchased outright or at least managed on a long-term basis by an external airport operator. However, this internationalisation could also occur as a result of greater cooperation between airport operators, or through the establishment of airport alliances (Forsyth *et al.*, 2011). Unlike airline cooperation, which is driven primarily by a need to expand networks and increase accessibility and market power, airport cooperation is likely to be encouraged by a desire to benefit from shared knowledge, expertise and financial resources. In the late 1990s there was considerable discussion about the possibility of the development of airport alliances, particularly in the light of increased competition in the airline industry and the emergence of their global alliances. This meant that airports themselves faced increased competition and were under greater pressure to reduce costs, improve quality and add value to their organisations – all of which, theoretically, could have been helped by airport cooperation.

The first real development of airport alliances occurred in 1999 when Galaxy International Cargo Alliance was established by Washington Dulles International airport and Chateauroux-Doels, with an overall aim of cooperating in joint marketing by establishing a common brand for member airports. By 2001 it had over 21 airports. In 2000, Aviation Handling Service (AHS) was established as a joint venture of three German airports and grew in numbers in the following years to provide common quality standards for ground handling services. However, the establishment of both these alliances had only limited effects. Also in 2000, the Schiphol–Fraport ‘Pantares’ alliance was formed, which was potentially a more far-reaching alliance agreement. Schiphol and Fraport believed that there was scope for cooperation because the two airports were both European hubs but serving different airlines alliances; they had complementary competencies, they were at similar levels of globalisation and they shared the same strategic approach. They identified seven key areas where cooperation seemed possible: aviation ground services; ground and cargo handling; retail and passengers; facility management; real estate; information technology; and international projects.

As part of the alliance partnership, the airports agreed not to compete against each other on international contracts. As a result the two airports cooperated in a few minor areas, but overall very few benefits were achieved. However, in 2008 Schiphol entered into a new strategic alliance, this time with AdP, which somewhat mirrored the earlier merger of the two Skyteam airlines KLM and Air France, and arguably has the potential to have a greater impact (see Case Study 2.4).

CASE STUDY 2.4
THE HUBLINK ALLIANCE AND INCHOEN AGREEMENT

In 2008 Schiphol and AdP entered into a new strategic alliance. This so-called ‘Hublink’ alliance of initially 12 years involved the exchange of 8 per cent equity stakes and increased cooperation to enhance the functioning of the dual hub system of AF–KLM in the areas of aviation, non-aviation and international development, with eight steering committees covering: dual-hub and network attractiveness; airport operations; retail; international development; real estate; telecoms and IT; sustainable development; and purchasing. Combined revenue and cost synergies of around €71 million per annum were expected to be realised by 2013, combined with a reduction in capital expenditure of €18 million on average per annum from 2013 onwards (AdP, 2008).

Five priority areas were further retained in 2017 (the digital airport, international operations, purchasing, innovation, human resources) with the goals of the Hublink alliance in the aviation area then being (AdP 2017, 69):

- to improve the competitiveness of the two groups through consolidation of a dual hub which is a requirement to handle the competition from other hubs, notably in the Middle East;
- to enhance the attractiveness of both groups through greater harmonisation of the lay-out and signalling at their terminals, and by the coordinated improvement of their passenger processes (check-in, information, and security);
- to reinforce the relationship of the two groups with their largest customers, including the Air France-KLM Group;
- to optimise their operational efficiency and reduce purchasing expenditure notably through volume pooling of some purchasing.

In the non-aviation area the stated aim was to: ‘step up growth in retail, real estate and the digital airport thanks to the exchange of know-how (experiments, projects under way and recently completed projects to find synergies)’. The two airports also wanted to continue to share information on future international developments opportunities having adopted a coordinated approach (they together formed a consortium to bid for Rio airport in 2013) and to be leaders in sustainable development by improving energy efficiency, using renewable energy and reducing greenhouse gas emissions.

The HubLink collaboration so far has mainly centred around joint purchasing and innovation. Examples include:

- A joint contract for the purchasing of signposting features in the landing area and escalators and moving walkways
- Developing joint pilot projects aimed at improving information services to passengers and upgrading payment systems
- Improving the Paris–Amsterdam flights by implementing dedicated queues at security and at the gate announcing information in both languages
- Implementing a common framework agreement for the provision of snow removal equipment
- Joint purchasing of de-icing products and the implementation of a joint framework contract for the supply of LED projectors

It was recently reported (Royal Schiphol Group, 2017) that the Management Board was pleased with the synergies achieved and would consider possible extensions with the agreement beyond 2020.

Meanwhile, in 2011 the two airports also signed an agreement with Incheon airport (a base of another key SkyTeam member, Korean Airlines) to help improve the quality of customer service and provide for the exchange of good practices in the following areas: aeronautical activities, airport shops, cargo and human resources. This includes case studies which are updated twice a year. This agreement was renewed in 2014 and again in 2017 for another four years adding in new areas such as innovation and digital technology. Some joint training with AdP, Schiphol, Incheon and TAV employees has been undertaken.

Elsewhere in recent years there has been the development of 'sister' agreements which can potentially bring benefits, especially between airports of different global regions where there is no competition. This usually involves having the agreements formalised in the shape of a memorandum of understanding (Stone, 2011). The airports may agree to work jointly on developing or supporting new routes between the airports (e.g. Birmingham/Chicago; Delhi/Sydney) and/or sharing information and best practice, as in the case with Singapore and Narita airports. It may also involve providing consultancy services, as with Incheon and the Bangladesh airports. Chicago O´Hare has agreements to cooperate on a wide range of areas including airport management, customer service, construction, planning, operations, information technology, and sustainable development with nine different airports worldwide. Generally many of these agreements involve multiple airport agreements, such as AOT with Munich, Incheon, Narita and Beijing; Beijing with Singapore, Sydney, Narita, Thailand, Chicago and Hong Kong; Munich with Beijing, Denver, Nagoya, Bangkok and Singapore; Abu Dhabi with Chicago, Narita and Bangkok; and Chicago with Beijing, Shanghai, Hong Kong, Incheon, Abu Dhabi and Narita. Narita airport has one of the most widespread agreement networks with 13 other airports (Table 2.16). This is certainly a development that has grown in popularly in recent years but the true level of benefits is hard to assess.

Table 2.16 NAA's Sister Airport Agreements

Airport Company	Date of Agreement
Korea Airports Corporation	July 1997
Port Authority of New York and New Jersey	November 1998
Fraport AG	February 2005
Pulkovo Airport Joint Stock Company	April 2008
Incheon International Airport Corporation	June 2009
Abu Dhabi Airports Company	March 2010
Beijing Capital International Airport Co., Ltd.	March 2010
Airports of Thailand Public Company Limited	July 2010
Changi Airport Group	May 2012
Denver International Airport	June 2013
Dallas Fort Worth	September 2015
Taiwan Taoyuan International Airport	September 2016
Airports Corporation of Vietnam	May 2017

Source: Narita Airport (2017)

References

ACI (2014) *Airport Economics 2014 Report,* Montreal: ACI.
ACI (2017) *Airport Ownership, Economic Regulation and Financial Performance*, Montreal: ACI.
ACI Europe (2016) *The Ownership of Europe's Airports 2016*, Brussels: ACI Europe.
Adler, N. and Liebert, V. (2014) 'Joint impact of competition, ownership form and economic regulation on airport performance and pricing', *Transportation Research Part A: Policy and Practice,* 64: 92–109.
AdP (2008) *Aéroports de Paris and Schiphol Group to create a leading Global Alliance in the Airport Industry*, press release, 21 October.
AdP (2017) *Registration Document and Annual Financial Report 2016*, Paris: AdP.
Arvantis, P. and Papatheodorou, A. (2015) 'Greek airports in transition: From public ownership to PPP concessions', *Journal of Airport Management*, 9(3): 284–95.
Ashford, N. and Moore, C. (1999) *Airport Finance*, 2nd edn, Loughborough: Loughborough Airport Consultancy.

Assaf, A. and Gillen, D. (2012) 'Measuring the joint impact of governance form and economic regulation on airport efficiency', *European Journal of Operational Research*, 220(1): 187–98.

Aviation Strategy (2015a) 'Airport valuations update', *Aviation Strategy*, March: 17–18.

Aviation Strategy (2015b) 'Airport valuations', *Aviation Strategy*, April: 11.

Barros, C. and Dieke, P. (2007) 'Performance evaluation of Italian airports with data envelopment – analysis', *Journal of Air Transport Management*, 13(4): 184–91.

Barros, C., Managi, S. and Yoshida, Y. (2010) 'Productivity growth and biased technological change in Japanese airports', *Transport Policy*, 17(4): 259–65.

Beesley, M.E. (1997) *Privatisation, Regulation and Deregulation*, 2nd edn, London: Routledge.

Bland, D. (2017) Brazil considering new airport concessions, *BNamericas*, 22 March. Online. Available at: https://www.bnamericas.com/en/news/infrastructure/brazil-considering-new-airport-concessions1/ (accessed 23 June 2017).

Bottasso, A. and Conti, M. (2012) 'The cost structure of the UK airport industry', *Journal of Transport Economics and Policy*, 46(3): 313–32.

Brunner, A. (2007) 'Bengaluru International Airport: India's largest private sector Greenfield airport', *Journal of Airport Management*, 1(3): 226–31.

Brutsch, U. (2013) 'International airport management: The government perspective', *Journal of Airport Management,* 8(2): 100–04.

CAPA (2007) 'Is airport privatisation running out of steam?', in ACI, *ACI Airport Economics Survey 2007*, Montreal: ACI.

CAPA (2011) *Time is running out on Brazil's bid to Privatise its Airports successfully*. Online. Available at http://www.centreforaviation.com/analysis/time-is-running-out-on-brazils-bid-to-privatise-its-airports-successfully-62128 (accessed 1 December 2011).

CAPA (2015) *Lyon and Nice airport privatisations – Lessons to be learnt from the Events at Toulouse*. Online. Available at http://centreforaviation.com/analysis/lyon-and-nice-airport-privatisations—lessons-to-be-learned-from-the-events-at-toulouse-249583 (accessed 30 January 2017).

CAPA (2016) *CAPA Airport Finance Privatisation Review – the day has come for PPPs*. Online. Available at http://centreforaviation.com/analysis/capa-airport-finance—privatisation-review-20152016-the-day-has-come-for-ppps-301329 (accessed 30 January 2017).

Carney, M. and Mew, K. (2003) 'Airport governance reform: a strategic management perspective', *Journal of Air Transport Management*, 9(4): 221–32.

Caves, R. and Gosling, G. (1999) *Strategic Airport Planning*, Oxford: Elsevier.

Clark, O. (2016) 'Private Lives', *Airline Business*, May: 32–33.

Competition Commission (2009) *BAA Airports Market Investigation*, final report, London: Competition Commission.

Condie, S. (2015) 'Airport ownership trends in Europe', *Journal of Airport Management*, 10(1): 14–23.

Coombs, T. (2016) 'Airport Transaction Update and 2016 Outlook', *RDC Aviation*. Online. Available on http://www.rdcaviation.com/Insights/Article/44/Airport-Transaction-Update-and-2016-Outlook (accessed 30 January 2017).

Cruz, C. and Marques, R. (2011) 'Contribution to the study of PPP arrangements in airport development, management and operation', *Transport Policy*, 18(2): 392–400.

De Almeida Valois, D., Barroso Uelze, H., Frizzo, H.K. and Martins, J.R. (2016) 'Brazil Launches RFP for 4 Airports as part of Investment Partnership Plan', *Mondaq,* 13 December. Online. Available at: http://www.mondaq.com/brazil/x/551394/Aviation/Brazil+launches+RFP+for+4+Airports+as+part+of+Investment+Partnership+Plan (accessed 4 February 2017).

Doganis, R. (1992) *The Airport Business*, London: Routledge.

Domney, M., Wilson, H. and Chen, E. (2005) 'Natural monopoly privatisation under different regulatory regimes', *International Journal of Public Sector Management*, 18(3): 274–92.

Enrico, S., Boudreau, B., Reimer, D. and Van Beek, S. (2012) *ARCP Report 66: Considering and Evaluating Airport Privatisation*, Washington, DC: Transportation Research Board.

FAA (2017) *Airport Privatization Pilot Program*. Online. Available at https://www.faa.gov/airports/airport_compliance/privatization/ (accessed 1 August 2017).

Feldman, D. (2008) 'Making airport privatisation consortia work', *Journal of Airport Management*, 3(1): 48–53.

Forsyth, P., Niemeier, H.-M. and Wolf, H. (2011) 'Airport alliances and mergers – structural change in the airport industry?', *Journal of Air Transport Management*, 17(1): 49–58.

Fraport Greece (2017) *14 Greek Regional Airports*, Athens: Fraport Greece

Freathy, P. and O'Connell, F. (1998) *European Airport Retailing*, London: Macmillan.

Fung, M., Wan, K., Hui, Y. and Law, J. (2008) 'Productivity changes in Chinese airports 1995–2004', *Transportation Research Part E*, 44(3): 521–42.

GAO (2014) *Airport Privatization: Limited Interest despite FAA's Pilot Program*, GAO-15–42, Washington DC: GAO.

Gibbons, S. and Wu, W. (2017) *Airports, Market Access and Local Economic Performance: Evidence from China*, SERC Discussion paper 211, London: SERC.

Gillen, D. (2011) 'The evolution of airport ownership and governance', *Journal of Air Transport Management,* 17(1): 3–13.

Gitto, S. and Mancuso, P. (2012) 'Two faces of airport business: a non-parametric analysis of the Italian airport industry', *Journal of Air Transport Management*, 20: 39–42.

Grad, C. (2017) 'The buying game', *Airport World*, 22 March. Online. Available at http://www.airport-world.com/features/other-articles/6109-the-buying-game.html (accessed 1 August 2017).

Graham, A. (2008) 'Airport planning and regulation in the United Kingdom', in C. Winston and G. de Rus (eds), *Aviation Infrastructure Performance*, Washington, DC: Brookings Institution Press.

Graham, A. (2011) 'The objectives and outcomes of airport privatisation', *Research in Transportation Business and Managemen*t, 1(1): 3–14.

Graham, A. and Morrell, P. (2017) *Airport Finance and Investment in the Global Economy*, Abingdon: Routledge.

Graham, A., Saito, S. and Nomura, M. (2014) 'Airport management in Japan: Any lessons learnt from the UK?', *Journal of Airport Management*, 8(3): 244–63.

Halpern, N. and Graham, A. (2017) 'Performance and prospects of smaller UK regional airports', *Journal of Airport Management*, 11(2): 180–201.

Holvad, T. and Graham, A. (2004) 'Efficiency measurement for UK Airports: an application of data envelopment analysis', *Empirical Economics Letters*, 3(1): 31–39.

Humphreys, I. (1999) 'Privatisation and commercialisation changes in UK airport ownership patterns', *Journal of Transport Geography*, 7(2): 121–34.

IATA (2005) *Airport Privatisation*, IATA economic briefing, Geneva: IATA.

IATA (2017) *Airport Privatization Fact Sheet*, Geneva: IATA.

ICAO (2012) *Manual on Privatisation in the Provision of Airports and Air Navigation Services*, Montreal: ICAO.

iGA (2017) *Who we are*. Online. Available at http://www.igairport.com/en/about-iga/who-we-are (accessed 1 August 2017).

Ison, S., Francis, G., Humphreys, C. and Page, R. (2011) 'UK regional airport commercialisation and privatisation: 25 years on', *Journal of Transport Geography*, 19(6): 1341–49.

Kato, K., Uemura, T., Indo, Y., Okada, A., Tanabe, K., Saito, S., Oguma, H., Yamauchi, H., Shiomi, E., Saegusa, M. and Migita, K. (2011) 'Current accounts of Japanese airports', *Journal of Air Transport Management*, 17(2): 88–93.

Koch, B. and Budde, S. (2005) 'Internationalisation strategies in airport companies', in W. Delfmann, H. Baum, S. Auerbach and S. Albers (eds), *Strategic Management in the Aviation Industry*, Aldershot: Ashgate.

LeighFisher (2011) 'Brazil: the waking giant seeks a private pilot', in *Finding the Opportunity in Change*. Online. Available at http://www.leighfisher.com/new/publication/finding-opportunity-change- stories-around-world (accessed 30 January 2012).

LeighFisher (2013) 'Brazil Redux: Round 2 Airport concessions', in *Airport Public-Private Partnerships: Setting the Stage for the Next 25 Years*. Online. Available at http://www.leighfisher.com/sites/default/files/free_files/compendium_-_airport_public-private_partnerships_-_november_2013_0.pdf (accessed 4 February 2017).

Lin, L. and Hong, C. (2006) 'Operational performance evaluation of international major airports: an application of data envelopment analysis', *Journal of Air Transport Management*, 12(6): 342–51.

Lipovich, G. (2008) 'The privatisation of Argentine airports', *Journal of Air Transport Management*, 14(1): 8–15.

Lunsford, M. (2012) 'Waking giant seeks a private pilot', *ACI Economics and Finance Conference,* London, March.

Marques, R. (2011) 'Together or separately? The efficiency and market structure of Portuguese airports', *Journal of Air Transport Management*, 17(6): 136–39.

Miyoshi, C. (2015) 'Airport privatisation in Japan: Unleashing air transport liberalisation?', *Journal of Airport Management*, 9(3): 210–22.

Narita Airport (2017) *Narita International Airport Corporation and Airports Corporation of Vietnam Sign Airport Agreement*, press release, 31 May, Tokyo: Narita Airport.

Ohta, K. (1999) 'International airports: financing methods in Japan', *Journal of Air Transport Management*, 5(4): 223–34.

Oum, T., Adler, N. and Yu, C. (2006) 'Privatisation, corporatisation, ownership forms and their effects on the performance of the world's major airports', *Journal of Air Transport Management*, 12(3): 109–21.

Oum, T., Yan, J. and Yu, C. (2008) 'Ownership forms matter for airport efficiency: a stochastic frontier investigation of worldwide airports', *Journal of Urban Economics*, 64(2): 422–35.

Oum, T., Yu, C. and Fu, X. (2003) 'A comparative analysis of productivity performance of the world's major airports: summary report of the ATRS global airport benchmarking research report – 2002', *Journal of Air Transport Management*, 9(5): 285–97.

Parker, D. (1999) 'The performance of BAA before and after privatisation: a DEA study', *Journal of Transport Economics and Policy*, 33(2): 133–46.

Parker, D. and Saal, D. (eds) (2003) *International Handbook on Privatisation*, Cheltenham: Edward Elgar.

Poole, R. (2016) *Annual Privatization Report 2016*, Los Angeles: Reason Foundation.

Poole, R. and Edwards, C. (2016) *Privatizing US Airports*, Cato Institute Tax and Budget Bulletin, No. 76, November.

Raghunath, S. (2010) 'Airport privatisation in India: investment opportunities in the next phase of development', *Journal of Airport Management*, 4(3): 235–51.

Rico, O. (2008) 'The privatisation of Mexican airports', *Journal of Air Transport Management*, 14(6): 320–23.

Rikhy, H., Roberts, J. and Cheung, S. (2014) 'Global airport privatisation: Trends, recent developments and challenges ahead', *Journal of Airport Management*, 8(4): 300–04.

Royal Schiphol Group (2017) *Annual Report 2016*, Amsterdam: Royal Schiphol Group.

Shibata, I. (1999) 'Japanese laws related to airport development and the need to revise them', *Journal of Air Law and Commerce*, 65(1): 125–36.

Stiller, D. (2010) 'Assessing the development of airport concession models and financing in times of a financial crisis', *Journal of Airport Management*, 4(3): 226–34.

Stone, R. (2011). Sister act, *Airport World,* 17 October.

Transport Canada (2015) *Pathways: Connecting Canada's Transportation System to the World*, Ottawa: Transport Canada.

Vasigh, B. and Gorjidooz, J. (2006) 'Productivity analysis of public and private airports: a causal investigation', *Journal of Air Transportation*, 11(3): 144–63.
Villard, P. (2011) 'Changing frames of reference and regulatory structures: French airport policy in transition', *Journal of Public Policy*, 31(1): 73–93.
Vinci Airports (2017) *Activity Report 2016*, Paris: Vinci Airports.
Vogel, H.-A. (2006) 'Impact of privatisation on the financial and economic performance of European airports', *Aeronautical Journal*, 110(1106): 197–213.
Vogel, H.A. (2016) 'Challenges of airport economics for financial management', *Journal of Airport Management*, 10(4): 416–35.
World Bank (2017a) *Airport Bots & Concessions of Legal and Regulatory Issues – Checklist*. Online. Available at http://ppp.worldbank.org/public-private-partnership/ppp-overview/practical-tools/checklists-and-risk-matrices/airport-concession-checklist (accessed 4 February 2017).
World Bank (2017b) *Private Participation in Infrastructure Database*. Online. Available at https://ppi.worldbank.org/snapshots/sector/airports (accessed 1 August 2017).
Yang, X., Tok, S. and Su, F. (2008) 'The privatisation and commercialisation of China's airports', *Journal of Air Transport Management*, 8(5): 243–51.
Yoshida, Y. and Fujimoto, H. (2004) 'Japanese-airport benchmarking with the DEA and endogenous-weight TFP methods: testing the criticism of overinvestment in Japanese regional airports', *Transportation Research Part E*, 40(6): 533–46.
Yuen, A. and Zhang, A. (2009) 'Effects of competition and policy changes on Chinese airport productivity: an empirical investigation', *Journal of Air Transport Management*, 15(4): 166–74.
Zhang, A. and Yuen, A. (2008) 'Airport policy and performance in mainland China and Hong Kong', in C. Winston and G. de Rus (eds), *Aviation Infrastructure Performance,* Washington, DC: Brookings Institution Press.

3 Airport economics and performance benchmarking

Industry profit levels

This chapter considers the economics of the airport industry. The modern-day commercial and business pressures being placed on most airports mean that a thorough understanding of the economics of airports is now, more than ever before, a fundamental prerequisite for all airport managers. The chapter begins by looking at profit levels within the industry and describing the revenue and cost structures. It goes on to discuss some of the key factors that influence the economics of airports. This leads to a discussion of how economic performance can be measured and the alternative methods currently being used to benchmark airport performance.

Table 3.1 shows the profit levels for 50 of the largest airport operators in the world in 2015. Nearly all the airports produced an operating profit (profit before interest and tax) with the exception of the US operators Chicago Department of Aviation, Miami Dade County Aviation Department and Dallas/Fort Worth International airport, and the Brazilian organisation Infraero. The operating profit margin for most airports was above 20 per cent and at a number of airports was substantially greater than this.

Table 3.1 Profitability for 50 major airport operators, 2015

Airport operator	Country	Revenues (million US$)	Operating profit (million US$)	Operating margin (per cent)
Heathrow Airport Holdings	UK	4,217	1,400.6	33.2
Aena Aeropuertos	Spain	3,885	1,380.9	35.5
Aeroports de Paris	France	3,216	867.9	27.0
Fraport	Germany	2,866	574.0	20.0

Airport operator	Country	Revenues (million US$)	Operating profit (million US$)	Operating margin (per cent)
Port Authority of New York & New Jersey	USA	2,537	979.3	38.6
Hong Kong International Airport	Hong Kong	2,344	1,227.7	52.4
Narita International Airport Corporation	Japan	1,819	360.6	19.8
Incheon International Airport	South Korea	1,709	927.7	54.3
Japan Airport Terminal	Japan	1,700	94.1	5.5
Schiphol Group	Netherlands	1,698	556.8	32.8
Airports Authority of India	India	1,650	n/a	n/a
Changi Airport Group	Singapore	1,561	n/a	n/a
New Kansai International Airport Company	Japan	1,500	443.8	29.6
Avinor	Norway	1,473	397.1	27.0
Munich Airport	Germany	1,379	303.3	22.0
Airports of Thailand	Thailand	1,361	693.6	51.0
Beijing Capital International Airport Group	China	1,353	445.1	32.9
State Airports Authority	Turkey	1,299	591.7	45.6
TAV Airports	Turkey	1,190	423.0	35.5
Manchester Airports Group	UK	1,168	263.3	22.5
Los Angeles World Airports	USA	1,122	208.3	18.6
Aeroporti di Roma	Italy	1,038	274.1	26.4

Airport operator	Country	Revenues (million US$)	Operating profit (million US$)	Operating margin (per cent)
Flughafen Zürich	Switzerland	1,025	284.5	27.8
Chicago Department of Aviation	USA	1,021	–250.9	–24.6
Gatwick Airport Limited	UK	1,009	295.1	29.2
Shanghai Airport Authority	China	999	527.9	52.8
GMR Airports	India	999	363.9	36.4
Malaysia Airports Holdings	Malaysia	984	11.7	1.2
Greater Toronto Airports Authority	Canada	930	328.3	35.3
Sydney Airport Group	Australia	916	515.0	56.2
Guangzhou Baiyun International Airport	China	894	278.6	31.2
Miami Dade County Aviation Department	USA	883	–107.3	–12.2
San Francisco International Airport	USA	815	206.3	25.3
Infraero	Brazil	800	–615.7	–76.9
SEA Group	Italy	766	161.1	21.0
Swedavia	Sweden	765	207.3	27.1
Metropolitan Washington Airports Authority	USA	762	131.4	17.2
DAA	Ireland	750	142.0	18.9
Flughafen Wien	Austria	722	157.6	21.8
Korea Airports Corporation	South Korea	712	198.8	27.9
Denver Department of Aviation	USA	687	87.0	12.7

Airport operator	Country	Revenues (million US$)	Operating profit (million US$)	Operating margin (per cent)
Dallas/Fort Worth International Airport	USA	679	–22.9	–3.4
ANA – Aeroportos de Portugal	Portugal	649	237.0	36.5
Australia Pacific Airports Corporation	Australia	636	469.4	73.8
Aeropuertos Argentina 2000	Argentina	633	206.7	32.6
Brussels Airport Company (estimate)	Belgium	610	n/a	n/a
Copenhagen Airports A/S	Denmark	600	234.2	39.0
Airports Company South Africa	South Africa	599	n/a	n/a
Massport	USA	572	245.7	42.9
ASUR Aeropuertos Del Sureste	Mexico	563	254.9	45.3

Source: Adapted from Airline Business (2016)

Figure 3.1 presents profits for both leading airport groups and major airlines. For the airports in 2015 an average operating margin of 25 per cent was recorded. In comparison, the airlines experienced a lower profit margin of 8 per cent in 2015 (although this was considerably higher than in previous years primarily due to lower fuel prices). Similar differences in the comparative level of profits were experienced in the previous years, and there are a number of reasons why this so-called ‘profitability gap’, which is frequently a bone of contention between the airlines and airports, exists. First, although airports increasingly face much greater competition than before, they are less substitutable than airlines that generally deal with much stiffer competition, which particularly puts pressure on them to reduce their fares. In a number of countries there tends to be a shortage of airport capacity that can push up prices, while in many airline markets there is overcapacity which has the opposite effect. In many cases the airports have a more diverse customer base than airlines, which means that airports have less exposure to downturns in individual markets. Also, not all airport revenues (e.g. landing charges, rents) are directly related to passenger numbers, which means that fluctuations in passenger numbers generally have less impact on airports. Finally, on the cost side, airports have less dependence on fuel prices, a key input cost for airlines over which they have very little control. So

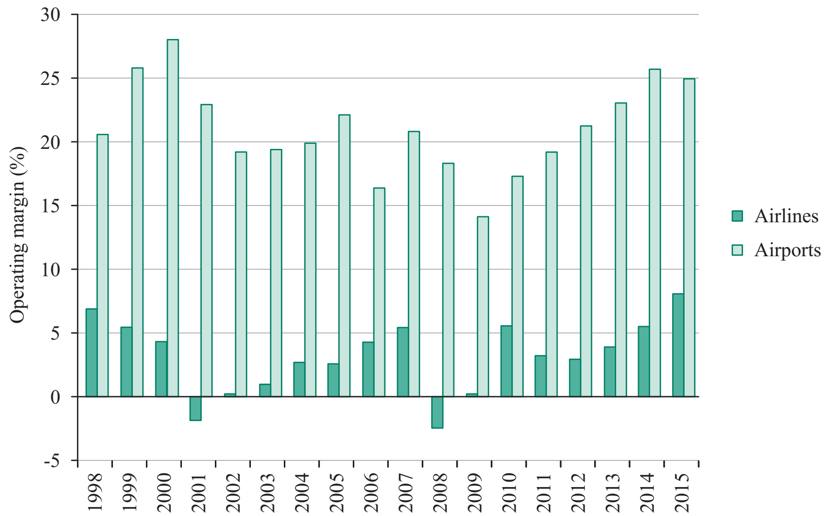

Figure 3.1
Operating margin of world airlines (top 150) and airports (top 50/100 depending on year) 1998–2015

Note: For 2014 and 2015, the airline data is for all airlines reporting to ICAO
Sources: Airline Business/ICAO

overall, airports are considered to have lower inherent financial and business risks, which may also reduce the cost of capital at the airport.

However, these relatively healthy profit figures tend to relate only to major airports. If smaller ones are included, a different picture emerges. For example, 92 per cent of world airports that made a net loss in 2015 handled fewer than one million passengers (ACI, 2017). This relates to the inherent cost and revenue disadvantages that small airports tend to have (see discussion below), and, in addition, in some countries there may be an oversupply of small airports which have been built by local governments for broader prestige or political reasons rather than just commercial motives, which, combined with increased airport competition, may lead to underutilisation. Within Europe, the European Commission's (EC) view is that airports under 1 million passengers find it hard to cover all of their operating costs, let alone their capital costs. At a size of 3–5 million they should be able to cover all their costs to a large extent, whereas beyond 5 million they should be profitable (EC, 2014). However, this apparent loss-making feature of small airports has been challenged by some, for instance by Starkie (2008), who argued that, for example in the UK, there is evidence that in certain market conditions even small airports can make reasonable profits.

Organisations are interested not just in the level of profits related to revenues, but also in how they use capital to generate profits by looking at ROCE or return on invested capital (ROIC) figures. In 2015, world airports recorded a ROIC value of 6.2 per cent. This needs to be compared with the weighted average cost of capital (WACC), which is the return on investing in airports that investors would expect. If the ROIC exceeds the WACC, then this can be seen as a true economic profit.

Typical values of WACC are between 6 to 8 per cent for the airport industry, suggesting that airports are not making excessive returns (ACI, 2017). Other evidence also suggests that airports are barely covering their WACC, or in fact falling slightly short of this (International Air Transport Association (IATA), 2013; Tretheway and Markhvida, 2013), with the differences between the airports and airlines being less evident. Vogel and Graham (2011) found there were no statistically significant differences in profitability between the two sectors when measured in terms of return on capital or assets. These comparative differences with these two profit measures (i.e. operating margins and return on capital) for airlines and airports can be explained primarily by the higher capital intensity of the airport industry, and also by the growing airline industry practice of placing aircraft off the balance sheet by leasing rather than buying them.

Revenue and cost structures

Airport revenue is usually classified into two main categories: aeronautical (or aviation) and non-aeronautical (or commercial) revenues (Table 3.2).

Aeronautical revenues are those sources of income that arise directly from the operation of aircraft and the processing of passengers and freight. Non-aeronautical revenues are those generated by activities that are not directly related to the operation of aircraft, notably those from commercial activities within the terminal and rents for terminal space and airport land. Then there are a few categories that can be classified as either type of revenue.

Table 3.2 Airport operating revenue sources

Aeronautical	Non-aeronautical
Landing fees	Retail*
Passenger and security fees	F&B*
Aircraft parking fees	Car hire*
Handling fees (if handling is provided by the airport operator)	Advertising*
Airline terminal rental fees (e.g. in USA)	Car parking*
Other aeronautical fees (air traffic control, infrastructure, airbridges, etc.)	Rents/property
	Utility recharges (for gas, water, electricity, etc.)
	Other non-aeronautical revenue (fuel and oil, in-flight catering, consultancy, visitor and business services, etc.)

*Usually shown as ‘concession revenue’ if provided by a third party.

For example, handling revenues are usually treated as aeronautical revenues, unless handling is undertaken by handling agents or airlines when the associated revenue (rent or fee based on turnover) is included under rents or concession revenue items. In the United States there are terminal rental fees paid by the airlines that are classified as aviation revenue, although usually rents are considered as commercial items. Revenue received by the airport from aircraft fuel companies or from airlines as a fuel and oil throughput fee can be regarded as directly related to aircraft operations and hence an aeronautical revenue. Alternatively, this can be considered as commercial revenue and hence a non-aeronautical item. Other revenues, including interest received and income earned from subsidiary companies, are usually included under a different 'non-operating' revenue category.

Figure 3.2 presents the average operating revenue breakdown for 2015 from the ACI economics survey. This is a survey undertaken every year that covers 827 airports representing 73 per cent of worldwide traffic (ACI, 2017). Overall, aeronautical revenue accounted for just over half the revenues, namely 60 per cent.

Unlike with revenues, there is no industry standard or unique way of reporting airport operating costs. ICAO (2013) lists these as personnel costs, supplies, contracted services, administrative overheads and other. Sometimes depreciation is reported as an operating cost and sometimes a capital cost. The ACI classification shows that personnel costs and depreciation are the largest items, followed by contracted services (outsourcing cost to third parties) (Figure 3.3). Costs can alternatively be differentiated by function, for example in Europe (ACI Europe, 2015a), where the two most important costs are aircraft movement areas/lighting and passengers/cargo terminal facilities, each accounting for 16.3 per cent, but with security costs coming in a very close third position – representing 16.0 per cent of the costs.

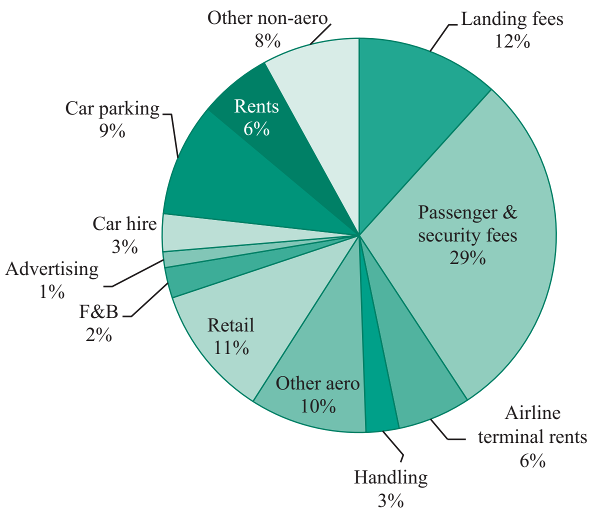

Figure 3.2
Revenue structures at ACI airports, 2015 (excluding non-operating items)
Source: Adapted from ACI (2017)

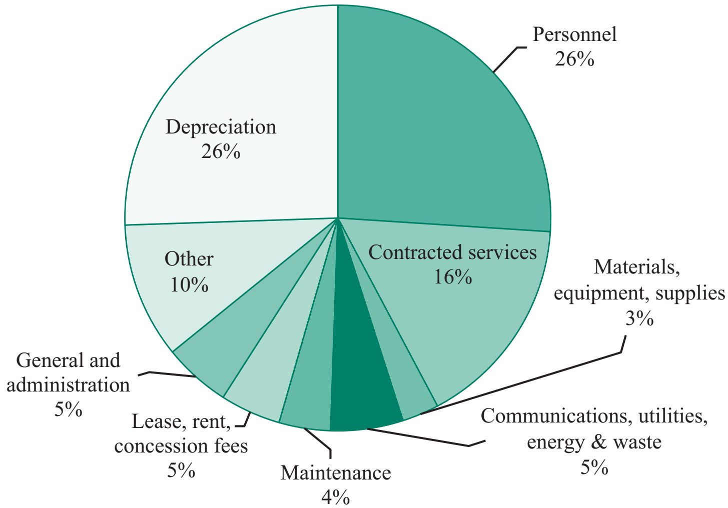

Figure 3.3
Operating cost structures at ACI airports, 2015
Source: Adapted from ACI (2017)

Over the years labour costs have decreased in significance, particularly since the 1990s (Table 3.3). In part this is due to more outsourcing being undertaken by airport operators, particularly in the handling area, and in many cases the use of a more productive labour force as a result of a focus on greater efficiency. Various technological developments have also reduced the need for so many staff.

However, airport operators tend to have less scope to reduce staff costs compared with some industries, including the airline sector, as the majority of staff functions are usually related to the essential safety and security aspects of operating an airport. In general, airports are fixed-cost businesses, having longer planning horizons than airlines and requiring major investments in runways, terminals and equipment. As a result, airports have limited flexibility to adjust these costs when traffic fluctuates. So financially it may be advantageous for airports to handle more traffic if they have the capacity, as the revenue benefits may well exceed the increased costs, but on the other hand if traffic falls and there are revenue losses, these may well translate disproportionately into reduced profits. This relates to the concept of economies of density, which is discussed below.

Table 3.3 also gives a broad breakdown of the trends in revenue structures over time. The dominant trend up until the late 1990s was a decline in the importance of aeronautical revenues, with a subsequent increase in reliance on non-aeronautical sources. This reflected not only pressures from airlines and regulatory bodies to keep airport charge increases to a minimum, but also the increased focus on commercial activities. At some airports, the increase in the proportion of non-aeronautical revenue over the 15 years

Table 3.3 Average airport operating revenue and cost structures

	1990	1996	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Revenues shares (per cent)														
Aeronautical	70	54	50	54	56	55	57	57	56	60	59	59	58	58
Non-aeronautical	30	46	50	46	44	45	43	43	44	40	41	41	42	42
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Cost shares (per cent)														
Labour	42	39	35	35	36	34	33	34	33	32	33	32	33	33
Depreciation	18	19	20	21	20	20	20	21	21	22	21	22	22	22
Other	41	43	44	45	45	46	47	45	46	47	46	46	45	45
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Sources: Revenue shares – adapted from ACI (2017); Cost shares – annual reports of a sample of European airports from 1983 to 1998 had been considerable – for example, at Copenhagen airport the share increased from 41 to 54 per cent and at Geneva airport it rose from 40 to 51 per cent. This trend was halted in 1999 because of the impact of the abolition of EU duty- and tax-free goods in that year, and since then the share of revenue from non-aeronautical sources has not followed this significant upward trend. There are a number of reasons for this, including industry maturity, increased retail competition from the internet and stricter security control, discussed in detail in Chapter 7.

However, these average cost and revenue values hide the variation between individual airports that in some cases is quite considerable. Table 3.4 shows the data for a number of European airports. The revenue figures reflect differences in strategy towards aeronautical and commercial activities, but also differences in the functions carried out by the airport operator itself. For example, many of the German, Italian and Austrian airport operators are involved in providing their own handling services. Overall, the total amount generated from commercial revenues tends to be high in Europe, reflecting in part the high proportion of international traffic, greater opportunities for landside as well as airside sales, and often high rents for surrounding land in many densely populated areas. The table also shows how labour costs vary quite considerably. At Vienna and Frankfurt airports they account for nearly half the total costs, again reflecting their heavy involvement in the labour-intensive handling activity. By contrast, airports such as Amsterdam, London Heathrow and Oslo, which are not involved with so many activities, have much lower staff costs.

In the United States, airports tend to use a different breakdown of their activities and revenues, with aeronautical revenues including not only aircraft landing fees and fuel charges but also rents and lease revenues from land, terminal and other buildings or hangars used by airlines. The remaining non-aviation revenues are the same as commercial or non-aeronautical revenues. Generally for many airports, albeit not all, the proportion of revenue from airport charges is low compared with elsewhere because the airports do not charge a passenger charge (although there is a PFC, but this is treated as non-operating revenue – see Chapter 4). They also do not get involved in providing services such as ATC or handling. The same situation applies in Canada. On the other hand, the revenue from rentals is higher because of the greater amount of space and facilities that are rented or leased to the airlines. The most important commercial revenues are associated with car activities, such as car parking and car hire, rather than retail, as is usually the situation elsewhere. In terms of costs, the share of staff costs tends to be low by international standards – again because these airports tend to get involved in very few additional services. These characteristics are illustrated in Table 3.5, which shows the revenue and cost structures for a number of US and Canadian airports. For the majority of these airports the staff costs are less than 26 per cent of total costs, which is the global average. Elsewhere in the world (Table 3.6) the share of staff costs also tends to be quite low, reflecting lower local wages costs (e.g. in Mexico and China) or minimum involvement in additional activities (e.g. the Australian airports).

Table 3.4 Operating revenue and cost structures at a selection of European airports, 2016

Airport	Revenues (per cent)			Costs (per cent)			
	Aeronautical	Non-aeronautical	Total	Labour	Depreciation	Other	Total
Amsterdam	59	41	100	17	22	61	100
Athens	80	20	100	20	45	36	100
Birmingham	41	59	100	30	26	44	100
Cologne	63	37	100	39	11	49	100
Copenhagen	59	41	100	50	27	23	100
Dusseldorf	60	40	100	36	19	45	100
East Midlands	44	56	100	35	18	47	100
Florence/Pisa	77	23	100	37	12	51	100
Frankfurt	59	41	100	47	16	37	100
Gatwick	53	47	100	40	29	31	100
Geneva	56	44	100	40	22	38	100
Hamburg	66	34	100	23	16	61	100
Heathrow	60	40	100	21	38	41	100
Malta	70	30	100	20	17	62	100
Manchester	52	48	100	33	22	45	100
Munich	53	47	100	40	21	39	100
Oslo	36	64	100	15	25	60	100
Paris	59	41	100	31	21	49	100
Rome	75	25	100	22	10	68	100
Venice	69	31	100	39	15	46	100
Vienna	71	29	100	47	26	27	100
Zurich	61	39	100	29	36	35	100

Note: The data may include other airports when the airport operator owns more than one airport, but most are associated with the major airports shown.

Sources: Annual reports

Table 3.5 Operating revenue and cost structures at a selection of US and Canadian airports, 2016

Airport	Revenues (per cent)			Costs (per cent)			
	Aeronautical	Non-aeronautical	Total	Labour	Depreciation	Other	Total
USA							
Atlanta	30	70	100	18	43	39	100
Charlotte	44	56	100	19	30	51	100
Chicago O'Hare	71	29	100	38	25	37	100
Dallas Fort Worth	47	53	100	27	35	38	100
Houston	38	62	100	24	38	38	100
JFK New York	74	26	100	22	20	57	100
Las Vegas	58	42	100	27	46	27	100
Los Angeles	62	38	100	43	25	32	100
Miami	64	36	100	24	39	37	100
Orlando	38	62	100	16	32	52	100
Phoenix	36	64	100	19	36	45	100
San Francisco	56	44	100	28	36	36	100
Seattle	52	48	100	26	32	42	100
Canada							
Calgary	47	53	100	10	42	48	100
Montreal	53	47	100	18	31	51	100
Toronto	56	44	100	18	29	53	100
Vancouver	37	63	100	11	30	59	100

Note: Aeronautical revenues do not include passenger facility fees (US) or airport improvement fees (Canada).

Sources: FAA/Annual reports

Table 3.6 Operating revenue and cost structures at a selection of other airports, 2016

Airport	Revenues (per cent)			Costs (per cent)			
	Aeronautical	Non- aeronautical	Total	Labour	Depreciation	Other	Total
Australia							
Brisbane	49	51	100	14	38	48	100
Melbourne	46	54	100	13	37	50	100
Perth	43	57	100	20	27	54	100
Sydney	51	49	100	9	58	33	100
New Zealand							
Auckland	45	55	100	22	34	45	100
Christchurch	48	52	100	25	36	39	100
Wellington	58	42	100	12	20	69	100
Other							
Aeropuertos del Sureste, Mexico	59	41	100	8	20	72	100
Airports Company South Africa	63	37	100	27	27	46	100

Airport	Revenues (per cent)			Costs (per cent)			
	Aeronautical	Non- aeronautical	Total	Labour	Depreciation	Other	Total
Airports of Thailand	58	42	100	25	26	49	100
Beijing	55	45	100	9	27	64	100
Hainan Meilan	59	41	100	28	18	54	100
Hong Kong	49	51	100	25	35	40	100
Malaysia Airports Holding Berhad	49	51	100	22	24	54	100
Operadora Mexicana de Aeropuertos	74	26	100	8	11	80	100
Singapore	37	63	100	17	22	60	100

Sources: Annual reports

Factors influencing costs, revenues and efficiency levels

There are many factors that affect an airport's level and structure of costs and revenues, and in a broader sense its overall economic efficiency. Some of these are more easily influenced by airport management than others. First of all, there is the regional location of the airport which the operator cannot influence. There is mixed evidence concerning this. Vasigh and Gorjidooz (2006) found that US airports outperformed European airports, but by contrast Oum *et al.* (2006) observed that, compared to North American airports, operating in Asia and Europe had a negative impact on efficiency whilst operating in Australia and New Zealand had a positive impact. Perelman and Serebrisky (2012) observed that Latin American airports were more efficient than European airports but were less efficient than Asian and North American airports. Industry reports (e.g. ACI, 2017) have shown much higher unit costs for the European region.

Then there is the volume and nature of the traffic, over which the airport operator has only limited control, and which can have a major impact on the airport's economic performance. As airports increase their traffic throughput, the long-run costs per unit of traffic, or unit costs, are generally thought to decline. This is largely because for small airports there will be certain fixed costs associated with the provision of infrastructure and services, which will be incurred at the airport, irrespective of the traffic levels, which will push up the unit costs. Also, some small airports may be more likely to have highly peaked operations (due perhaps to seasonal holiday traffic or morning and evening domestic business services) which will make it more difficult to achieve the best use of resources.

Studies of British airports in the 1970s showed that unit costs, measured in costs per passenger handled or per work load unit (a WLU is equivalent to one passenger or 100 kg of freight) fell dramatically as total traffic increased to around 1 or 1.5 million passengers (or WLU). Then, at a traffic level of around 3 million passengers or WLU, the unit costs tended to flatten out and ceased to exhibit a strong relationship with airport size (Doganis and Thompson, 1973). However, further research of UK airports estimated that average costs decreased up to 5 million passengers, were constant for 5–14 million passengers and then started to increase (Bottasso and Conti, 2012). Another UK study (Main *et al.*, 2003) found a steep decrease in average costs until around 4 million passengers and then very mild, but persistent, decreases in costs until at least 64 million passengers. By contrast, for Spain it was concluded that cost economies were not exhausted at any level of traffic for the sample of airports (Martín *et al.*, 2011), with similar results confirmed for a worldwide sample (Martín and Voltes-Dorta, 2011a).

Related economic research into the area of returns to scale, which investigates the changes in the level of outputs as a result of changes in inputs, has also often found increasing returns to scale, for instance with Wanke (2012) in Brazil, Yoshida (2004) in Japan, and Tsekeris (2011) in Greece. European airports have been found to have decreasing returns to scale from 12.5 million passengers on the airside but increasing returns on the terminal side for European airports (Pels *et al.*, 2003). For the UK case, Assaf (2010b) identified small UK airports operating under increasing returns to scale with the larger UK ones being mainly scale efficient or operating under decreasing returns.

So the evidence related to size is mixed and somewhat inconclusive. Some researchers (e.g. Murillo-Melchor, 1999) have advocated that as airports become large they start to experience diseconomies. This suggests there might be an optimal size of airport in economic terms (Pels *et al.*, 2001). This may be because the airport system will become more complex, for example with a number of different terminals that involve more coordination and duplication of services and facilities. Surface access expenditure and costs to alleviate greater environmental damage will also grow significantly as airports become large. It has also been suggested by Kamp *et al.* (2007) that the costs might rise because of more expensive labour costs (due to higher unionisation and using staff from farther distances) and the scarcity of cheap land.

In a more short-run situation if the capacity is assumed to be unchanged, the concept of economies of density/capacity utilisation may be relevant. This is because as the fixed capacity is used more intensively, the fixed costs can be spread over more units or output, and hence average costs may decline (until the full capacity is approached when costs may rise due to delays). For the North American case, both Lin *et al.* (2013) and McCarthy (2014) found evidence of such short-run economies, with McCarthy calculating a 0.27 per cent cost elasticity related to departure demand (i.e. a 10 per cent increase in departures will push costs up by 2.7 per cent). For the UK, a broad figure in the region of 0.3 to 0.5 for operating cost elasticities related to passenger demand has been estimated (Steer Davies Gleave, 2012). Similarly, in forecasts of operating costs for Dublin airport various different operating cost elasticities have been applied, ranging from 0.1 for energy costs, to 0.3 for security staff costs and 0.7 for retail staff costs (Steer Davies Gleave, 2014). Interestingly for the UK case there has been some additional evidence of greater cost elasticity responsiveness if the traffic is declining, but this is in conflict with more detailed and broader research of 194 worldwide airports between 2007 and 2009 which showed that overall operating costs actually grew more proportionally as traffic dropped, suggesting that the airports had major problems with cost flexibility and control (Martín *et al.*, 2013; Voltes-Dorta and Pagliari, 2012).

As regards unit revenues, it is likely that these will increase as the traffic rises, especially on the non-aeronautical side (see Chapter 7). It is also quite common to find smaller airports dominated by a few airlines, and if this is the case such airlines may be in a powerful position to negotiate preferable deals on airport charges, thus reducing aeronautical revenue. In addition, airline customers may be more price-sensitive due to their smaller operations, which may drive down airport charges.

Often, but not always, larger airports have a higher share of international passengers. Costs associated with international passengers tend to rise as this type of traffic requires more space in the terminal for customs and immigration, and these passengers spend longer in the terminal. International passengers also tend to have more luggage and need larger baggage handling facilities. However, as international passengers have more dwell time in the terminal, they spend more money on commercial facilities such as retail and

F&B that will push up unit revenues – particularly if they have access to duty- and tax-free shopping. A number of performance studies, including those undertaken by the Air Transport Research Society (ATRS), confirm that the proportion of international traffic does have a significant impact on airport performance (e.g. Oum *et al.*, 2003).

Low-cost and charter passengers will not usually need certain services, such as airline lounges and transfer facilities, which will influence the airport's cost and revenue levels. They also have different spending patterns from traditional scheduled terminal passengers, as do transfer passengers at hub airports. (A more detailed description of different spending patterns is given in Chapter 7.) Airports serving holiday destinations may have a problem with seasonality and uneven capacity utilisation, which can push up costs and reduce efficiency, as observed by Tsekeris (2011) in Greece and Gitto and Mancuso (2012a) in Italy. Elsewhere, hub airports, with a 'wave' pattern of flights with well-defined peaks and troughs of traffic, will find it more costly to handle this type of traffic than a more evenly spread distribution of flights. In a broader sense, operating as a hub may increase an airport's overall attractiveness and thus improve its performance. This helps explain why the evidence related to hub traffic and airport performance is mixed, with Oum *et al.* (2004) observing that having a hub role lowered performance, while Sarkis (2000), Lin and Hong (2006), Barros and Dieke (2008), Perelman and Serebrisky (2012), Fung *et al.* (2008), and Assaf (2011b) argue that hub airports achieve better performance.

Airport operators have greater choice over the physical and service standards they consider desirable to provide an acceptable level of service (LOS) for their passengers. If an airport decides to offer a more exclusive and upmarket product, as with the business airport London City, or offer cutting-edge technology, this will clearly have resource implications. At the other extreme, there are a few airports, such as Kuala Lumpur, Marseille and Lyon, that offer a dedicated LCT which again has implications for the cost levels of the airport (see Chapter 5). The research of Merkert and Assaf (2015) was some of the first to include a service quality variable in their assessment of airport profitability and efficiency; previously the lack of a reliable service quality measure had prevented this from happening (see Chapter 6).

There is no 'typical' airport when it comes to looking at the services and facilities provided. Beyond the basic operational functions, different airports have little in common. The level of direct involvement will vary, with some airport operators providing activities such as security, ATC, handling, car parking, duty-free shops and cleaning, while others will contract these out or have certain services provided by the state. All this will have an impact on both cost and revenue levels. Handling services may even be produced jointly, for example with the airport operator supplying the check-in desks and the airlines staffing the desks.

Moreover, the situation is more complex than in many other industries as it is not just the fact that the airport outsources certain activities that remain a cost to the airport operator (e.g. cleaning), but also that other activities (such as handling) may be passed over totally to another organisation (typically an airline or handling agency) – leaving the airport with very little financial involvement (except perhaps for generating a rent or concession fee). In the former case the level of costs would be expected to be broadly similar (although differently split between labour and other operating costs), whilst in the latter case the lack of direct involvement in certain activities would significantly reduce the costs (and revenues) involved. Here the third party will charge for the service it is contracted to offer and the cost to the airport operator is the revenue foregone less any rents or fees. The extreme cases are when whole facilities are operated by different bodies, for example at certain US airports such as New York JFK where major airlines run their own terminals, or in Japan where at most airports separate companies are responsible for operating the terminals and commercial facilities. Employment data show that the most common activities which are undertaken by third parties are cleaning, handling, ATC and security. By contrast core activities such as fire and rescue and airfield operations are rarely provided by others (ACI, 2016).

There are many reasons for this varied situation. First, there are the generic arguments in favour of outsourcing, such as lower costs and greater flexibility, and gaining access to expertise from specialist companies who may also be able to take advantage of scale benefits and higher productivity. These can be applied to the more general activities such as cleaning. However, many of the functions of an airport need more specific consideration. Security is a particular case in point, where there is considerable debate as to whether it should be the airport operator or state responsibility to protect the travelling public. As a result, practice varies considerably with the involvement of different bodies, such as the airport operator, the airlines, third-party security operators, the police and other state agencies (see Chapter 5). In other cases, there may be competition reasons for the provision of services, such as handling (see Chapter 4). Arguably, the most complex situation is with commercial facilities, with the most popular option being to contract these out to specialist retail, F&B and other commercial companies (see Chapter 7). Overall, empirical research related to the impact of industry outsourcing is rare with some research showing that outsourcing improved airport economic efficiency in both Italy (Abrate and Erbetta, 2010) and Spain (Tovar and Martin-Cejas, 2009), whilst Martín *et al.* (2013) actually found that a high level of outsourcing reduces cost flexibility.

Economic comparisons in any industry must acknowledge the accounting policies adopted by individual operators. Within the airport industry, accounting procedures vary considerably, particularly as some airports adopt government or public authority accounting methods rather than commercial practices. With government-owned airports it is possible, for example, to find that the airport's land will not be considered to be an airport asset, and hence will not appear in any balance sheet. Views differ on how assets should be depreciated. For example, Zurich depreciates buildings for up to 40 years, Amsterdam for 20–60 years, and Copenhagen 80–100 years. At Dublin, runways are depreciated for 10–50 years, at Amsterdam for 15–60 years, and at Copenhagen for 80–100 years. Airports are also subject to different taxation regimes, with many public sector airports, for instance those in the United States, being exempt from most business taxes. This will have an impact on any comparative analysis of net profit levels.

Chapters 2 and 4 discuss whether privatisation and economic regulation, respectively, have had an impact on economic performance. Ownership patterns can influence factors such as funding arrangements and the cost of capital that may well affect an airport's finances. In addition, an airport's performance is likely to depend very much on where it is positioned in the investment life cycle, as investment at airports tends to be long-term, large and 'lumpy' in both physical and financial terms, rather than continuous and gradual. When major developments have taken place, capital costs are likely to be high and poor utilisation may push up the operating costs. Later in the cycle the capital costs will reduce and utilisation will hopefully improve. If an airport is congested, it may not be very attractive to its customers, but from an economic viewpoint it may perform relatively well. This leads to the expression 'sweating the assets'.

There are many other factors dependent on an airport's location and geographical situation that, to a large extent, will be beyond the airport operator's specific control. For instance, weather-related expenses, such as snow removal and de-icing facilities, will be incurred only at certain airports. Location and possible physical constraints are also likely to influence the layout and design of the airport and the positioning of both airfield and terminal facilities. For example, an airport may require two or more runways not to meet traffic needs, but because of wind conditions or some other particular climatic or geographical characteristic. Environmental limits, imposed to reduce noise or other adverse impacts of air transport, may also mean that the airport cannot make the most efficient use of all resources. An airport may be forced to close at night even if there is sufficient demand to make night flying feasible. More general national economic conditions, such as the cost of labour and other resources, availability of capital, currency fluctuations, or government policies and taxation regimes, can also have an influence. For example, in Europe the cost of labour is comparatively expensive, and with high levels of unionisation this can push staff costs even higher.

Overall, it is very apparent that numerous factors influence an airport's performance, with different degrees of control existing for the airport operator. Typically, external factors mostly beyond management control are the volume and nature of traffic; ownership, governance and regulatory systems; environmental constraints; and location costs. Internal factors under management control include the degree of outsourcing; the quality of service; and the investment cycle. Reinhold *et al.* (2010) classify the factors that influence performance – in other words, heterogeneities – as external (exogenous) and internal (endogenous). Exogenous heterogeneities are caused by the environment (e.g. geographical constraints or social particularities) while endogenous heterogeneities may be due to national differences in the regulatory framework or managerial decisions. Similarly, PA Consulting (2017) classify the factors or drivers along a spectrum associated with being increasingly difficult to influence/change. Those least difficult to change are defined as realised drivers (e.g. productivity, quality of service, rents, labour rates and materials/utilities costs), then systemic drivers (e.g. organisational and ownership structure, airport objectives, equipment age and reliability) and then structural drivers (e.g. scale, capacity utilisation, operational complexity, airline/passenger/destination mix). The most difficult to influence are identified as inherent drivers such as regulatory requirements, taxes and rates, safety and security overheads, employment and social legislation, infrastructure layout, environmental requirements and geographic location.

Measuring economic performance and efficiency

Growing interest in performance assessment and benchmarking

Until the 1980s, the systematic monitoring and comparing of airport economic performance was not a widely practised activity within the airport industry. This can be attributed largely to insufficient commercial and business pressures for airports, and the general lack of experience of benchmarking techniques within the public sector as a whole. The difficulties involved with producing meaningful comparisons, such as varying participation in airport activities and different accounting policies, only further discouraged most airports from seriously attempting to analyse their comparative performance.

With airport commercialisation and privatisation has come a marked interest in performance comparisons and benchmarking. As airports have become more commercially oriented, they have been keen to identify the strong performers in the industry and adopt what are seen as best practices. Senior managers can use performance measures to help them define goals and targets. Comparative performance analysis can also give valuable insight into issues including whether privatised airports are more efficiently run than public sector airports; what is the best organisational framework for an airport; and whether airports operated as part of national networks or systems perform better than individual airports. There is thus a growing recognition of the value of continuous performance appraisal within the airport industry.

Many other organisations external to the airport sector are also showing a keen interest in using performance measures to compare achievements between airports. Such bodies will have a different ultimate objective for comparing performance and hence are likely to view the findings from a different perspective. Investors and bankers, traditionally much more used to using financial ratios and other benchmarking techniques, are anxious to identify possible business opportunities and to ensure their chosen airport investments continue to perform well. Airlines, now operating in a much more cost-conscious and competitive environment, have an interest in identifying whether airports are being inefficiently managed – particularly to add substance to any lobbying against increases in user charges. Economic regulators of privatised or autonomously managed airports also have good reason to monitor airport performance to ensure users are being charged fairly and that the airports are run efficiently (see Chapter 4). In addition, local communities may be anxious to ensure the airport is being run in an efficient manner so that they can benefit fully from the economic benefits, such as tourism and inward investment, that the airport can bring.

Analysing an airport's economic performance has therefore become an important task for many of those involved, directly or indirectly, with the airport industry. However, economic performance appraisal is only one aspect of airport performance that needs to be assessed (Graham, 2005; Helios, 2009). There are a wide range of operational activities that need to be monitored by looking at measures relating to airside delays, baggage delivery, terminal processing times, equipment availability and so on. In addition, consumer satisfaction levels should be assessed, typically through passenger surveys. With growing concern for the environment, there is also an increasing use of environmental indicators at airports. A study related to US airports (Infrastructure Management Group *et al.*, 2010) identified seven broad areas for performance investigation (safety, security, customer services, environmental sustainability, people, customer relations and IT) while ACI (2012) identified six (core, safety and security, service quality, productivity/cost-effectiveness, financial/commercial and environmental). Some of these non-economic areas are considered in detail in other chapters, but the interrelationships between these different aspects of performance must be recognised. For example, any decision on service levels or operational procedures will greatly influence an airport's cost and manning levels, and *vice versa*.

With the growth of this emphasis on performance assessment of different aspects of airport management, a number of performance measurement frameworks have been adopted. In particular, a balanced scorecard system has been used by a number of North American airports including Dayton, Salt Lake City, Dallas Fort Worth and Toronto, and elsewhere, for example at Dublin airport. This approach views an airport typically from four different perspectives, one of which relates to the financial area. The other three usually relate to the customer, internal processes, and learning and growth. For each of these four perspectives there are objectives, measures and targets. The scorecard shows how these measures are interrelated and affect one another. At Hartsfield Atlanta, the financial measures cover areas including revenue generation, overtime practices, debt coverage and overruns on budgets. The customers' measures range from responses to comment cards to measurement of passenger transit time. Processes consider issues such as payment of invoices, while within the learning and growth area measures look at training hours, employment satisfaction, existence of vacant positions and so on (Ricondo and Associates *et al.,* 2009). At Dublin airport the four strategic perspectives are defined as the customer, optimum return, strategic focus, and people and processes (ACI Europe, 2015b). This balanced scorecard approach is just one example of the many different systems of performance measurement that are now used at airports.

Performance concepts

More consideration is now given to the performance concepts specifically related to economic performance and efficiency. In simple terms, performance measures analyse the relationship between inputs and outputs at an airport. This relationship can be expressed in both financial and physical terms. As with other businesses, labour and capital are the major inputs of the airport system. The simplest physical measure of the labour input is the total number of employees. Any part-time and temporary staff should be converted to full-time equivalents. To capture the effect of the cost of labour as well as productivity per head, the labour input can also be measured in financial terms: employee wages and salaries.

Determining a reliable measure of the capital input is much more difficult. In physical terms, capital input is measured by the production capability or capacity of the system. At an airport this cannot be assessed by one measure. The capacity of the runways, terminal, gates and so on all have to be considered. Capacity can be measured on an hourly, daily or annual basis. Depreciation or asset values can be used to measure the financial capital input. These will, however, reflect the accounting policies of the specific airport and may not always be closely related to its economic production capability.

The financial measurement of output is relatively straightforward and can be measured by considering the total revenues generated. Physically, the output of an airport can be assessed in three ways: in terms of quantities of aircraft, passengers or freight. These measures do not cover all aspects of an airport (e.g. its role as a retail facility), but they do capture the key outputs. The use of aircraft movements is not ideal as such measures will not differentiate between different sizes and different types of aircraft. Since most airports handle both passengers and freight, this suggests the use of an output measure that combines the two, such as the WLU. The WLU originated from the airline industry and uses a weight criterion for combining these two types of traffic (one WLU = one passenger or 100 kg of freight). Some argue, however, that the focus should be on passenger numbers, as freight handling at airports is very much an airline activity and has little impact on an airport's economic performance.

The WLU, although probably the most widely accepted aggregate measure, is a rather arbitrary method of linking the two outputs, as the same weight of passengers and freight does not involve using the same resources. Ideally, the WLU formula should therefore reflect the relative importance or value of the different outputs and perhaps should include an aircraft movement element. Costs or employee numbers associated with the different outputs theoretically could be used to determine the scaling factor, but there is the major problem of joint costs or joint tasks undertaken by the staff. An alternative scaling parameter could be the relative prices of the outputs, but this assumes a close relationship between price and cost which is not usually the case at airports because of market imperfections, regulation and government interference and, sometimes, cross-subsidies between different traffic. There is the additional problem that there are even different costs and revenues associated with different passenger types, the most notable examples being international and domestic passengers or terminal and transfer passengers.

LeighFisher produces annual global benchmarking reports and uses a different measure of output, the airport throughput unit (ATU) (LeighFisher, 2016). It is defined as:

ATU = Passengers + (10 x freight tonnes) + (100 x ATMs)

It thus keeps the WLU relationship of 1:10 between passengers and freight, but also includes an aircraft movement component. The value of 100 was derived by looking at past studies and determining that handling one air transport movement (ATM) required approximately the same effort as handling 100 WLU.

To summarise, performance measures or indicators are all about relating one or more of the outputs to one or more inputs. By using a number of these indicators, an airport can assess different aspects of its performance and identify where its strengths and weaknesses lie. These indicators can be grouped into certain categories, such as cost efficiency, labour and capital productivity, revenue generation, and commercial performance and profitability. In addition to these input:output ratios, a few other key measures (e.g. share of revenue from aeronautical sources; percentage of costs allocated to staff) can give further insights into comparative performance. Table 3.7 presents around 20 indicators that cover all airport operations typically used at a senior management level.

These are often defined as key performance indicators (KPIs), each with an important target that links to the airport achieving its strategic and operational goals. Beneath these KPIs may be a hierarchical system of more specific indicators that cover various aspects of performance in greater detail. In their comprehensive study of all performance indicators at airports, Hazel *et al.* (2011) describe a three-level hierarchical system consisting of core, key/departmental and other indicators. When selecting the number of measures and hierarchical levels there needs to be balance between limiting the number so that the measures are relatively easy to compute and interpret, but at the same time ensuring that they are sufficient in number to cover all areas of importance. Externally high-level data are usually possible to obtain for most airports, but the more detailed data may not be published and therefore be less readily available.

While airport managers will be very keen to understand how efficiently the airport is using its infrastructure and how cost effectively it is doing so, the financial sector will be focused more on ratios related to the business potential of the airport, including profit levels, liquidity ratios and capital expenditure (CAPEX) levels. In the international financial markets, profit excluding depreciation is known as earnings before interest, tax, depreciation and amortisation (EBITDA), and profit including depreciation is known as EBIT – the latter being very similar to the operating profit, except that it includes non-operating items. Another indicator is the EBITDA or EBIT margin: earnings expressed as a percentage of revenue. The ratio of operating profit to total assets is commonly referred to as ROCE or return on assets. Putting the traditional indicators in these financial terms enables comparisons to be made easily with other business sectors. Other standard financial ratios, including the interest cover (EBIT/interest), the dividend cover (post-tax profit/dividends), and gearing (debt as a share of shareholders' funds), can be used to assess the financial wellbeing and capital structure of the airport company. CAPEX per WLU or passenger, employee or revenues can also give an indication as to the amount of investment that is taking place (Graham and Morrell 2017; Vogel and Graham, 2006). Table 3.8 lists the productivity and financial indicators suggested by both ICAO (2013) and ACI (2012), with the latter including some EBITDA and debt measures.

For publicly quoted airport companies, additional indicators associated with the value of the company can be used. A number of these ratios relate the EV, which shows the market value of the company's core businesses, to sales, earnings or throughput (e.g. EV/total revenues; EV/EBITDA; EV/EBIT; EV/WLU). Reference is made to these value ratios in Chapter 2, where privatisation trends are considered. The price earnings ratio (PER or

Table 3.7 Performance indicators commonly used to assess economic performance*

Indicator	Area
Cost efficiency	Costs excluding depreciation per WLU†
	Costs including depreciation per WLU
	Depreciation costs per WLU
	Labour costs per WLU
	Depreciation share of operating costs
	Labour share of operating costs
Labour productivity	WLU per employee
	Revenues per employee
Capital productivity	WLU/total assets
	Revenues/total assets
	Total assets per employee
Revenue generation	Revenues per WLU
	Aeronautical revenues per WLU
	Non-aeronautical revenues per WLU
	Aeronautical share of total revenues
Commercial performance	Concession plus rental revenues per passenger
	Concession revenues per passenger
Profitability	Operating margin
	Operating profit excluding depreciation per WLU
	Operating profit including depreciation per WLU
	Operating profit including/excluding depreciation/ total assets
	Net retained profit after interest and taxation per WLU

*Only operating revenues and cost are included (interest, extraordinary items, taxation and dividends are excluded) with the exception of the final indicator (net retained profit after interest and taxation per WLU).

† Some analysts use passenger numbers rather than WLUs and may include aircraft movements as an airport output measure.

Table 3.8 Performance indicators suggested by ICAO and ACI

ICAO	ACI
Productivity	**Productivity/cost effectiveness**
Aircraft movements per employee	Passengers per employee
Aircraft movements per gate	Aircraft movements per employee
Passengers per employee	Aircraft movements per gate
Tonnage per employee	Total cost per passenger
	Total cost per movement
	Total cost per WLU
	Operating cost per passenger
	Operating cost per movement
	Operating cost per WLU
Cost-effectiveness	**Financial/commercial**
Total cost per movement	Aeronautical revenue per passenger
Total cost per traffic units	Aeronautical revenue per movement
Staff cost as % revenue	Non-aeronautical revenue as % total revenue
	Non-aeronautical revenue per passenger
	Debt service as % revenue
	Long-term debt per passenger
	Debt to EBITDA ratio
	EBITDA per passenger

Sources: ICAO (2013); ACI (2012)

P/E), which shows the relationship between the price of the share and earnings attributable to that share, can also be used.

Inter-airport performance

Airport benchmarking can be undertaken internally through time (self-benchmarking) which can show trends over the years and give indications as to the direction in which the airport is heading. However, the inherent weakness here is that the airport is considered in total isolation with all the evaluation related entirely to its own sphere of operation. As a consequence, it will not be possible to identify areas of performance which are substandard compared to other airports, or to be familiar with what is actually achievable in the industry. This can be overcome with external inter-airport measures with different airports or peers when performance is measured against others with similar characteristics. Comparisons can be with an industry standard (e.g. an average) or best practice (e.g. the best performing airport). Overall, internal approaches tend to be marginally more popular. For example, a recent survey of benchmarking methods (albeit for all airport activities) of 50 airports in Europe found that 18 per cent of airports undertook internal benchmarking only, 14 per cent external benchmarking only, and with a higher value of 60 per cent for both types of benchmarking (ACI Europe, 2015b).

Producing meaningful inter-airport performance indicators is fraught with difficulty because of serious problems of comparability – particularly due to the varying range of activities undertaken by airport operators themselves. Comparing indicators from the raw data can give misleading impressions, as airports involved with more activities would inevitably have higher cost and revenue levels and poorer labour productivity. The situation is also complicated by the fact that it is not just the number of outsourcing activities that are a cost to the airport operator (e.g. cleaning) which varies, but also the range of services actually provided by the airport operator, for which it has associated costs and revenues. For example, if an airport operator chooses to 'outsource' handling, it will have very few costs and revenues associated with this, unlike the cleaning case where it still has to cover all the costs.

These problems can be addressed by standardising or normalising the airport data so that each airport's performance is presented as though it undertakes a uniform set of activities by taking into account the typical profit margins associated with each separate airport activity. For example, if an airport operator undertakes ground handling activities itself, the assumed costs, revenues and staff numbers associated with this can be deducted to make the data more comparable with airports with no involvement with this activity. A hypothetical concession income from handling agents can then be added to the airport's revenues. Similar adjustments can be made for car parking and other commercial activities. This is the approach used by LeighFisher in its airport benchmarking work (LeighFisher, 2016). In the United States there is also a comparability problem because in some cases the airlines have developed and operated the terminals. One option here that has been used in benchmarking studies is to add in the relevant airline data to ensure more 'like-with-like' assessments are being made (ACI, 2006).

However, there will obviously be an element of subjectivity in any assumptions that are used when making adjustments. Using such adjustments will inevitably mean there is a movement away from reality – which may be less helpful for the airports concerned – and the complementarity of the different activities or the reasons why the airport chooses to provide certain services may be ignored. Ideally, the accounts of each airport could also be adjusted to conform to a common treatment of depreciation, asset values and so on, but the problems associated with getting sufficient detail related to the capital input normally make this too difficult a task. Another way to lessen some of these comparability problems is to aim to choose a set of airports or cluster airport together that are as similar as possible, but this is often a very difficult task given the multi-dimensional nature of airport operations and data limitations (Vogel and Graham, 2013; Rodríguez-Déniz and Voltes-Dorta, 2014). For example, in choosing comparators for London Heathrow, PA Consulting (2017) considered airports with similar characteristics in terms of scale and complexity, operating model, capital city airport status, destinations served, traffic/airline mix and capacity utilisation.

An additional issue to be faced in comparing airport performance is the difference in cost of living between countries. Official exchange rates may not be a close reflection of relative prices at different airports in different countries. This problem can be addressed by using purchasing power parity exchange rates rather than market exchange rates. Purchasing power parity exchange rates are calculated by dividing the cost of a given basket of goods in one currency by the cost of the same basket of goods in another country. So, effectively, they convert currencies on the basis of equalising buying power rather than on the basis of prevailing market conditions. They also overcome problems of currency fluctuations during the period under investigation. Alternatively, the special drawing right (SDR) – a basket of five currencies (the euro, the US dollar, the British pound, the Japanese yen and the Chinese yuan), weighted according to the relative importance of the currency in international trade and finance – can be used to overcome the currency fluctuation problem. Figure 3.4 presents a sample indicator – total costs per passenger – from LeighFisher's benchmarking study that adjusts the data to produce a standardised airport. Thirty airports from the study have been selected, with the range of values obtained being quite striking, from Heathrow (SDR 26.65) to Delhi (SDR 3.41). The majority of the European airports here tend to have higher than average costs.

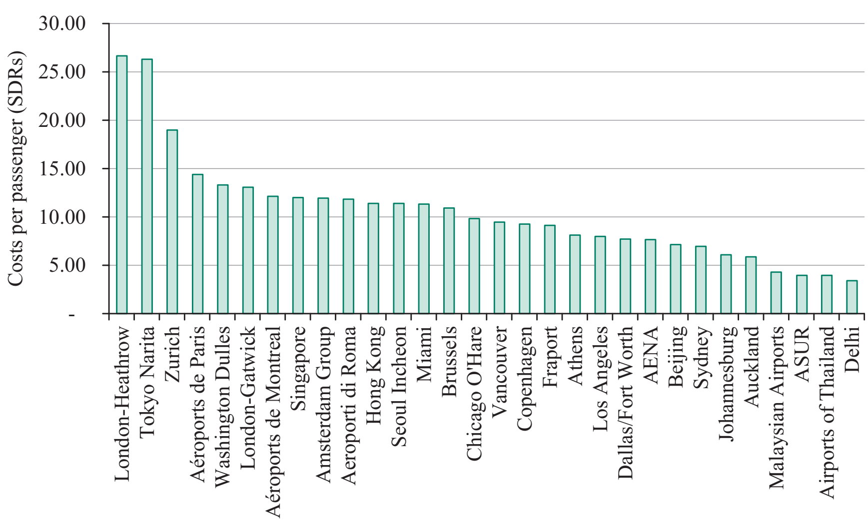

Figure 3.4

Total costs per passenger for selected world airports, 2015

Source: Adapted from LeighFisher (2017)

Overall performance measures

The performance measures in Table 3.7 are partial or one-dimensional measures in that they give an indication of performance that relates specifically to the inputs and outputs that have been chosen. These measures usually require only limited data (unless the data are being adjusted), are relatively easy to compute, and are intuitively simple to understand. They can highlight strengths and weaknesses in certain areas and indicate where specific improvements can be made, but they cannot give an overall picture or identify the 'best in class'. By definition, they give only a partial and rather disjointed diagnosis of the situation, and can be misleading if only selected indicators are chosen. To cover all areas, many measures are needed. These cannot take account of factor substitution, for example if one airport uses an employee to undertake a specific task while another uses a machine. It is also difficult to take account of differences in the prices of the inputs (e.g. labour) and, as discussed above, there are difficulties in choosing an output measure that covers a number of outputs (e.g. passengers and freight) if this is appropriate.

These shortcomings can be overcome by investigating the relationship between the combined inputs and combined outputs to produce a single or overall multi-dimensional efficiency measure. In contrast to other transport operations and public sector organisations, there was little exploration of the use of such methodologies until the 1990s, the airport sector preferring to concentrate mostly on traditional partial measures (Lemaitre, 1998). Since then there has been growing interest in these alternative measures and a considerable number of efficiency studies have been undertaken for various countries and regions of the world (see Merkert *et al.*, 2012; Liebert and Niemeier, 2013; Lin *et al.*, 2013), though many of these have focused more on technical or operating efficiency and productivity analysis rather than purely financial or economic performance – primarily due to the data problems associated with the financial data (Vogel and Graham, 2006).

There are a number of different ways in which overall performance or efficiency can be assessed, being primarily based on averaging evaluations or making comparisons with a defined efficiency frontier. A parametric or statistical approach can be adopted by using a production or cost function that recognises several variables influencing performance (Table 3.9). For example, the cost function expresses cost as a function of outputs, input prices and other factors, such as traffic characteristics, that may influence output or input. This function can be estimated by using regression analysis (ordinary or corrected least squares) or more commonly now by the stochastic frontier method, which involves the estimation of a 'frontier' – the airport is efficient only if it operates on the frontier. These models can be used, for example, to investigate the impact of variations of input and output prices and to test for economies of scale. However, this approach has detailed data requirements.

Alternatively, a non-parametric index numbers method, such as the Tornqvist total factor productivity (TFP), can be used (Table 3.10). This requires the aggregation of all outputs into a weighted outputs index and of all inputs into a weighted input index, with no assumptions or estimates of the parameters of the underlying production or cost

Table 3.9 Examples of airport performance and efficiency studies: parametric (stochastic) cost/production function methods

Reference	Data sample (number of airports and nationality)	Period
Pels *et al.* (2001)	34 European	1995–97
Martin-Cejas (2002)	31 Spanish	1996–97
Pels *et al.* (2003)	34 European	1995–97
Barros (2008a)	27 UK	2000/01–2004/05
Barros (2008b)	13 Portuguese	1990–2000
Oum *et al.* (2008)	109 Global	2001–04
Assaf (2009)	27 UK	2002/03–2006/07
Barros (2009)	27 UK	2000/01–2006/07
Martín *et al.* (2009)	37 Spanish	1991–97
Tovar and Martin-Cejas (2009)	26 Spanish	1993–99
Chow and Fung (2009)	46 Chinese	2000
Abrate and Erbetta (2010)	26 Italian	2000–05
Assaf (2010a)	13 Australian	2002–07
Tovar and Martin-Cejas (2010)	26 Spanish	1993–99
Martín and Voltes-Dorta (2011a)	161 Global	1991–2008
Martín and Voltes-Dorta (2011b)	161 Global	1991–2008
Martín and Voltes-Dorta (2011c)	36 Spanish	1991–97
Assaf (2011a)	27 UK	2004/05–2006/07
Assaf and Gillen (2012)	73 Global	2003–08
Assaf *et al.* (2012)	27 UK	1998–2008
Assaf *et al.* (2014)	71 Global	2003–08
Scotti *et al.* (2012)	38 Italian	2005–08
Lin *et al.* (2013)	62 North American	2006

Reference	Data sample (number of airports and nationality)	Period
Martín *et al.* (2013)	194 Global	2007–09
Zhao *et al.* (2014)	54 North American	2002–08
McCarthy (2014)	50 US	1996–2008
Kutlu and McCarthy (2016)	50 US	1996–2008

Table 3.10 Examples of airport performance and efficiency studies: non-parametric index number methods

Reference	Data sample (number of airports and nationality)	Period
Hooper and Hensher (1997)	6 Australian	1988/89–1991/92
Nyshadham and Rao (2000)	25 European	1995
Oum *et al.* (2003)	50 Global	1999
Oum and Yu (2004)	76 Global	2000–01
Oum *et al.* (2004)	60 Global	1999
Yoshida (2004)	30 Japanese	2000
Yoshida and Fujimoto (2004)*	67 Japanese	2000
Oum *et al.* (2006)	116 Global	2001–03
Vasigh and Gorjidooz (2006)	22 US/European	2000–04
Vasigh *et al.* (2014)	26 UK, US/Latin American	2010
See and Li (2015)	22 UK	2001–09

functions having to be made. The outputs are weighted by revenue shares and the inputs are weighted by input cost shares.

One of the most comprehensive studies of TFP in the airport sector is contained in the Global Airport Benchmarking Report, produced annually (since 2002) by the ATRS. The 2017 report (ATRS, 2017) looked at 206 airports and 24 airport groups in Asia-Pacific, Europe and North America. It considered various partial measures of performance, but unlike LeighFisher's global study did not adjust the data to take account of different involvement in activities. The TFP method that was adopted was an index number approach using revenue shares as weights for the outputs (aircraft movements, passengers, cargo and other revenue) and cost shares as weights for the inputs (labour, other non-capital inputs, runways, terminals, gates). The capital input was excluded in most measures because of the difficulties in obtaining accurate, comparable data for this, and so an index called variable factor productivity (VFP) was considered. Two overall VFP measures were produced, the 'gross' value and the 'net' or 'residual' value. The net value had the effect of certain factors that were considered beyond management control removed, including airport size, the share of international and cargo traffic and capacity constraints, in order to leave a measure that was more likely to reflect managerial efficiency. As an illustration, Figure 3.5 shows the value for a selection of Asian airports – the higher the score, the better the performance. The South Korea airports (Jeju, Gimhae, Gimpo and Incheon) appear to perform particularly well.

The most popular methods are non-parametric frontier methods and, in particular, a linear programming technique called data envelopment analysis (DEA), which also produces a weighted output index relative to a weighted input index similar to the non-parametric TFP measure (Table 3.11). The key advantages of this non-parametric method are that it does not involve the estimation of underlying production or cost functions, and the weights for the inputs and outputs are not predetermined but instead are the result of the programming procedure. DEA is therefore a more attractive technique than the index number TFP for dealing with multiple input and output activities because it has less demanding data requirements. It assesses the relative efficiency of a set of

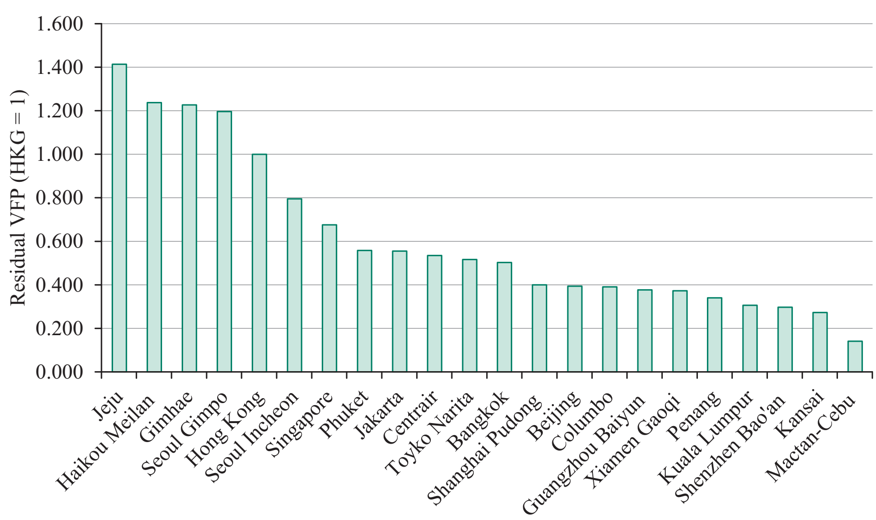

Figure 3.5

Residual variable factor productivity at selected Asia-Pacific airports, 2015

Source: Adapted from ATRS (2017)

decision-making units (DMUs), in this case airports, that are engaged in performing the same function, with efficiency being measured not in absolute terms but in relation to the sample. The most efficient DMUs are located on the frontier with a relative index of 1. Another advantage of the DEA approach is that it can be used to measure scale effects on airports as there are both constant and variable returns to scale models. However, a key limitation of DEA is its sensitivity to outliers and parameter selection, and the results may be very different if the input and output selection is different. If the combined number of inputs/outputs is large relative to the DMUs, DEA tends to overstate performance and leads to many DMUs achieving a maximum efficiency value of 1. DEA produces relative rankings, but does not by itself explain the observations. This can be partially overcome with application of the Malmquist index which, when used with DEA, is a useful way of identifying the sources of productivity differences over a certain time period as this index allows productivity change to be decomposed into technical changes gained from

Table 3.11 Examples of airport performance and efficiency studies: non-parametric frontier methods

Reference	Data sample (number of airports and nationality)	Period
Gillen and Lall (1997)	21 US	1989–93
Murillo-Melchor (1999)	33 Spanish	1992–94
Parker (1999)	22 UK	1979/80–1995/96; 1988/89–1996/97
Salazar de la Cruz (1999)	16 Spanish	1993–95
Sarkis (2000)	44 US	1990–94
Adler and Berechman (2001)	26 global	1996
Gillen and Lall (2001)	22 US	1989/90–1992/93
Martín and Roman (2001)	37 Spanish	1997
Abbott and Wu (2002)	12 Australian	1989/90–1999/2000
Fernandes and Pachero (2002)	35 Brazilian	1998
Bazargan and Vasigh (2003)	45 US	1996–2000
Pachero and Fernandes (2003)	35 Brazilian	1998
Barros and Sampaio (2004)	10 Portuguese	1990–2000
Holvad and Graham (2004)	21 UK	2000/01

Reference	Data sample (number of airports and nationality)	Period
Sarkis and Talluri (2004)	44 US	1990–94
Yu (2004)	14 Taiwanese	1994–2000
Lin and Hong (2006)	20 Global	2003
Martín and Roman (2006)	34 Spanish	1997
Pachero *et al.* (2006)	58 Brazilian	1998–2001
Vogel (2006a)	35 European	1990–99
Vogel (2006b)	35 European	1990–99
Vogel and Graham (2006)	31 European	1990–99
Barros and Dieke (2007)	31 Italian	2001–03
Barros (2008c)	32 Argentine	2003–07
Barros and Dieke (2008)	31 Italian	2001–03
Fung *et al.* (2008)	25 Chinese	1995–2004
Martín and Roman (2008a)	34 Spanish	1997
Pathomsiri *et al.* (2008)	56 US	2000–03
Yu *et al.* (2008)	4 Taiwanese	1995–99
Barros and Weber (2009)	27 UK	2000/01–2004/05
Chi-Lok and Zhang (2009)	25 Chinese	1995–2006
Lam *et al.* (2009)	11 Asia-Pacific	2001–05
Ablanedo-Rosas and Gemoets (2010)	37 Mexican	2009
Assaf (2010b)	27 UK	2007
Barros *et al.* (2010)	16 Japanese	1987–2005
Curi *et al.* (2010)	36 Italian	2001–03
Suzuki *et al.* (2010)	30 European	2003
Yu (2010)	15 Taiwanese	2006
Assaf (2011a)	13 Australian	2002–07

Reference	Data sample (number of airports and nationality)	Period
Curi *et al.* (2011)	18 Italian	2000–04
Gitto and Mancuso (2012a)	28 Italian	2000–06
Kocak (2011)	40 Turkish	2008
Psaraki-Kalouptsidi and Kalakou (2011)	27 Greek	2004–07
Sharma *et al.* (2011)	29 Asia-Pacific	2001–05
Tsekeris (2011)	39 Greek	2007
Gitto and Mancuso (2012b)	28 Italian	2000–06
Perelman and Serebrisky (2012)	21 Latin American	2000–07
Wanke (2012)	65 Brazilian	2009
Adler *et al.* (2013)	43 European	1998–2007
Lin *et al.* (2013)	62 North America	2006
Adler and Liebert (2014)	48 European/ Australian	1998–2007
Merkert and Mangia (2014)	81 Italian/Norwegian	2007–09
Oliveira-Neto *et al.* (2014)	63 Brazilian	2006
Marques *et al.* (2015)	141 Global	2006
Merkert and Assaf (2015)	30 Global	2013
Ülkü (2015)	73 Spanish/ Turkish	2009–11
Zou *et al.* (2015)	42 US	2009–12
D'Alfonso *et al.* (2015)	34 Italian	2010
Alder *et al.* (2015)	58 European/ Australian	1990–2010

adopting new technologies and efficiency changes. The relationship between the performance measure and the explanatory factors can be measured with a Tobit model, and in recent years techniques called bootstrapping procedures have been used to improve the reliability of this analysis.

In summary, over the past decade or so an increasing number of performance techniques have been applied to the airport industry, and this has helped to increase the understanding of comparative airport performance which was previously very limited. All these methods have their own advantages and disadvantages, cover various aspects of performance and require different data and assumptions. As a result, no one overarching optimal method has emerged, leaving open to debate their relative reliability and robustness. Interestingly, Lin *et al.* (2013) used all three methods in their analysis of 62 North American airports, and whilst they produced similar rankings in the top 15 and bottom-ranked airports, considerable differences existed for airports in the middle range. An increasing number of researchers have discussed the challenges in assessing airport performance and efficiency (e.g. Adler *et al.*, 2013; Bezerra and Gomes, 2016; Graham, 2005; Hazel *et al.*, 2011; Merkert *et al.*, 2012, Adler *et al.*, 2009; Morrison, 2009). Liebert and Niemeier (2013) argued that whilst data availability remains a methodological difficulty for airport performance research, the heterogeneous nature of airports is now more effectively taken into account with such research.

The majority of studies have been confined to one specific country because of the lack of central sources and problems of obtaining detailed and comparable data for a number of different countries, which does mean that the international context is lost. Also, in some cases only airport group data are available, without specific data for individual airports. The shortcomings of the partial performance measures suggest that it might also be useful to consider the relationship of the combined inputs with the combined output produced, when the difficult task of interpreting a varied set of partial indicators is spared and in some cases, influencing variables, such as economies of scale, can be taken into account. However, with such an aggregate overall efficiency value it may not always be apparent what this is measuring, and thus may not be very informative for management action unless additional research to explore the observed differences is undertaken.

Hence it seems that airport benchmarking has now been generally accepted as a useful exercise to undertake. However, as Morrison (2009) argues, often the results of airport benchmarking tools appear to be very sensitive to the definitions of variables, model structure, underlying assumptions and the methodology employed. As a result, it still remains difficult to determine with any certainty whether variations are due to management policy, external factors or data inconsistencies. With continuing research, hopefully some of the shortcomings of the current approaches may be overcome.

References

Abbott, M. and Wu, S. (2002) 'Total factor productivity and efficiency of Australian airports', *Australian Economic Review*, 35(3): 244–60.

Ablanedo-Rosas, J. and Gemoets, L. (2010) 'Measuring the efficiency of Mexican airports', *Journal of Air Transport Management*, 16(6): 343–45.

Abrate, G. and Erbetta, F. (2010) 'Efficiency and patterns of service mix in airport companies: an input distance function approach', *Transportation Research Part E*, 46(5): 693–708.

ACI (2006) *Airport Benchmarking to Maximize Efficiency*, Geneva: ACI.

ACI (2012) *Guide to Airport Performance Measures*, Montreal: ACI.

ACI (2016) *Airport Economics 2016 Report*, Montreal: ACI.
ACI (2017) *Airport Economics 2017 Report,* Montreal: ACI.
ACI Europe (2015a) *ACI Europe Economics Report 2014*, Brussels: ACI Europe
ACI Europe (2015b) *Performance Management at European Airports*, Brussels: ACI Europe.
ACI Europe (2016) *ACI Europe Economics Report 2015*, Brussels: ACI Europe.
Adler, N. and Berechman, J. (2001) 'Measuring airport quality from airlines' viewpoint: an application of data envelopment analysis', *Transport Policy*, 8(3): 171–81.
Adler, N., Forsyth, P., Mueller, J. and Niemeier, H.-M. (2015) 'An economic assessment of airport incentive regulation', *Transport Policy*, 41: 5–15.
Adler, N. and Liebert, V. (2014) 'Joint impact of competition, ownership form and economic regulation on airport performance and pricing', *Transportation Research Part A: Policy and Practice,* 64: 92–109.
Adler, N., Liebert, V. and Yazhemsky, E. (2013) 'Benchmarking airports from a managerial perspective', *Omega,* 41(2): 442–58.
Adler, N., Oum, T. and Yu, C. (2009) 'A response to "Understanding the complexities and challenges of airport performance benchmarking", *Journal of Airport Management,* 3(2): 159–63.
Airline Business (2016) 'Airport group financials', *Airline Business*, November: 42–43.
Assaf, A. (2009) 'Accounting for size in efficiency comparisons of airports', *Journal of Air Transport Management*, 15(5): 256–58.
Assaf, A. (2010a) 'The cost efficiency of Australian airports post privatisation', *Tourism Management*, 31(2): 267–73.
Assaf, A. (2010b) 'Bootstrapped scale efficiency measures of UK airports', *Journal of Air Transport Management*, 16(1): 42–44.
Assaf, A. (2011a) 'Accounting for technological differences in modelling the performance of airports: a Bayesian approach', *Applied Economics*, 43(18): 2267–75.
Assaf, A. (2011b) 'Bootstrapped Malmquist indices of Australian airports', *Service Industries Journal*, 31(5): 829–46.
Assaf, A. and Gillen, D. (2012) 'Measuring the joint impact of governance form and economic regulation on airport efficiency', *European Journal of Operational Research*, 220(1): 187–98.
Assaf, A., Gillen, D. and Barros, C. (2012) 'Performance assessment of UK airports: evidence from a Bayesian dynamic frontier model', *Part E: Logistics and Transportation Review*, 48 (3): 603–15.
Assaf, A., Gillen, D. and Tsionas, E. (2014) 'Understanding relative efficiency among airports: a general dynamic model for distinguishing technical and allocative efficiency', *Transportation Research Part B: Methodological*, 70: 18–34.
ATRS (2017) *Global Airport Benchmarking Report*, Daytona Beach: ATRS.
Barros, C. (2008a) 'Technical efficiency of UK airports', *Journal of Air Transport Management*, 14(6): 175–78.
Barros, C. (2008b) 'Technical change and productivity growth in airports: a case study', *Transportation Research Part A*, 42(5): 818–32.
Barros, C. (2008c) 'Airports in Argentina: technical efficiency in the context of an economic crisis', *Journal of Air Transport Management*, 14(6): 315–19.
Barros, C. (2009) 'The measurement of efficiency of UK airports, using a stochastic latent class frontier model', *Transport Review*, 29(4): 479–98.
Barros, C. and Dieke, P. (2007) 'Performance evaluation of Italian airports: a data envelopment analysis', *Journal of Air Transport Management*, 13(4): 184–91.
Barros, C. and Dieke, P. (2008) 'Measuring the economic efficiency of airports: a Simar–Wilson methodology analysis', *Transportation Research Part E*, 44(6): 1039–51.
Barros, C., Managi, S. and Yoshida, Y. (2010) 'Productivity growth and biased technological change in Japanese airports', *Transport Policy*, 17(4): 259–65.

Barros, C. and Sampaio, A. (2004) 'Technical and allocative efficiency in airports', *International Journal of Transport Economics*, 31(3): 355–77.
Barros, C. and Weber, W. (2009) 'Productivity growth and biased technological change in UK airports', *Transportation Research Part E*, 45(4): 642–53.
Bazargan, M. and Vasigh, B. (2003) 'Size versus efficiency: a case study of US commercial airports', *Journal of Air Transport Management*, 9(3): 187–93.
Bezerra, G. and Gomes, C. (2016) 'Performance measurement in airport settings: A systematic literature review', *Benchmarking: An International Journal*, 23(4): 1027–50.
Bottasso, A. and Conti, M. (2012) 'The cost structure of the UK airport industry', *Journal of Transport Economics and Policy*, 46(3): 313–32.
Chi-Lok, A. and Zhang, A. (2009) 'Effects of competition and policy changes on Chinese airport productivity', *Journal of Air Transport Management*, 15(4): 166–74.
Chow, C.K.W. and Fung, M.K.Y. (2009) 'Efficiencies and scope economies of Chinese airports in moving passengers and cargo', *Journal of Air Transport Management*, 15: 324–29.
Curi, C., Gitto, S. and Mancuso, P. (2010) 'The Italian airport industry in transition: a performance analysis', *Journal of Air Transport Management*, 16(4): 218–21.
Curi, C., Gitto, S. and Mancuso, P. (2011) 'New evidence of the efficiency of Italian airports: a bootstrapped DEA analysis', *Socio-Economic Planning Sciences*, 45(2): 84–93.
D'Alfonso, T., Daraio, C., and Nastasi, A. (2015) 'Competition and efficiency in the Italian airport system: new insights from a conditional nonparametric frontier analysis', *Transportation Research Part E: Logistics and Transportation Review*, 80: 20–38.
Doganis, R.S. and Thompson, G.F. (1973) *The Economics of British Airports*, Transport Studies Group Research Report 1, London: University of Westminster (formerly Polytechnic of Central London).
EC (2014) *Communication from the Commission: Guidelines on State aid to Airports and Airlines*, Official Journal C99, 4 April.
Fernandes, E. and Pachero, R. (2002) 'Efficient use of airport capacity', *Transportation Research Part A*, 36(3): 225–38.
Fung, M.K.Y., Wan, K.K.H., Hui, Y.V. and Law, J.S. (2008) 'Productivity changes in Chinese airports 1995–2004', *Transportation Research Part E*, 44(3): 521–42.
Gillen, D. and Lall, A. (1997) 'Developing measures of airport productivity and performance: an application of data envelopment analysis', *Transportation Research E,* 33(4): 261–74.
Gillen D. and Lall, A. (2001) 'Non-parametric measures of efficiency of US airports', *International Journal of Transport Economics*, 28(3): 283–306.
Gitto, S. and Mancuso, P. (2012a) 'Two faces of airport business: a non-parametric analysis of the Italian airport industry', *Journal of Air Transport Management*, 20: 39–42.
Gitto, S. and Mancuso, P. (2012b) 'Bootstrapping the Malmquist indexes for Italian airports', *International Journal of Production Economics*, 135(1): 403–11.
Graham, A. (2005) 'Airport benchmarking: a review of the current situation', *Benchmarking: An International Journal*, 12(2): 99–111.
Graham, A. and Morrell, P. (2017) *Airport Finance and Investment in the Global Economy*, Abingdon: Routledge.
Hazel, R., Blais, J., Browne, T. and Benzon, D. (2011) *Resource Guide to Airport Performance indicators,* ACRP Report 19A, Washington, DC: Transportation Research Board.
Helios (2009) *Optimising Airport Performance*, Farnborough: Helios.
Holvad, T. and Graham, A. (2004) 'Efficiency measurement for UK airports: an application of data envelopment analysis', *Empirical Economic Letters*, 3(1): 29–39.
Hooper, P. and Hensher, D. (1997) 'Measuring total factor productivity of airports – an index number approach', *Transportation Research E*, 33(4): 249–59.
IATA (2013) *Profitability and the Air Transport Value Chain*, IATA Economics Briefing No. 10, Geneva: IATA.
ICAO (2013) *Airport Economics Manual*, Doc 9562, 3rd edition, Montreal: ICAO.

Infrastructure Management Group, Performance Institute and Counter Technology Incorporated (2010) *Developing an Airport Performance-Measurement System*, ACRP report 19, Washington, DC: Transportation Research Board.

Kamp, V., Niemeier H.-M. and Mueller, J. (2007) 'What can be learned from benchmarking studies? Examining the apparent poor performance of German airports', *Journal of Airport Management*, 1(3): 294–308.

Kocak, H. (2011) 'Efficiency examination of Turkish airports with DEA approach', *International Business Research*, 4(2): 204–12.

Kutlu, L. and McCarthy, P. (2016) 'US airport ownership, efficiency, and heterogeneity', *Transportation Research Part E: Logistics and Transportation Review*, 89, 117–32.

Lam, S., Low, J. and Tang, L. (2009) 'Operational efficiencies across Asia Pacific airports', *Transport Research Part E*, 45(4): 654–65.

LeighFisher (2016) *Airport Performance Indicators 2016*, London: LeighFisher.

Lemaitre, A. (1998) 'The development of performance indicators at airports', *Air Transport Research Group Conference*, Vancouver, July.

Liebert, V. and Niemeier, H-M. (2013) 'A survey of empirical research on the productivity and efficiency measurement of airports', *Journal of Transport Economics and Policy*, 47(2): 157–89.

Lin, L. and Hong, C. (2006) 'Operational performance evaluation of international major airports: an application of data envelopment analysis', *Journal of Air Transport Management*, 12(6): 342–51.

Lin, Z., Choo, Y. and Oum, T. (2013) 'Efficiency benchmarking of North American airports: Comparative results of productivity index, data envelopment analysis and stochastic frontier analysis', *Journal of the Transportation Research Forum*, 52(1): 47–68.

Main, B., Lever, B. and Crook, J. (2003), *Central Scotland Airport Study*, Edinburgh: The David Hume Institute.

Marques, R. Simões, P. and Carvalho, P. (2015) 'The influence of the operational environment on efficiency of international airports', *Journal of Advanced Transportation*, 49(4): 511–22.

Martín, J., Rodríguez-Déniz, H. and Voltes-Dorta, A. (2013) 'Determinants of airport cost flexibility in a context of economic recession', *Transportation Research Part E: Logistics and Transportation Review,* 57: 70–84.

Martín, J. and Roman, C. (2001) 'An application of DEA to measure the efficiency of Spanish airports prior to privatisation', *Journal of Air Transport Management*, 7(3): 149–57.

Martín, J. and Roman, C. (2006) 'A benchmarking analysis of Spanish commercial airports. A comparison between SMOP and DEA ranking methods', *Networks and Spatial Economics*, 6(2): 111–34.

Martín, J. and Roman, C. (2008a) 'The relationship between size and efficiency: a benchmarking analysis of Spanish commercial airports', *Journal of Airport Management,* 2(2): 183–97.

Martín, J. and Roman, C. (2008b) 'International airports: economies of scale and marginal costs', *Journal of Transportation Research Forum*, 47(1): 5–22.

Martín, J., Roman, C. and Voltes-Dorta, A. (2009) 'A stochastic frontier analysis to estimate the relative efficiency of Spanish airports', *Journal of Productivity Analysis,* 31(3): 163–76.

Martín, J. and Voltes-Dorta, A. (2011a) 'The econometric estimation of airports' cost function', *Transportation Research B*, 45(1): 112–27.

Martín, J. and Voltes-Dorta, A. (2011b) 'The dilemma between capacity expansions and multi-airport systems: empirical evidence from the industry's cost function', *Transportation Research E*, 47(3): 382–89.

Martín, J. and Voltes-Dorta, A. (2011c) 'Scale economies in marginal costs in Spanish airports', *Transportation Research E*, 47(2): 238–48.
Martin-Cejas, R. (2002) 'An approximation to the productive efficiency of the Spanish airports network through a deterministic cost frontier', *Journal of Air Transport Management*, 8(4): 233–38.
McCarthy, P. (2014) 'US airport costs and production technology: A translog cost function analysis', *Journal of Transport Economics and Policy*, 48(3): 427–47.
Merkert, R. and Assaf, A. (2015) 'Using DEA models to jointly estimate service quality perception and profitability – Evidence from international airports', *Transportation Research Part A: Policy and Practice*, 75: 42–50.
Merkert, R. and Mangia, L. (2014) 'Efficiency of Italian and Norwegian airports: a matter of management or of the level of competition in remote regions?', *Transportation Research Part A: Policy and Practice*, 62: 30–38.
Merkert, R., Odeck, J., Brathen, S. and Pagliari, R. (2012) 'A review of different benchmarking methods in the context of regional airports', *Transport Reviews*, 32(3): 379–95.
Morrison, W. (2009) 'Understanding the complexities and challenges of airport performance benchmarking', *Journal of Airport Management*, 3(2): 145–58.
Murillo-Melchor, C. (1999) 'An analysis of the technical efficiency and productive change in Spanish airports using the Malmquist Index', *International Journal of Transport Economics,* 26(2): 271–91.
Nyshadham, E. and Rao, V. (2000) 'Assessing efficiency of European airports', *Public Works Management and Policy*, 5(1): 106–14.
Oliveira-Neto, F., Pontes, P. and Wichmann, B. (2014) 'A benchmarking analysis of the Brazilian airport infrastructure: An application of the expected minimum input frontier', *Journal of Transport Economics and Policy*, 48(2): 297–313.
Oum, T., Adler, N. and Yu, C. (2006) 'Privatisation, corporatisation, ownership forms and their effects on the performance of the world's airports', *Journal of Air Transport Management*, 12(2): 109–21.
Oum, T., Yan, J. and Yu, C. (2008) 'Ownership forms matter for airport efficiency: a stochastic frontier investigation of worldwide airports', *Journal of Urban Economics*, 64(2): 422–35.
Oum, T. and Yu, C. (2004) 'Measuring airports' operating efficiency: a summary of the 2003 ATRS global airport benchmarking report', *Transportation Research Part E,* 40(6): 515–32.
Oum, T., Yu, C. and Fu, X. (2003) 'A comparative analysis of productivity performance of the world's major airports: summary report of the ATRS global airport benchmarking research report – 2002', *Journal of Air Transport Management*, 9(5): 285–97.
Oum, T., Zhang, A. and Zhang, Y. (2004) 'Alternative forms of economic regulation and their efficiency implications for airports', *Journal of Transport Economics and Policy*, 38(2): 217–46.
PA Consulting (2017) *Benchmarking of High Level Economic and Financial Metrics of Heathrow Airport*, London: PA Consulting.
Pachero, R. and Fernandes, E. (2003) 'Managerial efficiency of Brazilian airports', *Transportation Research A*, 37(4): 667–80.
Pacheco, R. R., Fernandes, E., and de Sequeira Santos, M. P. (2006), 'Management style and airport performance in Brazil', *Journal of Air Transport Management*, 12(6): 324-30.
Parker, D. (1999) 'The performance of BAA before and after privatisation: a DEA study', *Journal of Transport Economics and Policy*, 33(2), 133–46.
Pathomsiri, S., Haghani, A., Dresner, M. and Windle, R.J. (2008) 'Impact of undesirable outputs on the productivity of US airports', *Transportation Research Part E*, 44(2): 235–59.

Pels, E., Nijkamp, P. and Rietveld, P. (2001) 'Relative efficiency of European airports', *Transport Policy*, 8(3): 183–92.
Pels, E., Nijkamp, P. and Rietveld, P (2003) 'Inefficiencies and scale economies of European airport operations', *Transportation Research Part E*, 39(5): 341–61.
Perelman, S. and Serebrisky, T. (2012) 'Measuring the technical efficiency of airports in Latin America', *Utilities Policy*, 22: 1–7.
Psaraki-Kalouptsidi, V. and Kalakou, S. (2011) 'Assessment of efficiency of Greek airports', *Journal of Airport Management*, 5(2): 170–86.
Reinhold, A., Niemeier, H.-M., Kamp, V. and Mueller, J. (2010) 'An evaluation of yardstick regulation for European airports', *Journal of Air Transport Management*, 16(2): 74–80.
Ricondo and Associates, Booz Allen Hamilton, George Mason University and National Service Research (2009) *Strategic Planning in the Airport Industry*, ACRP Report 19. Washington, DC: Transportation Research Board.
Rodríguez-Déniz, H. and Voltes-Dorta, A. (2014) 'A frontier-based hierarchical clustering for airport efficiency benchmarking', *Benchmarking: An International Journal*, 21(4): 486–508.
Ryan, M. (2012) 'Performance management in the Dublin Airport Authority', *ACI Airport Economics and Finance Conference*, London, March.
Salazar de la Cruz, F. (1999) 'A DEA approach to the airport production function', *International Journal of Transport Economics*, 26(2): 255–70.
Sarkis, J. (2000) 'An analysis of the operational efficiency of major airports in the United States', *Journal of Operations Management*, 18(3): 335–51.
Sarkis, J. and Talluri, S. (2004) 'Performance based clustering for benchmarking of US airports', *Transportation Research A,* 38(5): 329–46.
Scotti, D., Malighetti, P., Martini, G. and Volta, N. (2012) 'The impact of airport competition on technical efficiency: a stochastic frontier analysis applied to Italian airport', *Journal of Air Transport Management*, 22: 9–15.
See, K.F. and Li, F. (2015) 'Total factor productivity analysis of the UK airport industry: A Hicks-Moorsteen index method', *Journal of Air Transport Management*, 43: 1–10.
Sharma, V., Dwivedi, P. and Seth, P. (2011) 'Airports and productivity', *International Journal of Aviation Management*, 1(2): 105–23.
Starkie, D. (2008) *The Airport Industry in a Competitive Environment: A United Kingdom Perspective,* Discussion paper No. 2005–15, Paris: International Transport Forum (ITF).
Steer Davies Gleave (2012) *Review of Operating Expenditure and Investment*, London: Steer Davies Gleave.
Steer Davies Gleave (2014) *Dublin Airport Operating Expenditure Efficiency Study*, London: Steer Davies Gleave.
Suzuki, A., Nijkamp, P., Rietveld, P. and Pels, E. (2010) 'A distance friction minimization approach in data envelopment analysis: a comparative study on airport efficiency', *European Journal of Operational Research*, 207(2): 1104–15.
Tovar, B. and Martin-Cejas, R. (2009) 'Are outsourcing and non-aeronautical revenues important drivers in the efficiency of Spanish airports?', *Journal of Air Transport Management*, 15(5): 217–20.
Tovar, B. and Martin-Cejas, R. (2010) 'Technical efficiency and productivity changes in Spanish airports: a parametric distance functions approach', *Transportation Research Part E*, 46(2): 249–60.
Tretheway, M. and Markhvida, K. (2013) *Airports in the Aviation Value Chain*, Discussion paper No. 2013–15, Paris: ITF.
Tsekeris, T. (2011) 'Greek airports: efficiency measurement and analysis of determinants', *Journal of Air Transport Management*, 12(4): 182–90.

Ülkü, T. (2015) 'A comparative efficiency analysis of Spanish and Turkish airports', *Journal of Air Transport Management*, 46: 56–68.

Vasigh, B., Erfani, G. and Sherman, B. (2014) 'Airport performance and ownership structure: Evidence from the United Kingdom, United States, and Latin America', *Journal of Aviation Technology Engineering*, 4: 40–49.

Vasigh, B. and Gorjidooz, J. (2006) 'Productivity analysis of public and private airports: a causal investigation', *Journal of Air Transportation*, 11(3): 144–63.

Vogel, H. (2006a) 'Airport privatisation: ownership structure and financial performance of European commercial airports', *Competition and Regulation in Network Industries*, 1(2): 139–62.

Vogel, H. (2006b) 'Impact of privatisation on the financial and economic performance of European airports', *Aeronautical Journal*, April: 197–213.

Vogel, H. and Graham, A. (2006) 'A comparison of alternative airport performance measurement techniques: a European case study', *Journal of Airport Management*, 1(1): 59–74.

Vogel, H. and Graham, A. (2011) 'Profitability in the airline versus airport business: a long-term perspective', *Journal of Airport Management*, 5(3): 255–68.

Vogel, H.-A. and Graham, A. (2013) 'Devising airport groupings for financial benchmarking', *Journal of Air Transport Management*, 30: 32–38.

Voltes-Dorta, A. and Pagliari, R. (2012) 'The impact of recession on airports' cost efficiency', *Transport Policy*, 24: 211–22.

Wanke, P. (2012) 'Efficiency of Brazil's airports: evidences from bootstrapped DEA and FDH estimates', *Journal of Air Transport Management*, 23: 47–53.

Yoshida, Y. (2004) 'Endogenous-weight TFP measurement: methodology and its application to Japanese-airport benchmarking', *Transportation Research E*, 40(2): 151–82.

Yoshida, Y. and Fuijimoto, H. (2004) 'Japanese-airport benchmarking with the DEA and endogenous-weight TFP methods: testing the criticism of overinvestment in Japanese regional airports', *Transportation Research Part E*, 40(6): 533–46.

Yu, M.-M. (2004) 'Measuring physical efficiency of domestic airports in Taiwan with undesirable outputs and environmental factors', *Journal of Air Transport Management*, 10(5): 295–303.

Yu, M.-M (2010) 'Assessment of airport performance using the SBM–NDEA model', *Omega,* 38(6): 440–452.

Yu, M.-M., Hsu, S.-H., Chang, C.-C. and Lee, D.-H. (2008) 'Productivity growth of Taiwan's major domestic airports in the presence of aircraft noise', *Transportation Research Part E*, 44(3): 543–54.

Zhao, Q., Choo, Y.Y. and Oum, T.H. (2014) 'The effect of governance forms on North American airport efficiency: A comparative analysis of airport authority vs. government branch', *Journal of the Transportation Research Forum* 53(2): 93–110.

Zou, B., Kafle, N., Chang, Y. T. and Park, K. (2015) 'US airport financial reform and its implications for airport efficiency: An exploratory investigation', *Journal of Air Transport Management* 47: 66-78.

4 The airport–airline relationship

The relationship between the airport operator and airlines is clearly fundamental to the success of any airport business. The sweeping changes that have occurred within the airline industry mean that airlines, more than ever before, are trying to control their costs in order to improve their financial position in an ever-increasingly competitive and deregulated environment. At the same time, most carriers have been facing significant changes in the price of fuel, both upwards and downwards, over which they have little control. This is having an impact on the aeronautical policies of airports and their regulation. In addition, an ongoing problem is that demand is outstripping capacity at a growing number of airports, and so the traditional mechanism for allocating slots is increasingly being challenged. All these issues are considered in this chapter.

The structure of aeronautical charges

Aeronautical charging historically was relatively simple, with most revenue coming from a weight-based landing charge and a passenger fee dependent on passenger numbers. Many airports still generate their aeronautical revenue in this way. At other airports, charging practices have become more complex and more market-based, with a shift away from a 'one-size-fits-all' charges structure. This reflects the increasingly commercial and competitive airport environment and the contemporary challenges faced by airports, including the growing pressure on facilities, environmental concerns and rising security costs.

Landing or aircraft-based charges

Most airports have a weight-related landing charge based on maximum take-off weight or maximum authorised weight. The simplest method is to charge a fixed-amount unit rate (e.g. US$*x* per tonne) regardless of the size of the aircraft. A fixed unit rate will favour smaller aircraft types since tonnage tends to increase faster than aircraft capacity or payload. It will also benefit airlines that have high load factors or seating capacities. This simple method is used at many airports throughout the world, including those in the United States, many of the German airports and Copenhagen. Some airports have a unit landing charge that declines as the weight of the aircraft increases, such as Oslo. At other airports, for example at Delhi, the unit rate increases for larger aircraft.

This charging mechanism uses 'ability to pay' principles, as airlines using larger aircraft are in a better position to pay higher charges. Some costs, such as runway wear and tear, do increase with weight and also larger aircraft require vortex separations that can reduce the number of aircraft movements during a certain period. Overall, however, there is not a strong relationship between aircraft weight and airfield cost, particularly as airfield costs can be affected by factors such as the type of landing gear. A flat-rate landing charge for all aircraft types may be more appropriate, especially at congested airports. This is because the cost of occupying the congested runway is movement-related and independent of aircraft size. Each aircraft movement will consume the same resource.

Very few airports have adopted a movement-related charge, which tends to be very unpopular with airlines flying small aircraft types. Notable exceptions are Heathrow, where there is a fixed runway charge for all aircraft above 16 tonnes. Other airports have not gone this far, but have made an attempt to charge the smallest aircraft more to encourage GA and small aircraft to move away from congested major airports. For instance, Frankfurt airport has a minimum landing charge set at 66 tonnes and another example of this practice is Tokyo Narita. Some other airports have differential landing charges by time of day (such as Manchester, Rome and Mexico City) or time of year (such as Dublin) to reflect peaking of demand. At other airports, domestic or short-haul services traditionally have paid a reduced landing fee. This is not a cost-related charge since the cost to land an aircraft is independent of its origin. Instead, it tends to exist to support local and regional services, which are usually comparatively expensive to operate. Occasionally, such services will have a social role in linking together regional communities, so in effect this policy will act as an unofficial subsidy.

Sometimes charges for ATC or terminal navigational facilities will be incorporated in the landing charge. At other airports, the airport operator may levy a separate charge. Typically, this charge will, like the landing charge, be related to the weight of the aircraft. There is no logical cost rationale for this, as each aircraft movement, regardless of the size of the airport, imposes the same costs on the ATC infrastructure. Alternatively, the airline will pay the ATC agencies directly and the airport operator will not be involved in the financing of ATC services at all. In addition, a growing number of airports have noise- and emissions-related surcharges or discounts associated with their landing charges as a result of increasing concerns about the environment. These are covered in Chapter 10.

Passenger charges

Passenger charges or passenger service charges (PSC) are the other main source of aeronautical revenue. These charges are most commonly levied per departing passenger. At most airports, there tends to be a lower charge for domestic passengers to reflect the lower costs associated with these types of passenger. There may be variations here – at the Paris airports there are three types of charge (domestic, Schengen-EU, non-Schengen-EU), while London Heathrow charges differently for domestic, European and other destinations. As with the landing charge, in some cases there may be political or social reasons for keeping down the cost of domestic travel. Historically, such policies were often maintained to subsidise the national carrier, which had a large domestic operation. It can be argued, however, that domestic passengers have less potential for generating commercial revenues and hence do not justify the lower passenger charge. Some other airports also have differential charges to reflect peaking, such as East Midlands and Glasgow airports. An interesting development at Frankfurt airport is a fee cap related to passenger charges, which means that a refunded amount is provided for all passengers when the load factor exceeds 83 per cent. Similar rebates exist at Budapest airport, namely 10 per cent for load factors between 90–92 per cent, and 15 per cent for even higher load factors. At other airports such as Dusseldorf, there is a volume rebate for passenger numbers; for example, the rebate is 5.5 per cent for airlines with more than six million passengers. LCC terminals, such as at Marseille and Lyon, also have lower passenger charges, as discussed in Chapter 5.

Many airports charge a lower fee for transfer passengers, for instance Amsterdam, Frankfurt, Heathrow, Paris, Madrid, Singapore, Kansai, Narita, Sydney and Toronto. At Paris and Madrid, for example, this represents a 40 per cent discount on the fees. Elsewhere, some airports waive the fee completely (e.g. Dubai and Kansai). A lower transfer charge can be justifiable on cost grounds, as such passengers will have no surface access requirements, will not have associated meeters and greeters, and very often will not need check-in, security and immigration facilities either. On the other hand, transfer passengers still require facilities such as baggage handling, and may require special facilities in order that a rapid transfer is achieved. They may also produce more peaked operations, if the airport operates as a hub with operations in 'waves', which will be more costly than with a more even pattern of demand.

Security charges

The responsibility for the provision and financing of airport security varies considerably from country to country (see Chapter 5). Security services may be provided by the airport's own employees, or by a private company under contract to the airport, the airlines, or a government agency. In many cases responsibility may be shared between these different bodies. This results in different systems being in place to finance the security measures. They may be paid for by the government via general taxation or via a special government departure tax. In other countries, security costs may be financed directly by the airport operator, who will have a special security charge or include it in the passenger charge. In the United States there is a US$5.60 security tax per passenger to cover some of the security costs. Sometimes there is a security charge based on aircraft tonnes as well as passengers, as at Frankfurt. The security charge is normally collected, as with the other charges, when the ticket is sold by the airline, although exceptions have existed, for instance at Riga airport up until 2015, where Ryanair refused to collect the tax and so the charge was €7 per Ryanair passenger compared with €6.50 for other passengers. The overall significance of such security charges can very, for example typically accounting for less than 1 per cent of charges paid at Mexico City airport, compared to around 33 per cent at Hong Kong airport (LeighFisher, 2016).

Other charges

There are also a number of other charges that tend to be fairly low compared with the landing and passenger fees. First, there is the parking charge which is usually based on the weight of the aircraft or, sometimes, on space occupied (e.g. Malta, Singapore), size of parking stands (e.g. Shannon), or as a percentage of the landing fee (e.g. Vienna, Beijing). There is normally an hourly or daily charge with, perhaps, a rebate for using remote stands. Most airports have a free parking charge, typically ranging from 1 to 4 hours to allow the airline to turn around at the airport without incurring any charges. At some airports, this may be for even longer, as at Charleroi airport where it is 12 hours. A few airports have no free parking charge (e.g. Frankfurt) or have a very short period (e.g. 30 minutes for wide-bodied aircraft at Heathrow) to encourage the airlines to minimise their turnaround time. For those airports that have a 24-hour charge, such as Amsterdam, Dusseldorf, Kansai and Bangkok airport, there is clearly no incentive for airlines to make the most effective use of the apron space. Other airports, such as Paris, differentiate between different areas of parking and between night and day. Typically, the parking charge represents less than 5 per cent of the total charges (LeighFisher, 2016).

A recent development, evident particularly at small regional UK and Irish airports that are not performing well financially, is an airport development or facility fee, which is paid directly by passengers in addition to the normal passenger fee. For example, such fees can be found at Norwich airport (£10), Durham Tees Valley airport (£6) and Knock airport (€10). They are conversional, as they can be viewed as yet another fee, so much so that Newquay airport scrapped its fee in 2015 after much opposition from its users. However, Durham Tees Valley has justified such fees with the message 'Secure our future' directed at the local residents who fly.

There are a few examples of development fees elsewhere, for instance at Athens and at the Canadian airports (so-called Airport Improvement Funds – AIFs) and they have recently been introduced at some privatised Indian airports such as Delhi (although discontinued in 2016), which have caused substantial increases in the overall level of charges levied. Sometimes, similar to the passenger charge, there are also cargo charges based on the weight of loaded or unloaded cargo, as is the case at the Rome airports. Elsewhere, there may be a lower fee for all-cargo aircraft, as at Amsterdam and Manchester airports, whereas at some airports, such as Belfast International, the landing charge for such aircraft is higher.

There may be other charges for certain facilities or services that airports choose to price separately rather than including them in the landing or passenger charge. There may be a charge for handling people with reduced mobility (PRM). For example, EU regulation requires PRM-related costs to be recovered through a cost-related fee, levied on all passengers. There may also be a movement-based (or less commonly passenger-based) infrastructure charge, as at Vienna, Copenhagen and Stockholm, which will cover the use of infrastructure-handling facilities such as check-in areas, baggage sorting and airbridges. Alternatively, these charges may be more specific, relating to separate facilities. For instance, at some airports, such as Lisbon, Mumbai, Kuala Lumpur and Bangkok, there is an airbridge fee, typically charged per movement, or based on the length of time that the airbridge is occupied. Having specific charges, rather than including them in the basic charges, is a development favoured by certain airlines, especially LCCs, which can then avoid them if possible if they are not related to their business model operations (e.g. excluding the use of airbridges or complex baggage handling systems). In general, this reflects the growing view that the one-size-fits-all model of airport charging is no longer always relevant and that a more 'menu-based' approach, when the service/price choices available for airlines are made explicit, is more suitable. This issue and quality of service modulations to charges are further discussed in Chapter 5.

Ground handling and fuel charges

Airlines incur three types of charge when they use an airport. First, they pay landing and passenger and, sometimes, other airport fees, discussed above. Then there are ground handling fees, which the airport operator may levy if it chooses to provide some of these services itself rather than leaving them to handling agents or airlines. Finally, there are the fuel charges that are levied by the fuel companies which are normally independent of the airport operator. There a few notable exceptions, such as certain Middle Eastern airports, where the fuelling is provided by a government company. Hence all services at the airport can be offered to the airline in one overall package.

It is difficult to find published data relating to handling and fuel charges. These are usually negotiable and the agreed prices will depend on various factors, including the size of the airline; the scale of its operation at the airport in question and LOS required; competition between different suppliers; and whether other airports used by the airline are served by the same handling and fuel companies. Further complexities occur since there are a variety of ways of charging for activities, including ramp handling, passenger handling, apron buses, aircraft cleaning, ground power, pushback and so on. In some cases, there may be just one or two charges that cover everything, whereas elsewhere there may be a multitude of individual fees.

Government taxes

Table 4.1 summarises the charges at an airport. There is one final charge that airlines or their passengers often experience at an airport, namely government taxes. This income does not go directly to the airport operator, but does impact on the overall cost of the 'turnaround' from an airline's point of view. For the passenger, it is very difficult to distinguish between these taxes, which go to the government, and airport passenger charges that represent revenue for the airport, as both are usually shown as 'airport taxes and charges' on the ticket. Sometimes these taxes may have a travel-related objective, as is the case with a number of taxes in the United States. The taxes may also cover the provision of noise mitigation measures, as at Amsterdam.

In the United Kingdom, a departure tax called the Air Passenger Duty (APD), which goes directly to the Treasury, was introduced in 1994. This was greeted with considerable

Table 4.1 Main aeronautical charges at airports

Charge	Common basis for charging	Income to airport operator?
Landing	Weight of aircraft	Yes
Terminal navigation	Included in landing charge or based on weight of aircraft	Sometimes
Passenger	Departing passenger	Yes
Security	Included in passenger charge or based on passenger numbers	Yes
Parking	Weight of aircraft per hour or 24 hours after free period	Yes
Infrastructure	Included in landing charge or based on aircraft movement	Yes
Ground handling	Different charges for different activities	Sometimes
Fuel	Volume of fuel	No
Government taxes	Departing passenger	No

opposition, especially from the new breed of LCCs, which complained that it was too large in proportion to the fares that were being offered. As a compromise, in 2001 a differential tax system with different amounts for economy and business-class passengers was used. Since then the tax has increased substantially, although recently some of the most expensive tax categories have been abolished. In France in 2006, a 'solidarity tax' was introduced to fund health and development aid in poorer countries. In July 2008, the Dutch government introduced a passenger tax of €11 for European travel and €45 for long-haul travel (transfer passengers were exempt), which was bitterly opposed by the airlines and was subsequently abandoned a year later. Similar taxes have now been introduced in other countries, including Germany, Austria, Ireland (now abandoned) and most recently Norway in 2016. The impact of these taxes is investigated further in Chapter 9.

Level of aeronautical charges

In general there has been a trend towards giving greater relative importance to the passenger fee as compared with the landing or aircraft-based fee. This is primarily because the aircraft-related fee represents a fixed charge for airlines, as it does not vary with load factor, while the passenger-based fee is a variable cost. Airlines will prefer the focus on the passenger fee as passenger numbers drive most of their revenues. In this case, more risk is also shared by the airport operator. In addition, as passenger charges are shown separately on the ticket under 'airport charges and taxes', this can also have a marketing advantage as it will have the effect of apparently reducing the overall fare (excluding charges and taxes) that the airline charges. As there is increased differentiation of airport services in the terminal (particularly for LCCs – see Chapter 5), this approach gives airlines more flexibility in that they pay only for passenger services they use, which can have a significant effect on the overall level of charges paid. Figure 4.1 shows that, in almost every world region, passenger charges account for over half the charges. Some airports have gone further than this, particularly those serving LCCs, such as Brussels South Charleroi airport (BSCA), by having a charge that is totally passenger-related. The same situation exists for international services at some Australian airports, such as Sydney.

It is very difficult to compare the level of charges at different airports because of the varied nature of the charging structures. To overcome this problem, comparisons have to be made by examining the representative airport charges. LeighFisher (2016) undertook this for eight different aircraft types on international services (ranging from the Airbus A319 with around 140 seats to the Boeing 747–400 with around 400 seats) and then calculated an overall index with London Heathrow's value set at 100. A selection of 30 airports from this is shown in Figure 4.2. The index includes aircraft-related costs, which include landing charges as well as ATC and infrastructure charges (if these exist); passenger-related costs, which include passenger charges and any security charges; but not government taxes. The data were not

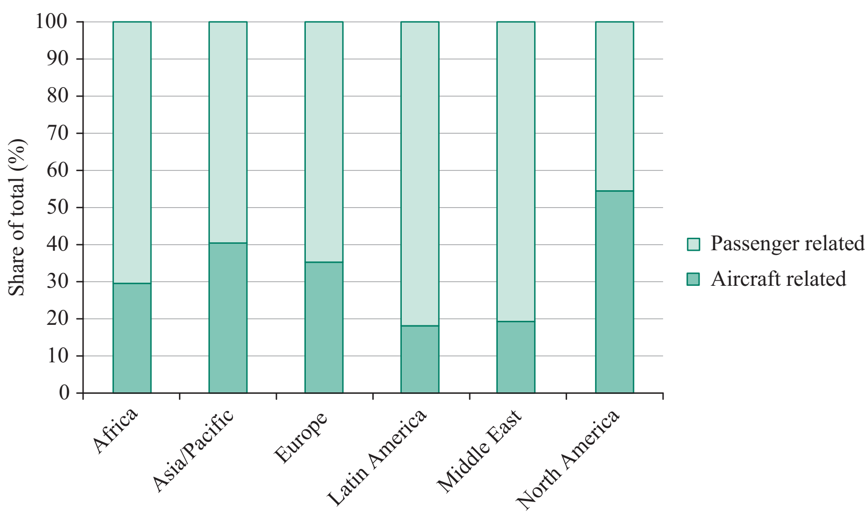

Figure 4.1

Aeronautical charges by source at ACI airports, 2015

Note: Excludes terminal rental revenue in North America which represents 36 per cent of total revenue but includes AIF (Canada) and PFC (US) fees

Source: Adapted from ACI (2017)

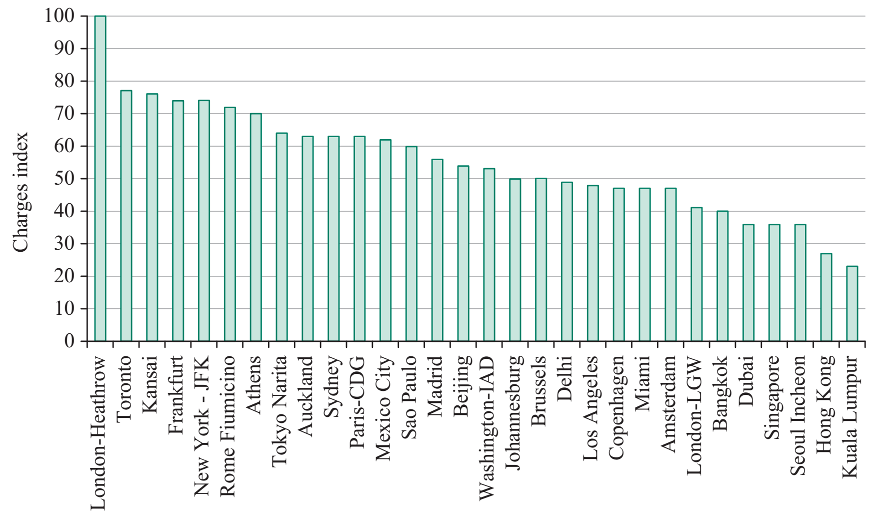

Figure 4.2

Airport charges index, 2016
Source: Adapted from Leighfisher (2016)

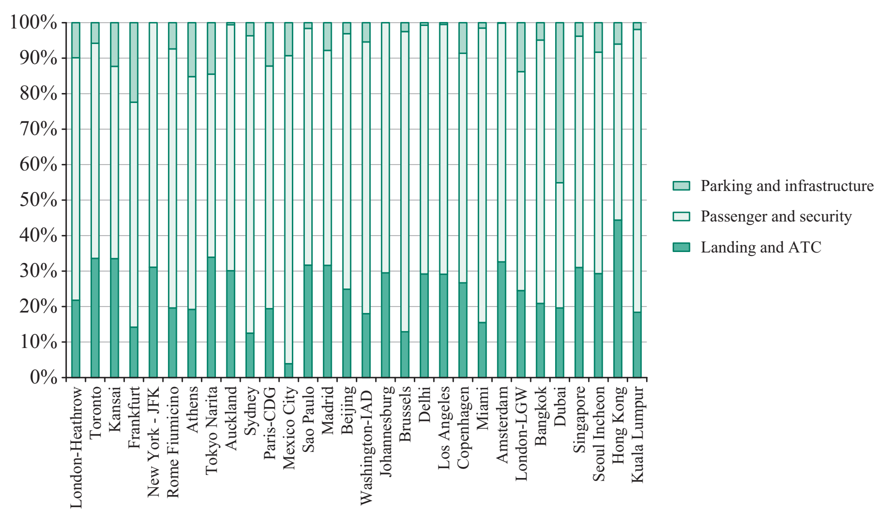

Figure 4.3

Importance of different charges with the airport charges index, 2016 (%)
Source: Adapted from Leighfisher (2016)

sufficient to allow ground handling and fuel costs to be added. Only published charges were used, so the figures do not take account of any discounts that may be available.

There is a wide spread of charges, with London Heathrow being the most expensive and a number of the Asian hubs and Dubai having the lowest charges. The highest charges are as much as three or four times more than the lowest ones. Figure 4.3 shows the importance of each charge and the dominance of the passenger/security charges is evident for all airports with the exception of Dubai where there are large infrastructure charges.

LeighFisher (2012) identified a number of factors that may affect airport charges and aeronautical revenues. These were classified as 'inherent' (catchment area size, runway utilisation, regulatory requirements, access time to the principal city); 'structural' (mix of airline served, mix of destination served, average aircraft size, distribution of short- and long-haul destinations, share of transfer, total passenger traffic, nature of airport ownership, the extent to which competition is available); systemic (airport objectives related to service offering, fixed assets/passenger, growth, profitability); and realised (operating processes, productivity, load factors and commercial revenues). They found that the structural factors, such as airline mix, destination mix and share of transfer passengers, seemed to be the most significant drivers for aeronautical revenue differentiation.

Other research, for example in the United States, has shown that unit aeronautical revenues (aeronautical revenue per flight) declined with the amount of traffic and were lower at airports facing competition from neighbouring airports, but increased with airline concentration (Van Dender, 2007). Choo (2014) found that large hub airports had higher aeronautical charges than other airports. Meanwhile, in Europe, Bel and Fageda (2010) concluded that the charges were higher at larger airports and lower when there were competing nearby airports. In addition, they found a negative relationship with airline concentration, suggesting that in this case the airlines had stronger countervailing market power. Bilotkach *et al.* (2012) also observed a positive relationship with traffic and hubs, but no nearby airport effect.

Impact of aeronautical charges on airline operations

In recent years, airport charges have become subject to increased scrutiny from the airlines. A more competitive airline environment and falling yields have forced airlines to focus on major cost-saving initiatives, including outsourcing, reductions in staff numbers and pegging the level of wages. These are all internal costs over which the airlines have a considerable degree of control. However, airlines have also been looking at their external costs such as airport charges, and calling for airports to adopt more cost-cutting and efficiency-saving measures themselves, rather than raising their charges. The existence of the profitability gap (discussed in Chapter 3) as a result of airports generally achieving much higher operating profits than airlines has also contributed to the friction between airports and airlines that has been experienced at some airports. An example of this tension was demonstrated in Europe in 2016 when the airline trade body, Airlines 4 Europe, reported that charges had increased at the 21 largest European airports by 80 per cent in the last decade and that, as a consequence, tighter economic regulation was needed (Aviation Economics, 2016). In a rebuttal, ACI Europe claimed that the charges had only increased by 25 per cent, representing an increase of less than €3 per passenger (ACI Europe, 2016).

This indicates the difficulties in obtaining a consensus of view about airport charges. It is true that on average they represent a relatively small part of an airline's total operating costs (typically less than 10 per cent), but this varies considerably for different types of airline. They are least important when long-haul operations are being considered, as the charges are levied relatively infrequently. Airport charges are the most significant for the charter and LCCs as these airlines have minimised or completely avoided some of the other costs that more traditional scheduled airlines face. Most LCCs operate short sectors, which means that they pay airport charges more frequently. So it is hardly surprising that this type of airline has been most active in attempting to bring down their airport costs by negotiating incentive deals at airports, or operating out of secondary or regional airports that have lower charges.

Accurate data to support this are difficult to obtain because many airlines do not report the passenger fee as an airport charge, and very often the airport charges may be combined with some other cost item. However, some limited data do exist for UK airlines, and in 2013–14 airport and handling expenses (includes landing and departure fees, en-route and navigation service charges, handling charges and parking fees, station costs, passenger services and passenger embarkation fees – airport specific charges were not available separately) for British Airways, with a mix of long- and short-haul flights, represented around 19 per cent of total costs. This share was larger for the LCCs Jet2 (24 per cent) and easyJet (35 per cent), and the regional carrier Flybe (29 per cent), indicating the influence of airline type on these airport expenses (Halpern *et al.,* 2016).

As discussed, peak charges have been introduced by a few airports to address congestion problems. The feasibility and effectiveness of using airport pricing to manage congestion has been frequently discussed in the literature, with the theoretical arguments summarised by Zhang and Czerny (2012). One of the key issues is the extent to which airlines already self-internalise congestion, so giving no role to congestion pricing, on which point views vary (Brueckner, 2005, Daniel and Harback, 2008).

From a practical perspective, airport operators tend to argue that their peak pricing makes the airlines that are generating the peak demand pay for the peak capacity infrastructure costs, and also that it is used with the intent of shifting some peak operations into off-peak. Arguably, this is unlikely to occur unless the differential between peak and off-peak pricing is very much higher than current practice. Airline scheduling is a complex task that has to take into account factors including passenger demand patterns, airport curfews and environmental restrictions, crew availability, and peak profiles at other airports. If the airline were to shift operations to outside the peak period, this could well mean that the peak is merely shifted to another time. In effect, these schedule constraints, coupled with the fact that charges make a relatively small contribution to airline total costs, mean that often demand can be fairly inelastic to changes in airport fees. Most peak pricing has very little impact on airline operations other than making it more expensive for airlines to operate in the peak. (The same is arguably true of noise and emission charges where maintenance costs and fuel burn considerations are generally likely to have a far greater impact on aircraft renewal strategies than increased airport charges.)

BAA was one of the few airport operators that developed a peak pricing charging system based on a detailed assessment of marginal costs. In theory, marginal cost pricing leads to the most efficient allocation of resources, as only the users, who value a facility at least as much as the cost of providing it, will pay the price for using it. In practice, such pricing policies are complex and very difficult to implement. In the 1970s, BAA introduced a peak surcharge on runway movements on certain summer days and a peak passenger and parking charge based on marginal cost principles at Heathrow and Gatwick airports. It proved to be ineffectual in shifting any demand largely because of the scheduling problems already described, but also because the charging system was so complex that it was very difficult for the airlines to react. The airport operator faced widespread opposition from the airlines, particularly the US carriers, to its peak charges, which were considered discriminatory. BAA and the US airlines finally resolved their differences through international arbitration, which required BAA to phase out the peak passenger charges. Heathrow is now effectively full in most hours and so the concept in this case of the peak hour has become far less relevant.

An airport charging policy arguably has its greatest impact on airline operations when new routes are being considered, particularly when there are incentive schemes or discounts. These are most likely to be offered at smaller airports that want to encourage growth and provide inducements to airlines that might otherwise not choose to use the airport. Such discounts have, in many cases, been a critical factor when LCCs have been selecting suitable airports for their operations (in addition to sufficient demand and fast turnaround facilities). This is particularly the situation when there have been a number of neighbouring or equally suitable airports from which to choose. These discount schemes are discussed in more detail in Chapter 8.

Another area of concern for airlines as regards charging policies is cross-subsidisation within an airport group under common ownership. This typically occurs when a large international airport provides financial support for a smaller airport, usually serving primarily domestic services. Operators of airport groups argue that the individual airports need to function as a system to make the most efficient use of resources and to produce cost savings. The airlines tend to be strongly opposed to such cross-subsidising and often argue that if the smaller airports really need financial help for social or economic reasons, they should be supported by government funds instead. There can be a similar issue when a system approach to pricing is used to fund investment at one particular airport in the system. The airport operator may justify this by arguing that such investment will bring benefits to the whole system, not just the individual airport. An example of common charging within an airport group is Finavia, the operator of Finnish airports.

A further important airport–airline issue is the pre-financing of future airport infrastructure through airport charges (Forsyth, 2017). Pre-financing has traditionally not been an acceptable principle, for a number of reasons. First, there is no guarantee that the airlines paying the charges will actually be the airlines that will benefit from the new infrastructure. Also, there may be no certainty that the airport charges will be spent efficiently to provide new facilities. The airlines tend to be fearful that they will pay twice for the infrastructure, both before it is built and once it is operational. However, in spite of these airline concerns, some airports have development fees for pre-financing purposes as already discussed above. Arguably, the most notable example is the United States, where PFCs go towards future development projects. A somewhat similar situation exists at Canadian airports, where there is the AIF.

Elsewhere, for example in the United Kingdom, the economic regulator of charges takes into account the fact that some pre-financing will take place when setting the appropriate level of charges. A topical issue within the UK is the possible pre-funding of a third runway at Heathrow. Another relevant recent example is Dublin airport and its new Terminal 2, where the majority of investment was not pre-financed, with an alternative approach being adopted. Generally, airports tend to argue that pre-financing in certain circumstances can provide a useful, cheaper source for funding investment in addition to loans and equity which can also be used as security for raising extra finance. Airports claim that pre-financing also avoids large increases in airport charges when the infrastructure comes on stream, as was experienced at Narita and Kansai airports in Japan. As regards the ICAO view of this, a long-established cost-recovery policy in the ICAO guidelines on airport charges was that charges should not be levied for any facilities until they become operational. However, in recent years ICAO has acknowledged that, with the growing commercialisation within the industry and diminishing dependence on government sources for financing, pre-funding could perhaps be considered, but only in specific safeguarded circumstances.

The relationship between aeronautical and non-aeronautical revenues

Chapter 3 shows how the mix of aeronautical and non-aeronautical revenues has been changing over the years. This raises various issues related to the complementarities of these two revenues and the suitability of a theoretical 'vertical structure' way of thinking, where airports can be considered to constitute the upstream market, which sells an essential input for the airline output (D'Alfonso and Nastasi, 2014). In fact, in recent years there has been some debate as to whether airports can be viewed as two-sided (or multi-sided) platforms. The concept of a two-sided business, which is a relatively new phenomenon, has been applied to areas such as credit cards or newspapers, where the businesses provide platforms for two distinct customers who both gain from being networked through the platform. It can be reasoned that airports serve both passengers and airlines, and so the positive interdependence between these two markets means that airport operators will be incentivised to compete for airline traffic and passengers, as these will influence both their aeronautical and non-aeronautical revenue. If passengers stay away, this will affect the airlines that might have to leave the airport. If airlines reduce or withdraw their services, this will reduce passenger numbers and consequently the non-aeronautical sales.

While the application of this concept to airports has been accepted by some (Gillen and Mantin, 2014; Ivaldi *et al.*, 2015; Thelle *et al.*, 2012), others have rejected it (Fröhlich, 2010), although acknowledging that the effects of the airport, airline and passenger vertical relationship and the role of non-aeronautical revenues have similar results. The main reason for this rejection is that the passenger's decision to buy an airline ticket already reflects their willingness to pay airport charges, and so this is not affected by what the airport does in the non-aeronautical area, which is the assumption with the two-sided platform.

This issue has been of particular concern in the UK during a recent assessment of the London airports' market power. Heathrow and Gatwick argued that since airports are a two-sided business and non-aeronautical revenues are important, they have an incentive to increase passenger numbers to generate these, which reduces the incentives to raise airport charges to airlines, which in turn reduces the extent to which the airport may exploit any market power (Charles River Associates, 2013; Gatwick Airport Ltd, 2010). However, the economic regulator (the CAA) responded by contending that the pricing of non-aeronautical services does not affect the overall demand of either passengers or airlines, and so instead adopted the vertical relationship approach in their thinking (CAA, 2013).

Connected to the aeronautical and non-aeronautical complementarities is the matter of what airport facilities and services should be considered when the airport prices are being set. There are two basic alternative approaches: the single till approach where all airport activities are included; and the dual till approach where just the aeronautical aspects of the operation are taken into account. (There are also hybrid approaches where just some non-aeronautical activities are considered.)

With the single till concept, growth in non-aeronautical revenue can be used to offset increases in aeronautical charges. Within the airport industry such single till practices, when commercial activities are used to reduce aeronautical charges, used to be widespread and were accepted by ICAO in its charging recommendations. The rationale for the single till is that without the aeronautical activities, there would be no market for the commercial operations and hence it is appropriate to offset the level of airport charges with profits earned from non-aeronautical facilities. This is the key justification the airlines use in favouring such a system, which is clearly likely to bring the lowest level of actual charges for them.

As traffic increases, the single till principle will tend to pull down airport charges. This may encourage growth and have the effect of increasing congestion and delays at the airport. The busiest, most congested airports are likely to be in the best position to significantly offset commercial revenues against airport charges. Yet it is these airports that need to manage their limited capacity the most. Bringing down the airport charges for such scarce resources makes no economic sense. In addition, it can be argued that using commercial revenues to offset aeronautical fees prevents these revenues from being used to help finance capital investment, or to aid the development of better commercial facilities. There is thus less incentive to develop commercial operations to their full potential.

By contrast, the dual till concept treats the aeronautical and non-aeronautical areas as separate financial entities and focuses on the monopoly aeronautical airport services. This is a difficult task because of having to allocate many fixed and joint costs between the aeronautical and non-aeronautical areas. The method does, however, provide airports with incentives to develop the commercial side of their business which effectively is uncontrolled, unlike with the single till approach, where any development in the commercial areas may well be accompanied by a reduction in aeronautical charges. There is a major logical argument in not including commercial activities within any economic regulatory framework as they cannot be considered as monopoly facilities. A further argument in favour of the dual till is that it can provide better incentives for aeronautical investment. This is because as well as gaining from additional aeronautical revenues if there is aeronautical investment, the airport can benefit from increased commercial revenues that will have been generated because of the additional passenger volumes. The counterargument here, however, is that with a dual till the incentives to invest on the aeronautical side might be worse, as in this case commercial investment might be favoured over aeronautical investment.

Hence different views, both from an academic and practical perspective, are held by various interested bodies (Czerny *et al.,* 2016). In respect to UK airports, Starkie (2008) argued in favour of the dual till for congested airports, stating that this would have positive effects on the allocation of scarce slot capacity and on investment decisions. More generally others (e.g. Czerny, 2006; Lu and Pagliari, 2004; Zhang and Czerny, 2012) agreed that a dual till approach was desirable when the aeronautical capacity is fully utilised or already overutilised, while the single till approach is preferable where excess capacity exists. In terms of revenue generation, evidence from ACI (2017) showed that, on average, non-aeronautical revenues per passenger in 2014 were highest with the dual till (US$8.57), then hybrid (US$8.07) and then single (US$7.61).

Airports and airlines often tend to have opposing views. For example, ACI (2017: 3) argued:

> The single till accounting method is born of a long-standing convention to support aircraft operators at the expense of infrastructure providers. Many economists, airport operators and a growing number of regulators agree that this method introduces price distortions and creates an artificial constraint that results in market inefficiencies both for airport operators and their airline customers. A movement away from single till regimes to dual and hybrid tills induces cost efficiencies and innovations on the commercial side of the airport business.

Meanwhile, IATA (2017a: 1) summarised its views by stating: 'Single till reflects the pricing mechanism airports would apply if they were under real competition: it is therefore the fairest mechanism of charging'.

The airport regulatory environment

Airports are subject to a number of different regulations at both international and national levels. Many of these are technical regulations related to the operational, safety and security aspects of managing an airport. Airports are also becoming increasingly subject to environmental regulations that may, for example, restrict aircraft movements due to noise considerations or limit airport infrastructure development. These environmental issues are discussed in Chapter 10. Then there is economic regulation, with the main focus being on charge or tariff control. Other economic aspects of operation, including handling activities and slot allocation, are also regulated in some areas of the world. Overall, economic regulatory interest in airports seems to be increasing at a time when, ironically, the airlines business is being progressively deregulated.

On a worldwide basis, the 1944 Chicago Convention, which established an international regulatory air transport system, provides a basis for airport charging. Article 15 gives international authority for the levying of charges by ICAO member states and specifies that there shall be no discrimination between users, particularly from different countries. ICAO produces more detailed guidelines that have an overriding principle that charges should be cost-related. They also recommend that the charging system should be transparent and that consultation should take place between airport operators and their customers if changes are proposed (ICAO, 2012). They are only guidelines and are open to different interpretations, but nevertheless have generally led to fairly similar overall pricing regimes being adopted by most airports, being broadly related to average cost pricing combined with some market or ability-to-pay pricing. Airport charges can also be subject to the international obligations of bilateral agreements – although this is becoming much less common now. For example, the old UK–US bilateral air service Bermuda 2 (replaced in 2008 by the EU–US Open Skies agreement) stated that airport charges must be related to costs and should allow only reasonable profits. This resulted in a lengthy dispute over Heathrow charges in the 1980s and 1990s between the US and UK governments.

Within Europe, the first proposal for any EU-wide regulation appeared in 1985, and subsequently there were several other attempts to seek approval for such legislation. Eventually the EU adopted a directive in March 2009, which had to be implemented in all Member States by March 2011 at the latest (EC, 2009). This covers all airports handling five million or more passengers. It builds on, and is complementary to, the ICAO policies. Key features include greater transparency regarding the costs that charges are to cover, with airports being obliged to provide a detailed breakdown of costs for the airlines. The ICAO principle of non-discrimination is maintained, although airports can differentiate their services as long as the criteria for doing so are clear and transparent. They can also vary charges on environmental grounds. Consultation on charges between airports and airlines is compulsory, and there has to be an independent supervisory authority whose job is to help settle disputes over charges between airports and airlines (Table 4.2).

Table 4.2 Main features of the 2009 EU airport charges directive

Policy	Details
Non-discrimination	Charges must not discriminate between users but can be modulated for issues of general/public and environmental interest
Airport network	Airport operators may decide to introduce a charging system that covers the whole network in a transparent manner
Common charging systems	Airport operators are authorised to apply a common and transparent charging system for airports serving the same urban community or conurbation
Consultation and remedy	Users will be consulted regularly (at least once a year) concerning the level of charges and quality of service

Policy	Details
Transparency requirements	Users will be informed about components serving as a basis for determining the level of charges covering the services and infrastructure provided, the methodology used, the revenue generated, any financing from public authorities and forecasts. Users will submit traffic/fleet forecasts and development plans to the airport operators
New infrastructure	Airport operators will consult with users before plans for new infrastructure are finalised
Differentiation of services	The difference in quality and scope of services may result in a variation in airport charges
Independent supervisory authority	Countries are required to have an independent supervisory authority to ensure compliance with the directive

Source: Adapted from EC (2009)

It was not the EC's aim to impose a common regulatory system on all countries but rather to establish shared principles that are same for the EU members. Moreover, since the legislation is a directive rather than a regulation, individual countries have more flexibility in its interpretation and implementation. Importantly it does not require for the airport's competitive situation or the existence of market power to be assessed and instead uses the simpler and more basic airport size criterion to determine whether the conditions of the directive need to be applied.

A review of the directive in 2013 (Steer Davies Gleave, 2013) found this inflexible size threshold to be a significant weakness but identified practical difficulties in changing this. The review also concluded that the consultation processes had improved since the directive had been introduced, that there was greater transparency of information, but there had been little impact on the structure and level of airport charges. Moreover, it was found that the directive had not been applied consistently at all airports and so overall the initial impacts had been mixed. The EC subsequently authored a report (EC, 2014) based on this assessment which concluded that whilst some positive results had been identified in terms of increased transparency of airport charges, more needed to be done to ensure the consistent application of the directive. A new expert group, the Thessaloniki Forum of Airport Charges Regulators, was set up in 2014 to discuss the implementation of the directive. Then when a new Aviation Strategy was adopted by the EC in 2015 (EC, 2015), within the action plan for 2016–17 was a planned evaluation of this directive (with the help of the Thessaloniki Forum), which may eventually result in changes being made.

Regulation of individual airports

At a national or individual airport level, the degree of government control varies considerably. Many airports under public sector ownership usually need to seek government approval before changing their charging level or structure. In some cases this may be just a formality. At the other extreme, it may be the government's responsibility to set charges – perhaps after receiving recommendations from the airports. In some countries, there may be a more formal economic regulation system when there are serious concerns that airports with considerable market power will abuse this situation. This is particularly relevant when airports are privatised, and a number of new regulatory frameworks have been set up in countries where privatisation has occurred. This has involved using regulatory authorities that are already in existence (as in the UK) or creating new bodies specifically for this purpose (as in Ireland).

Although the regulatory systems at different airports vary, their common purpose is usually to allow the regulated airports a reasonable ROR on capital while providing the correct incentives for an efficient operation and an appropriate investment policy. In choosing the most suitable regulatory system, consideration has to be given to the best incentives to encourage appropriate investment, the treatment of commercial revenues and the maintenance of standards of service. A suitable review process also has to be established.

In general, there are three key ways in which organisations can be regulated:

- ROR or cost-based regulation
- Incentive or price cap regulation
- Reserve regulation

The ROR mechanism, or so-called profit control regulation, is the traditional mechanism which was used extensively, for example, in the United States and Australia, to regulate natural monopolies. The aim is to prevent regulated companies from setting prices that bear no relation to costs, by permitting enough revenue to cover costs and make a profit which provides a reasonable ROR on the asset base. Price increases can be justified only when an increase in costs is incurred. This type of mechanism guarantees a ROR regardless of other developments and can encourage airports to adequately invest, as larger profits can be made if the capital investment is higher to produce the same overall return.

However, whilst this method can ensure that prices are related to costs, it provides no incentives to encourage efficiency or reduce costs, and cost inefficiencies can be passed onto users through increased prices. It can also provide an incentive to overinvestment (the so-called gold-plating problem or Averch-Johnson effect) in order to achieve returns on a higher asset base. In practice, this approach can be cumbersome and problematic to implement because of the difficulty in reaching agreement as to what assets should be included in the asset base and what ROR is 'reasonable'. Moreover, to prevent cost inefficiency and overinvestment, financial data has to be scrutinised at a very detailed and intrusive level, and every time there are changes to the financial situation or other factors, these have to be considered. There is another similar regime called cost-based regulation (or cost of service/cost recovery regulation) where the focus is primarily on the cost or providing the service (rather than investment) and so whilst this is a simpler method it still provides no incentives to reduce costs.

To overcome these shortcomings, alternative regulatory systems were sought. In the 1980s, 'incentive' regulation began to be used – for example in the United Kingdom, where a number of the state utilities, including gas and electricity, were privatised. This type of regulation, often called incentive regulation, was considered to be more favourable because it can provide the regulated company with incentives to reduce costs while simultaneously controlling price increases. The most popular form of incentive regulation is a price cap that works by establishing a formula that provides a maximum price that can be set. Typically, the formula will be adjusted for inflation and an efficiency factor:

$$\text{price cap CPI} - X \text{ or RPI} - X$$

where CPI is the consumer price index, RPI the retail price index and X the efficiency gain target. Costs that are beyond the control of the company (e.g. security costs) can be excluded from the regulation:

$$\text{price cap CPI} - X + Y$$

where Y is the external costs.

Since there is no cap on the profit levels, unlike the ROR method, any efficiency gains that the regulated company can make in excess of the required X will directly benefit the company. Such a method tends to be simpler to administer, as companies can change their level or structure of prices as long as they still conform to the price cap without any justification from the regulator, which would be the situation with the ROR system. Therefore, the airport's operating costs, asset base and ROR only need to be reviewed periodically, typically three to five years, to set the price formula. However, there is an issue that the price cap may give inadequate incentives to investment because of the focus on short-term operational efficiency gains within each relatively small price control period combined with the lumpiness and long lead time of investments.

On the other hand, it has also been argued that price cap regulation is not an effective alternative to cost-based regulation as the regulator will take into account the ROR of the company, as well as other factors, including operational efficiency, planned investment and the competitive situation, when setting the price cap. For example, in order to calculate the total revenue required, a regulated asset base (RAB) is usually defined and valued at the beginning of the price control period and then consequently enlarged to take account of projected CAPEX. A WACC and depreciation allowance based on this RAB is then added to the projected level of operating expenditure (which will have taken account of any feasible improvements in efficiency) to arrive at the total revenue requirement. The RAB valuation and WACC assumptions are therefore key in determining the maximum level of prices allowed. Thus the regulated company may still have an incentive to overstate the CAPEX needed, which will be discouraged only by careful scrutiny of the regulator. In spite of these shortcomings, incentive regulation has been the most popular approach adopted for privatised airports.

A further type of regulation is the 'light-handed' approach or 'trigger', 'reserve', 'shadow' or 'conduct' regulation. While the technical definitions of these vary somewhat, the general principle is that the regulator will become involved in the price-setting process only if the airport's market power is actually abused or if the company and its customers cannot reach agreement. In this case it is the threat of regulation, rather than actual regulation, which is used to provide an effective safeguard against anti-competitive behaviour. Sometimes, with reserve regulation for example, there may be a predetermined regulatory model that will become effective at this stage. In recent years, primarily because of the increasingly competitive environment, the arguments for a more light-handed approach, or even total deregulation relying on competition law, have been given increased attention (Thelle *et al.,* 2012; Bush and Starkie, 2014).

With regulated airports, decisions have to be made as to which airport facilities and services are to be considered under the pricing regime, that is, whether a single or dual till should be used. In addition, if a price cap is used the regulator must also decide how the 'price' element of the formula is to be set. The main choice is whether to use a revenue yield or tariff basket methodology. The revenue yield formula means that the predicted revenue per unit (usually passengers in the case of airports) in the forthcoming year will be allowed to increase by the CPI – X or RPI – X percentage. With the tariff basket definition, the weighted average price of a specified 'basket' of tariffs or charges will be allowed to be raised by CPI – X. Both methods have their drawbacks, and their relative strengths have been fiercely debated by regulators and the industry. The tariff basket approach tends to be simpler as it operates directly on charges and is independent of any forecasts. Companies might, however, be encouraged to put the largest increases on the faster-growing traffic, as the weights used in the tariff basket are from a previous period. With the revenue yield methodology, an artificial incentive may be created to increase passengers to inflate the denominator in the definition. This could lead to the setting of some charges below the marginal costs of the corresponding services. In general, the tariff basket approach is usually considered to give airports greater incentives to move to a more efficient pricing structure.

It is common practice to set the price cap in relation to the average costs, which will include consideration of any proposed investment programme, additional costs related to improvements in the quality of service and a reasonable ROR. There has been some debate, however, as to whether industry benchmarking could have a much more active role in this process. Industry best practice could, in theory, replace an assessment of accounting costs as the basis for setting the price cap. This has already been used by the utility regulators for both England and the Netherlands. This would mean that the regulatory control would be independent of any company action inappropriately influencing the key variables used in the regulatory formula, including inflating the asset base.

Alternatively, benchmarking could be used much more as a cross-check to internal methods of setting the price, estimating investment costs or assessing the scope for efficiency and service quality improvements.

However, the adoption of such regulatory benchmarking or 'yardstick' regulation is fraught with difficulties because of the extensive problems of comparability associated with such an exercise, the subjective nature of how some of the associated problems are overcome, and the lack of general consensus as to the optimal method of benchmarking (see Chapter 3). There is also the fundamental issue that such an approach assumes high costs are in fact the result of inefficiency, whereas in reality they may be due to a number of other factors. Only a very detailed assessment of the benchmarking data may be able to identify these factors.

A practical example is in Ireland where the regulator previously tried to use benchmarking techniques, but came under criticism for failing to take full account of outsourcing and the nature of traffic and choosing an inappropriate selection of comparator airports. Guiomard (2016) subsequently identified some of the problems involved with trying to benchmark Dublin airport. More generally, Reinhold *et al.* (2009) have argued that although benchmarking methods are not totally robust, they can nevertheless serve as an effective decision aid tool in airport regulation as long as the limitations are recognised. An illustration of this is with the London airports where so-called 'top-down' benchmarking, using other company accounting data, together with 'bottom-up' approaches, which focus on individual activities and processes of the airports, have been used to inform regulatory reviews.

Another area of major concern within any regulatory framework is often the quality of service. When the regulation does not formally establish service standards or require an appropriate quality-monitoring system, there may be little incentive for the airport operator to optimise quality. In reducing the service standards at the airport, the operator could be able to soften the blow of the price control. This could be overcome, in theory, by ensuring there are measures of congestion and delays to assess the adequacy of the airport facilities, and by assessing passenger and airline feedback to determine the operational efficiency of the airport. As a consequence, a number of airports have formally established service standards (e.g. London, Dublin, Paris, Delhi) or require an appropriate quality monitoring system within the regulatory framework (e.g. the Australian airports, Hamburg). Further detail is provided in Chapter 6.

Finally, it needs to be emphasised that a fundamental difficulty with airport economic regulation is actually in measuring the possible existence of market power in order to determine whether regulation is needed. There is no common way of assessing this as Bilotkach and Mueller (2012) debated in their analysis of Amsterdam. Maertens (2012) developed a common approach that he used on a wide range of European airports but even in countries where more detailed market power analysis has been undertaken, such as in the UK, considerable areas of disagreement remain.

Regulation examples

Overall, according to ACI (2015), at 66 per cent of global airports there was no formal regulatory system but instead charges were subject to government approval. ROR or cost recovery was practised at 15 per cent of airports and price or revenue cap regulation existed at 12 per cent of airports. At a further 8 per cent of airports there was no specific regulation or instead light-handed regulation existed. Forty-five per cent of airports used a single till, and in contrast 37 per cent of airports had adopted a dual till. The remaining 18 per cent of airports had a hybrid till.

Table 4.3 compares the key features of economic regulation systems that currently exist at a number of selected major European airports in terms of type of regulation and regulatory till. Some major airports such as Zurich, Stockholm, Oslo, Prague and Helsinki are not subject to formal regulation and so not included in the table. The most popular approach for airports in the table is incentive regulation using a mixture of tills. Examples include Dublin that has a single till price cap of CPI–4.2% for the period 2015–19 and Paris that has a hybrid till price cap of CPI+1.75% for 2016–20. At Vienna airport, a slightly different model has been adopted, taking into account both inflation rates and traffic growth patterns. The regulation is applied directly to the charges, with a tariff basket approach. There is a sliding scale that protects revenues when there is slow growth, while requiring productivity gains to be made when traffic growth is high. Only a few airports use a cost-based approach, although this is a more popular approach when just government approval of charges is used rather than formal regulation. Germany is an interesting example because the government regulatory powers are devolved to the 16 German States and so there are a number of different regulatory approaches (Littlechild, 2012a).

Table 4.3 Examples of economic regulation at selected European airports

Airport	Type of regulation	Single or dual till
Amsterdam	Cost-based	Dual till
Athens	Cost-based	Dual till
Brussels	Incentive*	Hybrid
Budapest	Incentive	Dual till
Copenhagen	Incentive*	Dual till
Dublin	Incentive	Single till
Frankfurt	Incentive	Dual till
Hamburg	Incentive	Dual till
London Gatwick	Incentive*	Single till

Airport	Type of regulation	Single or dual till
London Heathrow	Incentive	Single till
Lisbon	Incentive	Dual till
Madrid	Incentive	Dual till
Munich	Cost-based	Dual till
Paris	Incentive	Hybrid
Rome	Incentive	Dual till
Vienna	Incentive	Dual till

*Charges negotiated directly with the airlines.

Source: Compiled by the author from various sources

Copenhagen airport is an airport that has had airport–airline agreements since the airport was privatised. Charge levels are decided on a price cap dual till basis for a four-year period between the airport operator, Danish airports and IATA (representing the foreign airlines). The price cap for 2015–19 is CPI–0. This is approved by the regulator (the Danish Civil Aviation Administration) who only intervenes if an agreement is not reached. Brussels airport also has five-year airline agreements, based on a hybrid till, which have to be ratified by the regulator. Gatwick airport is another airport that has reached agreements will airlines – this is discussed in Case Study 4.1. A number of other countries outside Europe have adopted incentive regulation for their privatised airports, including South Africa and Argentina (single till), Brazil and India (hybrid till), and Mexico and Peru (dual till) (Graham and Morrell, 2017). The situation in the US is somewhat different and so is discussed in Case Study 4.2

The regulation of the Australian airports has received considerable attention (e.g. Arblaster 2014; Littlechild, 2012b). The initial regulatory framework for the privatised Australian airports was fairly similar to that adopted by the UK airports, in that there was a CPI–*X* formula, although there was a dual rather than a single till. The Australian airports used the basket tariff rather than the revenue yield approach. As in the United Kingdom, the price cap was set for an initial five years, but the Australian regulatory framework had more formal conditions relating to airport access and quality of service monitoring that did not apply to the UK airports. The problems of inadequate investment under such regulation were also recognised and so provision was made for an upward adjustment to the price cap if approved investment was undertaken. The only major airport that was not controlled in this way was Sydney airport, which was not privatised when this regulation was introduced and was subject to a ROR-type regulation that just involved the surveillance or monitoring of prices rather than more restrictive price control (Forsyth, 2008).

This price regulation of Australian airports was identified as causing a number of problems (particularly the requirement of detailed and cumbersome regulatory intervention if investment was planned) and overall profit volatility. These problems became acute with the events of 9/11 and the collapse of Ansett, Australia's second largest domestic airline. As a consequence, in October 2001 the Australian government suspended the price regulation at all but the four largest airports. Price surveillance was maintained at Sydney airport; at Melbourne, Perth and Brisbane the price caps were adjusted upwards, which allowed the airports to increase their charges substantially. Under the regulatory system, the Australian Productivity Commission was required to undertake a review after it had been in force for five years. It was recommended that price regulation should be replaced by a much more light-handed price monitoring or surveillance approach, although the price control could be reintroduced if the airports abused their pricing freedom. Among some of the arguments used to support this change in regulatory approach (i.e. reserve regulation) was the fact that the price cap system had been costly to administer, had produced poor financial results for the airports, and was unnecessary as commercial pressures would ensure the airports would not abuse their market power. The temporary relaxation of the pricing controls was subsequently made permanent and the airports moved to this reserve regulation system. In 2006, a further review undertaken by the Productivity Commission recommended a continuation of the current system for a further six years, and the government accepted this recommendation (Forsyth, 2008). The Productivity Commission subsequently reviewed the system again in 2011 and recommended that the system should continue to operate, although with some enhancements. Subsequently, in 2012, the government accepted their overall decision and no changes have been made.

Related to this is the case of New Zealand, where the two main airports of New Zealand, Auckland and Wellington, were partially privatised in 1998. The privatisation legislation allowed for these airports and Christchurch airport to review their charges every three years, but they were not subject to any formal price regulation. The legislation also called for the regulator to conduct periodic reviews to assess whether price controls were necessary. However, this light-handed approach led to much conflict between the airport operators and users regarding the level of charges, particularly at Auckland airport, and in 2002 it was recommended by the Commerce Commission that price control should be introduced at Auckland airport. This was not recommended for Christchurch and Wellington, however, where the abuse of market power was not considered to be a major issue. In spite of this, in 2003 the Commerce Minster decided that there would be no controls on any of the three airports (Mackenzie-Williams, 2004). However, since 2011 the airports have been required to disclose more information and to comply with more auditing, certification and verification standards in accordance with the Commerce Act (Specified Airports Services Information Disclosure) Determination 2010. This includes annual disclosure of financial results and service quality, land valuation reports, fieldwork documentation related to the passenger satisfaction indicators, and a price-setting disclosure following each price setting event (intended to align with the five-year price consultation process).

Long-term contracts between airports and airlines

Historically, the normal contract between an airline and an airport was the published airport conditions of use, which described the services provided in exchange for the aeronautical fees. This was not a formalised relationship as it did not identify the rights and obligations of both parties. For example, there was no agreement as regards the standard of services to expect, and no process was identified should disputes between the airlines and airports arise. The only country that has always tended to have the rights and obligations clearly defined and incorporated into a legally binding contract was the United States. These use agreements (see Case Study 4.2) concentrated on the fees and rentals to be paid, the method by which these were calculated, and the conditions of use of the facilities. Service standards were not usually incorporated into these agreements.

However, in recent years there has been some evidence of a more formalised airline–airport relationship emerging. For example, as discussed above, at airports with light-handed regulation, airports usually have voluntarily agreed charge levels directly with their airline customers rather than having to go through a regulator. For example, this is the situation at Copenhagen and Brussels airports. Likewise in Australia, the movement from price regulation to price monitoring encouraged the airports and airlines to reach five-year agreements that cover charges and service.

Perhaps of greater significance, going beyond the focus of regulation, has been the development of long-term contracts between LCCs and airports within Europe. Starkie (2012) and Graham (2013) have argued that this has been a result of a fundamental change in the airline–airport relationship here. Deregulation has meant that the airlines have considerable freedom, especially with the cost of the internet reducing the cost of entry for airlines into the local markets. This has resulted in the LCC business models operating on a pan-European basis and in airlines having increased buying power. In turn, this has given more business risk to the airports and therefore long-term contracts seem to be a way in which airports can attempt to introduce more stability into this increasingly unstable situation.

Details about the contracts are difficult to obtain because of their confidential nature, but generally they range from 5 to 20 years, where the airport operator will offer discounted charges in return for long-term commitment from the airlines. The charges will tend to be simple, usually on a departing passenger basis linked to a price inflation index since, as discussed earlier, it is passenger numbers that drive the revenues of the LCCs. There may also be volume discounts available. There will be a number of other obligations on the airport operator, including the quality of service to be supplied regarding minimum turnaround times and the requirement to undertake marketing on behalf of the airline. If the contract covers a long period there might be commitments by the airport operator to undertake staged investment. In return, the airline will typically be obliged to guarantee to base a certain number of aircraft initially at the airport and to provide a roll-out programme for adding additional aircraft. Sometimes the airline will also have to guarantee a minimum number of passengers.

One of the earliest contracts was agreed between easyJet and Liverpool airport in 1998. Another example includes a 10-year contract signed between Durham Tees Valley airport in the UK and bmibaby (a subsidiary of BMI) in 2003. Initially, it was agreed that bmibaby would operate a minimum of two B737s exclusively from the airport in return for discounted charges and other financial support from both the airport and local government. More recently, both London Gatwick and Stansted have reached long-term agreements with many of their airlines (see Case Study 4.1). It could well be that that this long-term contract approach is how the industry will evolve to cope with this new airline–airport relationship, especially where LCCs are concerned. However, if public airports are involved it can raise issues related to state aid (discussed in Chapter 8).

Finally, relevant here is the recent development concerning a somewhat different agreement that was reached between Lufthansa and Fraport in 2017. It concerns short-term costs savings. Lufthansa and Fraport are working together, for example, to improve utilisation of their existing infrastructure; to reduce costs by improving the advance planning of passenger traffic; and to have better coordination concerning customer relations to optimise services in the non-aviation area. Fraport will not raise charges in 2018 and it is planned that this agreement will provide the basis for further discussions regarding a medium- and long-term partnership (Fraport, 2017).

Impacts of economic regulation

Different types of economic regulation can have various impacts, particularly on airport efficiency and financial performance, through their impact on prices, cost and profits and its incentives or disincentives to invest. One of the first comparative assessments of this with a sample of global airports was undertaken by Oum *et al.* (2004), who concluded that dual till price cap regulation improved economic efficiency for large, busy airports compared to the single till approach. Meanwhile, more recently Adler and Liebert (2014) looked at the efficiency of European and Australian airports and observed that dual till price cap appeared to be the most appropriate form in weakly competitive markets, whereas for relatively competitive markets, regulation seemed to be unnecessary for encouraging cost efficiency. Moreover, Adler *et al.* (2015), with their comprehensive worldwide assessment of incentive regulation, suggested that this regulation type does encourage productive efficiency and is superior to cost-based regulation in efficiency terms.

In their study of airport charges, Bel and Fageda (2010) found no statistical difference between the regulation mechanism and the level of airport charges. Later research by these authors found that large airports, with SMP, tended to be subject to highly prescriptive regulation and airports that have nearby competing airports tend to be subject to less prescriptive regulation (Bel and Fageda, 2013). With other research of charges by Bilotkach *et al.* (2012), it was concluded that single till regulation and more light-handed regulation both tended to produce lower charges. Moreover, Yang and Fu (2015) modelled price cap and light-handed approaches and found that the light-handed approach may lead to higher welfare.

Overall, this research on impacts has helped to inform the considerable debate that within the airport sector in recent years as to what, if any, is the optimal method of economic regulation to use (e.g. ACI, 2013; Biggar, 2012; Charlton, 2009; Marques and

Brochado, 2008; Starkie, 2008; Niemeier, 2010; Oxera, 2013). Some argue that, given that airports are operating in an increasingly competitive environment, they should no longer be considered as monopoly providers and consequently in the future more governments should move towards a more reserved or light-handed approach, perhaps with airline contracts. It has also been contended that many of the current regulatory systems are time-consuming, bureaucratic and costly, and that in most cases litigation or national competition law could cope with any abuses of market power.

CASE STUDY 4.1
ECONOMIC REGULATION IN THE UK

In the United Kingdom, both BAA London and Manchester airports became subject to single till price cap regulation in 1987. The other smaller regional airports did not have direct price control as they were not considered to have sufficient market power to warrant this. The price cap was reviewed every five years after an extensive assessment of the airport's operations, financial performance and future plans has been undertaken (Graham, 2008). Over the years, the approach tended to drift much more closely to an ROR method, with very detailed consideration of the RAB and cost of capital – which, as discussed, tends to be one of the shortcomings of the price cap approach. The revenue yield method was adopted at these airports.

Initially, the price cap was the same at all airports, being RPI–1 (Table 4.4). During the second five-year review period in the early 1990s, the price cap was far more restrictive, particularly for the London airports. These airports could allow most increases in security costs to be passed straight through to the airline. Initially 75 per cent of costs were permitted to be passed through, with this percentage rising to 95 per cent after the first five-yearly review. A major impact of the single till regulation at the London airports in the earlier years was that the commercial aspects of the business expanded considerably, which simultaneously led to a substantial reduction in real charges to airline users. This was until 2003–08 at Heathrow airport, when the price cap was set at RPI +6.5 per cent to take account of £7.4 billion investment needs (particularly terminal 5). It was also decided at this time that there should be rebates for users if certain service quality standards were not achieved (see Chapter 6 for details) (CAA, 2003).

The regulation process was somewhat complex because there were two regulators involved (Graham, 2008). There was the sector regulator with detailed knowledge of the aviation industry, namely the CAA, and the Competition Commission (previously known as the Monopolies and Mergers Commission), which was a very experienced more general trading regulator. It was the Competition Commission that undertook the detailed review of the airports' operations every five years and then offered advice to the CAA concerning the most appropriate level of price control. The CAA made the final decision on the price cap after consultation with the industry and other interested parties.

While the skills of these two regulators should be complementary, the two bodies were not always in agreement. For example, in the 1991 review of BAA they had very different views on assumptions concerning the cost of capital that led to substantially different values of *X* in the pricing formula being suggested until a compromise was eventually reached (Toms, 2004). Also, in the review for the years 2003–08, the CAA favoured a shift to the dual till while the Competition Commission wanted retention of the single till.

In the end, the single till was kept. In the review for 2008–13, a price cap of +23.5 and +21.0 per cent had been applied for Heathrow and Gatwick, respectively, for 2008–09, followed by +7.5 per cent and +2.0 per cent for the other four years (CAA, 2008). These positive values of *X* were to take account of the increases in costs of security and recent and new investments – particularly at Heathrow with terminal 5 and Heathrow East – but the scale of increases was very unpopular with the airline industry. Manchester airport was no longer price regulated beyond 2008, after a review by the government decided that the airport did not have enough market power to warrant this (Department for Transport, 2008a). Stansted was also investigated, but in this case the price cap was kept (Department for Transport, 2008b).

Table 4.4 The X value used for the UK airport price caps

Airport	1987–91	1992–93	1994	1995–96	1997–2002*	2003–08	2008–14†
Heathrow	–1	–8	–4	–1	–3	+6.5	+7.5
Gatwick	–1	–8	–4	–1	–3	0	+2.0
Stansted	–1	–8	–4	–1	+1	0	+1.6
	1988–92	1993–94	1995	1996–97	1998–2002	2003–08	2008–14
Manchester	–1	–3	3	–3	–5	–5	n/a

*The normal five-year charging period was extended to six years because of the timing of decisions related to the development of terminal 5 at Heathrow.

†The 2008–13 charging period was extended to 2014, when the new regulation was introduced.

After being in force for 20 years, the airport regulatory system in the UK underwent an extensive government review in 2009, and a new regime was introduced in 2014 (Department for Transport, 2009). This gives the CAA a single overriding duty to further the interests of passengers and owners of cargo in the provision of airport operation services with a more flexible licensing regime. The CAA is allowed, where appropriate, to replace fixed price caps on airports with lighter touch forms of regulation. This has superseded the previous one-size-fits-all policy for all designated airports for price control regulation. The CAA is also empowered to carry out a market power test to determine whether an airport operator should or should not be subject to economic regulation. This has replaced the designation of airports for price control regulation directly by the government; moreover, there is no automatic referral to the Competition Commission. A summary of the new and old systems is shown in Table 4.5.

Table 4.5 A comparison of the main features of the new and old UK regulatory systems

	Old (1987–2013)	New (2014 onwards)
Designation responsibility	Secretary of State for Transport	CAA
Framework	Price cap established by statute	Licence established by statute
Regulatory process	CAA five-yearly review with automatic referral to the Competition Commission	Licence details determined after review by CAA Initial period: Heathrow: April 2014–December 2018 (extended to 2019 in 2016) Gatwick: April 2014–March 2021
Appeal	Limited to judicial review	The airport operator or airlines can appeal to the Competition and Markets Authority and/or Competition Appeal Tribunal
Regulation details	Heathrow, Gatwick, Stansted (and Manchester up to 2008 when de-designated) single till, RAB based, price cap	Initial period: Heathrow: single till, RAB based, price cap Gatwick: monitoring process Stansted: not designated
Duties	Four unweighted duties	Primary duty to further the interests of users of air transport services

As a result of a review of market power in 2013, only Heathrow and Gatwick have licences. Heathrow's licence involves a price cap control (X = –1.5) whereas at Gatwick a more light-handed approach has now been introduced for the first time (CAA, 2014a, 2014b; Cheong, 2015). This was partly in response to Gatwick's 'Contracts and Commitments Initiative', which involved agreeing a series of commitments with its airlines on price, service conditions and investment, With a few key airlines (easyJet, Thomson and Norwegian) it has integrated these commitments into bespoke formal contracts. For Stansted it was decided that the airport no longer possessed significant market power (CAA, 2013), with a key influencing factor again being long-term contracts agreed with the airport's three main airlines customers, namely Ryanair, easyJet and Thomas Cook.

A key reason for the CAA accepting the Gatwick commitments framework was a belief that it would encourage bilateral airlines contracts that could be better tailored to the needs of individual airlines and their passengers, and would facilitate efficient investment, as the airport operator would have flexibility to tailor investment to the needs of airlines. This framework includes:

- A price commitment – RPI+0 for the 'blended' price (which takes accounts of discounts agreed in bilateral contracts) and RPI+1 for the published price
- A service standards commitment, incorporating a system of service quality rebates similar to before
- An investment and consultation commitment, including a commitment to develop the infrastructure to meet service quality standards and to invest at least £700 million over the seven-year regulatory period

The framework was reviewed in 2016 (CAA, 2016) and it was found that the airport had agreed bilateral contracts with airlines representing more than 85 per cent of passengers, traffic growth had exceeded expectations and overall passenger satisfaction had increased, and the airport had kept to its price and (nearly all) service quality commitments. The CAA therefore did not propose any specific changes, although it did have some concerns about the progress of airfield investment projects and some aspects of the airport operator's relationships with airlines, and so will continue to monitor the situation.

Looking forward for Heathrow, one of the major issues is the possible development of a third runway, which the government has indicated that it favours. For this airport there has always been a certain degree of pre-funding within the regulatory system but this has always been a controversial issue (as discussed above), particularly as there can be no guarantee that the airlines paying now will benefit from the future facilities. This is particularly relevant as the EU slot allocation process (described below) favours new entrants when new slots become available (CAA, 2015; Humphreys, 2015).

Slot allocation

Traditional system and recent changes

The rise in air traffic in recent years has put increasing pressure on airport capacity, particularly runway capacity, throughout the world. Theoretically, while timely capacity addition might provide a solution to this problem, in many cases environmental, physical or financial constraints have meant that in practice this has not been a feasible or desirable option. Instead, attention has been focused on more short-term solutions to provide some relief for the shortage of capacity, both by consideration of capacity or supply-side approaches and by the assessment of demand management options. In a climate of growing environmental opposition to new developments, such solutions may be politically more acceptable.

Supply-side options aim to make more efficient use of existing capacity by improving ATC services and ground-side facilities, and thus provide for incremental increases in traffic. Demand management techniques consider the most appropriate mechanisms for allocating airport slots. Airport slots are usually defined as an arrival or departure time at an airport – typically within a 15- or 30-minute period. They are different from ATC slots, which are operational take-off and landing times assigned to the airline by ATC authorities.

Alternative slot allocation procedures have to be considered at airports because the pricing mechanism fails to balance demand with the available supply. As already discussed, the current level of charges at airports and peak/off-peak differentials when in existence have a relatively limited impact on airline demand. Peak charges would have to be considerably higher to ration demand or to be the equivalent of the market-clearing price needed to match supply and demand or 'clear the market'. This is obviously not helped by the acceptance at many airports of the single-till concept which can pull down the level of charges to below that of the cost of supply.

Currently, in most parts of the world except the United States, the mechanism for allocating slots is industry self-regulation by using the administrative system that involves IATA Schedule Co-ordination Conferences and Committees. These voluntary conferences of both IATA and non-IATA airlines are held twice a year for the summer and winter seasons, with the aim of reaching consensus on how schedules can be coordinated at designated capacity-constrained airports. These airports are designated at two levels:

Schedules facilitated airports: Demand is approaching capacity, but slot allocation can be resolved through voluntary cooperation. These are known as level 2 airports.

Fully coordinated airports: Demand exceeds capacity and formal procedures are used to allocate slots. These are known as level 3 airports. The most important of these procedures

Table 4.6 Key features of the 1993 EU slot allocation regulation

Slots are allocated on the basis of historical precedence or 'grandfather rights'
Airlines must use slots of 80 per cent of the time – 'use-it-or-lose-it' rule
There is a slot pool for new or returned slots
50 per cent of slots in the pool are allocated to new entrants
Certain slots can be ring-fenced if they are vital for social or economic reasons
Airports are non-coordinated, coordinated (schedules facilitated) or fully coordinated
Coordination status is defined after capacity review and consultation
An independent coordinator supervises the allocation of slots

Source: Adapted from EC (1993)

is 'grandfather rights'. This means that any airline that has operated a slot in the previous similar season has the right to operate it again. This is as long as the airline operates 80 per cent of the flights – the so-called slot-retention requirement or 'use-it-or-lose-it' rule. The airline does not, however, have to use its slots for the same services each year and can switch them, for example, between domestic and international routes. Preference is also given to airlines that plan to use a slot more intensively to make the most effective use of the capacity. For example, priority would be given to an airline that plans a daily service rather than one that is less than daily, or a service that operates throughout the season rather than only in the peak.

There are also level 1 airports that are non-coordinated airports, where supply exceeds demand and slot allocations can be decided through simple discussions between the airline, handling agent (if relevant) and airport.

In 1999, there were 120 fully coordinated airports with more than 10 others being fully coordinated in the summer months only. Around 80 airports were schedules facilitated. By 2012, this had increased to 159 fully coordinated airports in the world and 121 schedules facilitated, and the current figure (as of Summer 2017) are 177 and 123, respectively (IATA, 2017b). Europe has most fully coordinated airports, followed by the Asia-Pacific area. Many US airports are also capacity-constrained, but do not come under the IATA Scheduling Committee mechanism. Within Europe there are 103 fully coordinated airports and 75 schedules facilitated. Sometimes demand substantially exceeds capacity at all times (such as at London Heathrow) whereas elsewhere capacity may be scarce only during certain peak periods.

Within the EU, slot allocation comes under regulation EU/95/93, which was introduced in 1993 (EC, 1993). While the IATA coordination system is voluntary, the EU rules are a legal requirement. The IATA system developed primarily as a process to coordinate schedules and to avoid unnecessary congestion, whereas the EU regulation had other key objectives, including making the most efficient use of capacity and encouraging competition. Nevertheless, many of the IATA features were just incorporated into the European law (Table 4.6). However, an important difference with the European regulation when it was introduced was that the slot coordinator had to be independent of all airlines at the airport. This enabled the process to be more transparent and impartial, as traditionally the coordinator tended to be the national carrier at the airport. In order for an airport to become coordinated, the legislation required that a thorough capacity analysis and consultation process should take place.

The European legislation aimed to encourage new entrants, who were clearly disadvantaged by the grandfather rights system, by giving them preference of up to 50 per cent of any new or unused slots. New entrants were defined as airlines with less than 4 per cent of daily slots at an airport or less than 3 per cent of slots in an airport system, such as the London airports. They were also airlines that had requested slots for a non-stop intra-EU service where two incumbent airlines already operated. Under certain conditions, slots could be reserved for domestic regional services or routes with public service requirements – so-called 'ring-fencing'. The grandfather rights system was adopted with an 80 per cent slot retention requirement, although this use-it-or-lose-it rule was temporarily suspended after 9/11 and in the summer of 2009. In these cases, airlines dropped routes because of the sudden drop in traffic, but did not want to lose their historical slots. This was permitted as the result of an amendment in 2002 which stated that in certain exceptional circumstances air carriers will not lose their grandfather rights to slots.

The EC undertook a review of this slot allocation process and found little evidence that it had encouraged competition or lessened the influence of the major network carriers at the airports. This is hardly surprising given that the European regime largely maintained the grandfather rights system. At the same time, delays and congestion at many European airports had increased. After a long period of further review and consultation, the EC put forward some new proposals in 2001. The proposals were divided into two parts: first, some immediate technical amendments to the existing regulation (adopted in 2004); second, some more long-term aims concerned with structural changes to the actual system of allocation.

The technical amendments in EC (793/2004) covered a number of different areas, primarily to make the system more flexible and to strengthen the coordinator's role (EC, 2004) (Table 4.7). They stated that there should be financially independent coordinators at each airport and that there should be better enforcement and monitoring of the slot rules. The legal status of slots was clarified by defining them as permissions rather than property to be owned. There was the retention of grandfather rights and the use-it-or-lose-it rule, but the new entrant threshold was raised to 7 per cent. Another new feature was consideration of environmental constraints, with the possibility of higher priority being given to larger aircraft size or lower priority to services where surface alternatives existed. There were then further EC communications in 2007 and 2008 that clarified certain points relating to slot trading, independency of coordinators, new entrants and local rules.

In the longer term the EC has been looking at more radical changes to the current process for some time. In 2004, a report considering market-oriented slot allocation mechanisms and their feasibility was completed for the EC (NERA Economic Consulting, 2004). This led to a period of consultation in 2004 and was followed by a second study in 2006 that focused on secondary trading in more detail, including an assessment of the full economic impacts (Mott MacDonald, 2006). Then in 2011 there was further research by Steer Davies Gleave (2011). This concluded that there was sub-optimal use of capacity at some airports, with some carriers unable to grow their operations to compete with incumbent carriers. It found that at some airports (e.g. Frankfurt, Munich, Heathrow, Paris CDG) the share of grandfather slots was 90 per cent or higher (99 per cent at Heathrow). It concluded that there was inadequate operation of the slot coordination process at some airports, and made a number of key recommendations. This included allowing slot trading; reforming the rules related to new entrants; tightening the rules related to demonstrating use of slots; tightening the rules relating to the independence of the coordinator; increasing the level of transparency on slot transactions; and improving the flow of information between different stakeholders. The research suggested that these proposed changes could be worth €5 billion to the European economy. Also, they could create 62,000 more jobs over the period 2012–25 and would allow the system to handle 24 million more passengers a year by 2025. Many of these suggestions have been incorporated into the EC's proposals for a revision of the slot regulation, which have been under consideration for a number of years, although now come under the planned changes within the new Aviation Strategy (EC, 2015).

Alternative slot allocation mechanisms

The discussion so far has provided details of the traditional system related to slot allocation and has outlined the changes that have occurred within Europe. There now follows a broader consideration of the alternative slot allocation mechanisms that could potentially be used in the future. Undoubtedly, the current scheduling committee system is widely accepted and has succeeded in providing a stable environment for allocating slots. However, there is considerable concern that as pressure on runway capacity continues, it may not be the most effective mechanism to manage the scarcity of slots or encourage competition. Critics claim that this procedure gives no guarantee that the scarce airport capacity is used by the airlines that value it most highly, it provides no guide to future investment requirements and is administratively burdensome. Also, many new entrants are prevented from competing at major airports. In addition, it can result in wasteful behaviour by airlines that 'warehouse' or 'babysit' slots by operating empty or 'ghost' flights to ensure they retain their slots. The current system, by being based on payment for actual use, provides poor incentives for airlines to actually use slots efficiently. Thus airlines may hold onto slots by using them enough to meet the use-it-or-lose-it criteria, but they may waste the scarce runway resources by not making full use of the slots all the time.

There have been lengthy debates discussing whether a better system could be introduced (e.g. DotEcon, 2006; Czerny *et al.*, 2008; Madas and Zografos, 2010). Various regulatory suggestions have been put forward including giving preference to long-haul international flights, which normally have less flexibility in scheduling than short-haul flights because of night closures and other constraints. This could potentially have an environmental

Table 4.7 Key features of the 2004 amendments to the 1993 EU slot allocation regulation

The coordinator is financially independent
The legal status of a slot is a permission, not entitlement or property
There is a broader definition of a 'new entrant'
At a local level the rules can be linked to aircraft size for environmental reasons
At a local level the rules can be linked to other transport modes
There are improved enforcement and monitoring procedures

Source: Adapted from EC (2004)

benefit by switching short-haul traffic from air to surface transport. Priority could be given to airlines that cause the least noise nuisance. Scheduled airlines could be favoured over charter airlines, and passenger aircraft could have preference over cargo airlines. Alternatively, frequency caps could be placed on certain services once a daily maximum limit has been reached. Another suggestion is to give priority to larger aircraft that make the most efficient use of slots.

Table 4.8 Examples of slot trades at Heathrow airport

Buyer	Seller	Date	Number of slot pairs	Approximate total price (million US$)	Approximate average price per daily slot pair (US$ million)
BA	Air UK	1998	4 per day	25	6
BA	SN Brussels	2002	7 per day	65	9
BA	Swiss	2003	8 per day	55	7
BA	United	2003	2 per day	20	10
Qantas	Flybe	2004	2 per day	35	18
Virgin	Flybe	2004	4 per day	35	9
Virgin	Air Jamaica	2007	4 per week	10	n/a
BA, Qatar Airways, Continental*	GB Airways	2007	4 per day	160	40
Continental, US Airways, BA*	Alitalia	2007	3 per day	140	47
Continental	GB Airways, Air France, Alitalia	2008	4 per day	210	52
Delta	Jet Airways	2013	3 per day	74	25
American	SAS	2015	1 per day	60	60
Oman Air	Air France/ KLM	2016	1 per day	75	75
Delta	Croatia Airlines	2017	5 per week	19	n/a

*There is some double counting with these 2007 trades as sale prices for individual airlines were not always available.

Source: Compiled by the author from various sources

While such mechanisms can be useful in pursuing some economic, social or environmental objective, they are still likely to be used in combination with grandfather rights. As a result, any such system will again share the shortcomings of the traditional system by not ensuring that the scarce runway slots are used by the airlines that value them the most and that will most closely serve the underlying passenger demand. Instead, market-based options (MBMs) could be considered for both primary allocation, where the slots are initially allocated, and secondary allocation, where the use of slots may be changed at some later stage. In the latter case this will involve setting up a system of secondary slot trading where airlines are able to buy and sell slots.

The simplest of all MBMs for primary allocation is the use of some charging mechanism, or so-called 'posted prices' to match demand and supply. A fee is attached to each slot, and demand is thus reduced by raising the cost of using the slot. This could either be a set fee or could be differentiated between peak and off-peak slots, to reflect the varying patterns of demand. However, as discussed, the market-clearing price would have to be set at a considerably higher rate than is the current practice with airport charges. An alternative suggestion is to use the auction mechanism as a means of allocating slots. These auctions could be held every six months, like the scheduling committees, but this would clearly lead to considerable upheaval and disruption for both airlines and passengers. At the other extreme, there could be just one auction, selling the slots rights in perpetuity, and then any further changes would have to be implemented through some secondary mechanism. Somewhere in between these two options, slots allocated under long-term lease agreements could be a more attractive compromise. Individual slots or a combination of slots could be auctioned at one particular time.

Alternatively, lotteries for slots could be held. This might potentially overcome the anti-competitive problem caused by slot trading in that all airlines of all sizes would have access to slots, but in practice this could cause havoc with airlines' schedules and be very disruptive. Slots obtained at one end of the route might not match up with those at the other end, and in general there would be a great deal of uncertainty. Also, a major issue with all these primary allocations would be deciding who should retain the money that has been paid for the slots (the airport operator? the government?), and whether it should be stipulated that it is used at the airport for future investment to provide capacity or to reduce the environmental impacts.

The research undertaken by NERA Economic Consulting (2004) considered the potential impacts of these different MBMs. The main focus was on investigating whether such mechanisms would achieve a more efficient use of scarce airport capacity by assessing the effect on passenger numbers. Other factors were considered, including the implementation costs, the potential for instability in airline schedules, the likelihood of increased concentration at hub airports, consistency with existing procedures and risk of international disputes. Five main options were investigated, the first three being secondary pricing and higher posted prices on their own, and then both together. The fourth option was using secondary trading with an auction of the pool slots, and the most radical case assumed that there would be a long lease agreement with an auction of 10 per cent of all existing slots each year in a rolling programme so that each slot would come up for auction every 10 years. This was considered with secondary trading.

It was concluded that all the options would produce higher passenger numbers with a shift in traffic patterns, because the airlines that would value and be prepared to pay most for the slots would tend to be those offering long-haul services with larger aircraft and those with higher load factors. In addition, slot utilisation would be expected to improve as the airlines would be less likely to hold onto slots that they do not need. One of the disadvantages with the higher posted prices is the risk of international disputes. The same is true of the 10 per cent auction and secondary trading option because of its more radical nature. This latter approach would also be the most expensive to implement and be the most disruptive to airline schedules. All scenarios would be likely to lead to an increased concentration of hub carrier slots.

In its proposals for revision to the directive, the EC is proposing the formal acceptance of secondary trading. Historically, airlines have not been officially permitted to undertake such practices except with the case of four US airports (see Case Study 4.2). In Europe, slot exchanges are allowed under the EU regulation, but slot trading was not specifically allowed or banned until the 2008 Communication where it said that it would not pursue infringement proceedings against countries that allowed secondary trading in a transparent way.

In the UK before this, an important decision was made in 1999 by the UK High Court when it ruled that the financial payment from BA to Air UK to 'compensate' for the exchange of some highly demanded slots with some less attractive slots did not invalidate the exchange. This allowed the so-called grey market for slot trading to develop where valuable slots were bought and very often exchanged for 'junk' or useless slots. Research on secondary trading at Heathrow by Mott MacDonald (2006) for Heathrow found that between 2001 and 2006, 499 slots a week (compared with a total of 8,700) had been traded. Overall, it was concluded the UK experience had led to a liquid and flexible market in slots, had fostered new entry and had been supported by the industry, with direct competitors being prepared to trade with each other. It had also improved slot efficiency as a number of short-haul carriers had been replaced with long-haul carriers with larger aircraft. More recently Fukui (2014) examined the effect of airport slot trading on route-level competition using data on slot trades in the UK. The results suggested that the slot trades among partner carriers contributed to slightly increased competition, whereas the slot trades between rival carriers had a negative effect on the number of competitors at the route level. More generally, slot trading has always been a subject of much debate (e.g. see Verhoef, 2010; De Wit and Burghouwt, 2008) and continues to be so.

As capacity has become scarcer, the price for a peak slot has risen sharply (Table 4.8), specifically at Heathrow. While the commercial nature of these transactions means it is difficult to get accurate figures, in the early 2000s it was generally thought that airlines were paying up to £10 million (around US$20 million) for a pair of slots in peak times. However, in 2007 the price appeared to have more than doubled, primarily because airlines were very keen to acquire slots at Heathrow to take advantage of the new route opportunities that had arisen because of the EU–US Open Skies agreement which came into effect in April 2008. Prices have continued to increase and in 2016, US$75 million was paid for a daily slot pair. Interestingly, the company Airport Coordination Limited (ACL) that coordinates slots at 39 airports (including Heathrow and 27 other airports in the UK and Ireland) has established a web portal, called slottrade.aero, to help airlines wishing to buy, sell, lease and swap scarce airport slots.

While there is now considerable evidence to suggest that some kind of market-based mechanism could make more efficient use of scarce runway resource, there have always been some competition concerns. This is because such an approach will usually increase the dominance of the major airlines at the airports, even though other second-tier airlines will have better opportunities to compete. In addition, such dominant airlines might place restrictive covenants on how the traded slots can be used to dampen the competition. These factors could be addressed by undertaking market investigations by relevant competition authorities, banning any restrictive covenants and generally increasing the amount of transparency associated with any slot sales. Some argue that such increased concentration may not always be a negative development for passengers.

Another potential issue may be reduced competition with short-haul services, and perhaps a loss of regional services which tend to be served with smaller aircraft that are less full. In this case use of the European PSO legislation may help to improve the situation, as might allowing slots to be sold to other bodies, such as regional authorities which could then safeguard slots. In general, making the best use of existing resources, while at the same time encouraging or enhancing competition for all, is not an easy matter. For example, it may be feasible to focus on competition, but that may cause sudden disruption in schedules. Likewise, it may be possible to protect certain routes through ring-fencing, but this may not produce the most effective use of the scarce runway slots.

However, in spite of these debates covering alternative mechanism, with the exclusion of Europe and the United States, most countries have continued to adopt the voluntary IATA scheduling standards with no plans for changes. A notable exception is Mexico, where in 2017 a different system was proposed. This included features such as the auctioning of slots to the highest bidder, the confiscation of 10 per cent of existing slots from airlines at congested airports, the withdrawal of slots based on punctuality criteria and the imposition of an 85 per cent, rather than 80 per cent, 'use-it-or-lose-it' rule. IATA was strongly opposed to these proposals (IATA, 2017c).

Ground handling issues

Ground handling activities at airports are very important to airlines. They have an impact on both an airline's cost and the quality of service they provide for their passengers and freight shippers. Ground handling services cover passenger handling, baggage handling, freight and mail handling, ramp handling, fuel and oil handling, and aircraft services and maintenance. Such activities are often divided between terminal or traffic handling (passenger check-in), baggage and freight handling, and airside or ramp handling (activities including aircraft loading and unloading, cleaning and servicing). Sometimes these services are offered by the airport operators, although at most airports they are provided by airlines or handling agents.

Whilst traditionally many airlines used to do their own handling, in recent years there has been a trend towards outsourcing, with IATA estimating that this happens for more than half the world's airlines (CAPA, 2014a). The ground handler industry has been consolidating, for example with WFS-Aviapartner in 2012, Swissport-Servisair in 2013 and Menzies-ASIG in 2017. Figure 4.4 shows the large number of stations served by the major handlers. One reason for this trend is to ensure a strong negotiation position as the airline industry itself becomes more concentrated (CAPA, 2014b). The leading handler is Swissport, which was bought by the Chinese company HNA Group (which owns both airlines and airports) in 2015. DNATA, part of the Emirates Group, has also been expanding through consolidation and merger (Steer Davies Gleave, 2016).

Historically, often the national airline or airport operator may have had a monopoly or near monopoly in ground handling. For example, within Europe some airport operators, including Milan, Rome, Vienna and Frankfurt airports, which traditionally were heavily involved in such activities, earned very significant revenues from such activities – sometimes over half the total income of the airport. In other cases, the airport operator earned just rental fees and perhaps a small concession fee from the airlines or agents that offered the handling services. Countries in Europe where the national airline used to have a handling monopoly included Spain with Iberia and Greece with Olympic.

For operational reasons, it is far easier to have a number of airlines providing traffic handling rather than ramp handling – given capacity constraints of the equipment and space in the ramp handling areas. Hence providers of monopoly services have claimed that

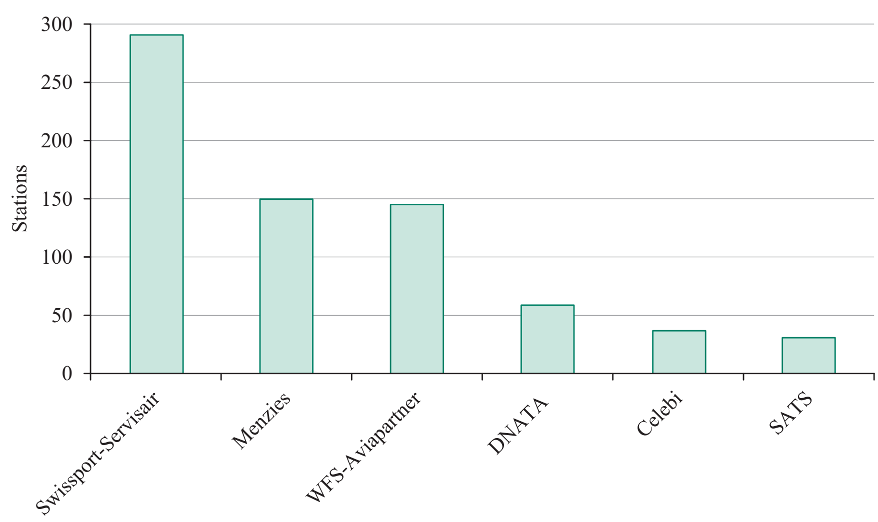

Figure 4.4

Ground handling stations by major companies, 2015/16

Source: Adapted from Steer Davies Gleave (2016) introducing competition, particularly for some ramp handling services, would merely duplicate resources and reduce efficiency, and may also cause considerable apron congestion, particularly at airports that are already at full or near capacity. However, others, particularly airlines, have argued that ground handling monopolies can push up prices and reduce service standards.

Within the EU it was argued that air transport could not be fully liberalised unless the ground handling activities were offered on a fully competitive basis, and this resulted in the EU's adoption of the ground handling directive EC/96/67 in 1996 (EC, 1996). The long-term purpose of this phased directive was to end all ground handling monopolies and duopolies within the EU by opening up the market to third-party handlers, recognising the right of airlines to self-handle, and guaranteeing at least some choice for airlines in the provision of ground handling services (Table 4.9) For airports larger than 2 million passengers, this allowed free access to third-party handlers, although for certain restricted categories of services (baggage handling, ramp handling, fuel and oil handling, freight and mail handling) the number of suppliers may be limited to no fewer than two. One of these suppliers has to be independent of the airport or the dominant airline (which handles over 25 per cent of the traffic). At all airports airlines are allowed to self-handle for the passenger services, but only at airports larger than 1 million passengers for the restricted services, where again there may be limits with no fewer than two airlines.

A study was undertaken in 2002 to investigate the impact of the directive (SH&E, 2002). The number of third-party handlers had increased although the number of self-handlers had remained the same or even decreased in some cases. It concluded that prices for ground-handling services had dropped, and this was particularly the case where there had previously been handling monopolies or a highly regulated market. This may have been due to the increase in competition between handlers because of the directive, but also because of cost pressures from the airlines. However, as regards quality of service levels, there was a more mixed picture.

Table 4.9 Key features of the 1996 EU ground handling directive

	General services	Restricted services*
Airline self-handling	All airports	All airports >1 million passengers or 25,000 tonnes. No fewer than two airlines
Third-party handling	All airports > 2 million passengers or 50,000 tonnes	All airports >2 million passengers or 50,000 tonnes. No fewer than two handlers. At least one handler must be independent of the airport operator or dominant airlines with more than 25 per cent of the traffic

*Baggage handling, ramp handling, fuel and oil handling, freight and mail handling.

Source: Adapted from EC (1996)

A further study in 2009 found that the number self-handlers and third-party handlers had increased significantly during the period 1996–2007 (Airport Research Center, 2009). Overall between 1996 and 2010, airport operators decreased their market share in ground handling from 25 to 16 per cent, and airlines decreased their share from 68 to 39 per cent. At the same time the independent handlers increased their share from 7 to 45 per cent (ACI Europe, 2011). However, at some airports, for example in Germany, Adler *et al.* (2013) have argued that it has been difficult for the airport operators to compete in handling as the strong labour unions prevent the airport management from either cutting wages or outsourcing this service to third-party providers without guarantees that workers would continue under the same conditions. Another relatively unexplored area is whether there is any potential for economies of scale or scope for handling operations at airports, although specifically for Brussels airport, Meersman *et al.* (2011) found this not to be the case.

While there has been an increase in overall competition as regards the EU ground handling markets, research (Airport Research Center, 2009; Steer Davies Gleave, 2010) has indicated that there could be improvements made to the efficiency and quality of services offered. In addition, some countries, including Spain, Germany, Austria, Belgium and Portugal, limited competition in the restricted services to the minimum of two service providers. Therefore, the EC put forward some revisions to the directive including increasing the minimum number of service providers (in restricted services) from two to three at large airports; allowing member states to go further in protecting workers' rights to maintain a high-quality workforce; strengthening the role of airports as the 'ground coordinator'; and providing them with a new set of tools, for example minimum quality standards, to do this. This was generally supported by the airlines but not the airports and was never actually implemented.

CASE STUDY 4.2
THE US EXPERIENCE

Airport use agreements

The relationship between airports and airlines in the United States is unique and so is worthy of special consideration (Riconda & Associates *et al.*, 2010). The airports and airlines enter into legally binding contracts known as airport use-and-lease agreements that detail the fees and rental rates that an airline has to pay, the method by which these are to be calculated, and the conditions for the use of both airfield and terminal facilities. A key reason for the existence of these agreements has been that private bondholders have demanded the security of such formal relationship between the airports and airlines before investing in the airport.

Traditionally, there have been two basic approaches to establishing the airport charges, namely residual and compensatory. With the residual approach, the airlines pay the net costs of running the airport after taking account of commercial and other non-airline sources of revenue. The airlines provide a guarantee that the level of charges and rents will be such that the airport will always break even, and so they take considerable risk. Alternatively, with the compensatory approach the airlines pay agreed charges and rates based on recovery of costs allocated to the facilities and services they occupy or use. The risk of running the airport is left to the airport operator. The residual approach is therefore more akin to the single till practice, while the compensatory approach is more similar to the dual till approach. Airports have applied these two approaches in various ways to suit their particular needs, and have increasingly adopted hybrid approaches that combine elements of both residual and compensatory methodologies.

The use agreements historically have been long-term contracts, but in more recent years they have become shorter to reflect the more volatile aviation environment. The length of use agreement will normally coincide with any lease agreements that the airlines have with the airport operator. In the United States, it is common for airlines to lease terminal space or gates, or even to lease or build total terminals – as in the case of JFK airport in New York. The airlines that carry most of the airport's traffic may also play a significant role in airport investment decisions if they agree to the majority-in-interest (MII) clauses in the use agreement. These clauses, which are far more common among residual agreements, typically mean that these signatory airlines have to approve all significant planned developments or changes at the airport. The anti-competitive nature of such agreements can be a problem if other non-signatory airlines are prevented from gaining access to terminal space and gates. As a result, there has been an increasing use of use-it-or-lose-it clauses – the control of assets is returned to the airport if the airline does not use the facilities as intended.

Capacity improvements that may bring more opportunities for competition may also not be approved by the signatory airlines. This has meant that some airport operators have tried to reduce the powers of the signatory airlines by requiring MII disapproval rather than approval, or have limited the airlines' influence to only major projects. Some airports have discarded MII clauses altogether.

In a survey undertaken by ACI North America (2012), it was found that 30 per cent of airports used the compensatory approach and 23 per cent used the residual approach, with a hybrid situation existing for the other airports. Comparable figures for 2003 were 21 per cent for compensatory and 26 per cent for residual – showing an increase in the use of the compensatory approach. The decline in length of agreement was also clearly observed with only 16 per cent of agreements lasting longer than 5 years in 2012 compared with 38 per cent in 2003. Two-thirds of airports had MII clauses. Specifically for the major airports, Table 4.10 shows the approaches used by 30 large hub US airports in 2015. With these airports, there are double the number using a compensatory methodology as opposed to the residual system (Wu, 2015).

Table 4.10 Use agreement approaches at large hub US airports, 2015

Residual	Compensatory	Hybrid
Detroit	Atlanta	Denver
Fort Lauderdale	Baltimore	Honolulu
Las Vegas	Boston	Washington Dulles
Chicago Midway	Charlotte	Washington National
Chicago O'Hare	Dallas Fort Worth	Salt Lake City
Miami	Houston	Tampa
Philadelphia	Los Angeles	
San Francisco	Minneapolis-St Paul	
	New York La Guardia	
	New York JFK	
	New York Newark	
	Orlando	
	Pheonix	
	Portland	
	San Diego	
	Seattle	

Source: Adapted from Wu (2015)

Interestingly, Richardson *et al.* (2014a) observed that the financial performance of US airports varied considerably by the agreement type. In further analysis Richardson *et al.* (2014b) found that the compensatory airports were the most financially efficient, particularly in terms of debt efficiency, revenue generation and profitability, but the residual airports delivered higher levels of commercial performance and cost efficiency.

Airport fees and taxes

The landing fees at US airports are normally very simple, being based on a fixed rate per 1,000 lb. Signatory airlines may pay less. The charges tend not to vary according to noise levels or peak periods, unlike the practice at some European airports. The level of landing fees tends to be relatively low, partly because the airport operator provides a minimal number of services itself. The generation of aeronautical revenues at US airports is subject to a number of statutory requirements determined by Congress and policy statements issued by the Federal Aviation Administration (FAA)/ Department of Transportation. First, there is the federal government requirement for 'fair and reasonable' and not 'unjustly discriminatory' aeronautical fees based strictly on costs. Second, airports are prohibited from using airport revenues for non-airport purposes. This latter requirement is one of the major obstacles in the way of any significant developments towards airport privatisation in the United States (Graham, 2004).

Unlike most other airports in the world, US airports do not have passenger charges – although some of the costs associated with terminal and gate space that are normally incorporated into the passenger fee may be covered by airline lease payments and terminal rental charges. US airports are not legally allowed to levy passenger charges, primarily because of fears that such revenues will be diverted from the airport to be used for non-aviation purposes. However, in 1990 the federal government approved the levying of PFCs. Although the PFCs are legally and constitutionally different from passenger charges levied elsewhere in the world, they have a similar impact on airlines. The initial PFC legislation allowed for airports to levy a US$1, US$2 or US$3 fee that had to be spent on identified airport-related projects or could be used to back bonds for the projects. In 2001 it was agreed that the maximum PFC could be raised to US$4.50. Airlines have no veto rights when it comes to PFC-funded projects, nor can they have exclusive rights.

PFCs were first used in June 1992. It has been estimated that US$3.3 billion was collected from PFCs just in 2016, with 96 out of the top 100 airports (by passenger numbers) using them. As of 31 July 2017 and since 1992, 396 airports have been approved to collect PFCs, and since their introduction 18 per cent of this total funding has been for airside projects, 38 per cent for landside projects, 4 per cent for noise projects, 6 per cent for access projects and 34 per cent for paying interest (this excludes the new Denver airport where US$3.1 billion in total was raised from PFCs) (FAA, 2017a). Some PFCs have been approved for a long time (longer than 30 years) whereas others have been used for as little as 3 years.

There are also a number of government taxes that push up the total amount paid by the airlines and their passengers (Table 4.11). There are the taxes that go into the Federal Airport and Airway Trust Fund, which provides the finance for airport investment grants under the AIP (and finance for the ATC system). The most significant of the taxes is the domestic passenger ticket tax, which accounts for around half of all the trust fund. Then there are also additional taxes relating to fuel, security, agriculture and health inspection, and customs and immigration services. Over the last 15 years, AIP grants have exceeded US$3 billion annually and it is estimated that there will be a need for around US$32 billion for AIP eligible projects between 2017 and 2021 (FAA, 2016). The participating airports are 3,340 in number, having been identified in the National Plan of Integrated Airport Systems (NPIAS). The grants can be used for capital planning and development, safety and security enhancement, noise abatement, and other non-revenue generating projects. They consist of two types, formula or entitlement funds based on airport passenger numbers, and discretionary funds for different types of airport projects. As well as these two types of finance, a major third source, particularly for the larger airports, is tax-exempt bonds – US$5.5 billion in such bonds was issued in 2014. Figure 4.5 shows the relative importance of these three main sources of funding.

Table 4.11 Taxes at US airports (as of 1 January 2017)

Type of tax	Tax rate	Unit of taxation
Airport and Airway Trust Fund		
Passenger ticket tax	7.5 per cent	Domestic air fare
Passenger flight segment tax	US$4.10	Domestic passengers
International departure & arrival tax	US$18.00	International passengers
Frequent flyer tax	7.5 per cent	Sale of frequent flyer miles
Cargo waybill tax	6.25 per cent	Waybill for domestic freight
Commercial aviation jet fuel	4.3 cents	Gallons
Passenger facility charge	Up to US$4.50	Passengers
Department of Homeland Security		
September 11 fee	US$5.60	Passengers
Aviation security infrastructure fee	Carrier-specific	
Animal and Plant Health Inspection Service passenger/aircraft fee	US$3.96/US$225.00	International passengers/aircraft
Customs user fee	US$5.50	International passengers
Immigration user fee	US$7.00	International passengers

*Includes retained earnings, state funding and other sources.

Source: Adapted from Airlines for America (2017).

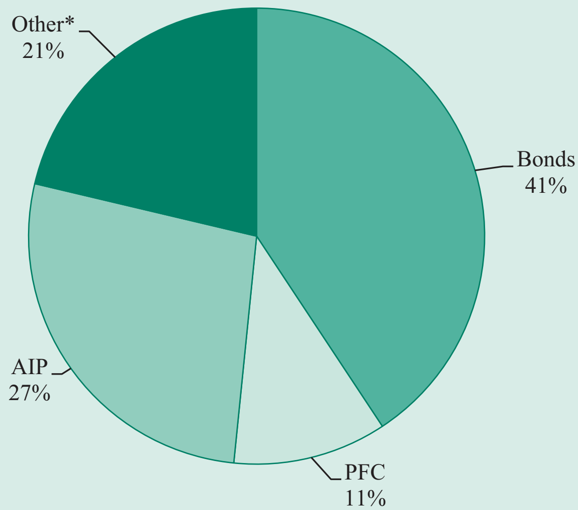

Figure 4.5
US airport capital funding for committed projects, 2013–17
Source: Adapted from ACI North America (2013)

In recent years there has been considerable debate as to the effectiveness of these sources of finance. The airport sector has favoured raising the PFC cap which they argue will provide airports with more local control to meet their individual needs. However, this has been opposed by the airline, fearing that it will lead to an increase in passenger cost and consequently to a decrease in passenger demand and airline profit (GAO, 2017). There has also been concern over the uncertainty of the future federal aviation budget, and fears that some of the AIP funds will not be fully allocated and may be diverted to other FAA operations or other government public spending activities (as has happened in the past), as well as the possible removal of the tax exemption for the municipal airport bonds. Interestingly, from a purely efficiency viewpoint Zou *et al*. (2015) found that PFC use has a positive impact on airport productive efficiency, whereas the use of AIP grants is negative, indicating that raising the PFC ceiling whilst decreasing AIP grants might be a beneficial solution.

Slot allocation

At most airports in the United States there is no formal slot allocation mechanism such as the IATA Scheduling Committees, since these would be in conflict with antitrust laws. This means that, instead, there is open access to the airports barring any environmental constraints, and airlines design their schedules independently, taking into account any expected delays. This 'first-come, first-served' system can result in considerable congestion at certain times of day when many flights are scheduled around the same time.

The exception to this practice is at a few airports that have been subject to the 'high-density airport rule'. This rule was introduced in 1969 by the FAA as a temporary measure to reduce problems of delay and congestion at JFK, La Guardia and Newark airports in New York (although it was relaxed for Newark in 1970), O'Hare airport in Chicago and Washington National airport. The traffic was divided into three categories: air carriers, air taxis (now commuters) and other (primarily GA), with a different limit on the number of flights during restricted hours for each category. No slot allocation mechanism was defined, but the relevant airlines were given anti-trust immunity to discuss coordination of schedules.

Initially, the rule worked relatively well, but the increase in traffic due to airline deregulation in 1978, and other factors including a major ATC strike, resulted in a new allocation system being introduced in 1985. This was the 'buy–sell' rule which effectively meant that after an initial allocation process based on grandfather rights, airlines were then permitted to buy and sell their slots. Airlines were also allowed to 'lease' slots on a short-term basis. This has been the only formal secondary trading market for slots in any part of the world. This trading of slots was limited to domestic operations (international routes being more complex because of international regulation), with air carriers slots being unable to be traded for commuter slots, and vice versa. Slots used for essential air services were excluded. There was a use-it-or-lose-it rule requirement of 65 per cent, and a slot pool was established for newly available slots. These were reallocated using a lottery – with 25 per cent initially being offered to new entrants. International slots were allowed to be coordinated through the IATA Scheduling Committees.

Over 10 years' experience of this slot trading led to increasing criticism of the system. There had been very few outright sales of air carrier slots, very few new entrants, and regional services had been reduced. The established airlines had increased their dominance at the airports – although this had to be viewed within the context of a US airline industry that itself had become more concentrated (Starkie, 1998). As a result of these concerns, the Aviation Investment and Reform Act (also known as AIR21) of 2000 made substantial changes to the slot rules at these airports. At Chicago O'Hare airport the slot rules were eliminated by 2002 (there was additional capacity). At the New York airports the rules were withdrawn in 2007.

In anticipation of severe delays following the expiration of the rules, at La Guardia the FAA introduced a temporary control order limiting operations. This was extended in 2009 and 2011. Equivalent restrictions were not imposed initially at JFK and Newark, and as a result there were severe delays and over-scheduling at these airports in 2007. The FAA responded by introducing similar control orders in 2008 at these two airports. These again have been temporarily extended. The orders limit the number of slots, have a minimum use requirement (80 per cent as in Europe) and allow secondary trading through leases, but not on a permanent basis. In 2009 it was planned that there would be an auctioning process for 10 per cent of the slots at the three New York airports, but this was unpopular, particularly with the airlines, was blocked by a federal appeals panel, and in the end was abandoned (GAO, 2012).

The FAA had plans to replace these temporary limits with longer-term limits which would continue to control the slots and establish a secondary market for slots. However, this policy was abandoned in 2016 when it was decided that Newark would become a level 2 airport, whilst the restrictions at JFK and La Guardia would be extended until 2018. At these slot-constrained airports, the FAA generally follows the IATA Committee guidelines unless they are in conflict with US laws or rules (FAA, 2017b).

References

ACI (2013) *The ACI Guide to Airport Economic Regulation*, Montreal: ACI.
ACI (2015) *Airport Economics Survey 2014*, Montreal: ACI.
ACI (2017) *Airport Ownership, Economic Regulation and Financial Performance*, Montreal: ACI.
ACI Europe (2011) *ACI Europe Position on Requirements for a Performing Ground Handling Market,* Brussels: ACI Europe.
ACI Europe (2016) *Levering Airport Investment to Drive the EU's Aviation Strategy*, Brussels: ACI Europe.
ACI North America (2012) *2011–12 Airport/Airline Use and Lease Agreement and MII Survey*, Washington, DC: ACI North America.
ACI North America (2013) *US Airport Capital Needs (2013-17)*, Washington, DC: ACI North America.
Adler, N., Forsyth, P., Mueller, J. and Niemeier, H.-M. (2015) 'An economic assessment of airport incentive regulation', *Transport Policy*, 41: 5–15.
Adler, N. and Liebert, V. (2014) 'Joint impact of competition, ownership form and economic regulation on airport performance and pricing', *Transportation Research Part A: Policy and Practice,* 64: 92–109.
Adler, N., Liebert, V. and Yazhemsky, E. (2013) 'Benchmarking airports from a managerial perspective', *Omega*, 41(2): 442–58.
Airlines for America (2017) *U.S. Government-Imposed Taxes on Air Transportation*. Online. Available at http://airlines.org/dataset/government-imposed-taxes-on-air-transportation/ (accessed 30 March 2017).
Airport Research Center (2009) *Study on the Impact of Directive 96/67/EC on Ground Handling Services 1996–2007*, Aachen: Airport Research Center.
Arblaster, M. (2014) 'The design of light-handed regulation of airports: Lessons from experience in Australia and New Zealand', *Journal of Air Transport Management*, 38: 27–35.
Aviation Economics (2016) *Analysis of Airport Charges – Airlines 4 Europe*, Airlines 4 Europe: London.
Bel, G. and Fageda, X. (2010) 'Privatization, regulation, and airport pricing: An empirical analysis for Europe', *Journal of Regulatory Economics*, 37: 142–61.
Bel, G. and Fageda, X. (2013) 'Market power, competition and post-privatization regulation: Evidence from changes in regulation of European airports', *Journal of Economic Policy Reform*, 16(2): 123–41.

Biggar, D. (2012) 'Why regulate airports? A re-examination of the rationale for airport regulation', *Journal of Transport Economics and Policy*, 46: 367–80.

Bilotkach, V., Clougherty, J., Mueller, J. and Zhang, A. (2012) 'Regulation, privatization and airport charges: Panel data evidence from European airports', *Economics of Transportation*, 42(1): 73–94.

Bilotkach, V. and Mueller, J. (2012), 'Supply side substitutability and potential market power of airports: Case of Amsterdam Schiphol', *Utilities Policy*, 23: 5–12.

Brueckner, J. (2005) 'Internalization of airport congestion: A network analysis', *International Journal of Industrial Organization*, 23(7–8): 599–614.

Bush, H. and Starkie, D. (2014) 'Competitive drivers towards improved airport/airline relationships', *Journal or Air Transport Management*, 41: 45–49.

CAA (2003) *Economic Regulation of BAA London Airports*, London: Civil Aviation Authority.

CAA (2008) *Economic Regulation of Heathrow and Gatwick Airports*, London: Civil Aviation Authority.

CAA (2013) *Market Power Determination for Passenger Airlines in Relation to Stansted Airport – Statement of Reasons*, CAP 1135, London: CAA.

CAA (2014a) *Economic Regulation at Heathrow from April 2014: Notice granting the Licence,* CAP 1151, London: CAA.

CAA (2014b) *Economic Regulation at Gatwick from April 2014: Notice granting the Licence,* CAP 1152, London: CAA.

CAA (2015) *Economic Regulation at New Runway Capacity*, CAP 1279, London: CAA.

CAA (2016) *Economic Regulation: A review of Gatwick Airport Limited's Commitments Framework*, CAP 1502, London: CAA.

CAPA (2014a) *Airport Ground Handling – Industry Overview 2014. Part 1: Liberalisation, Efficiency and Compensation*, 18 November. Online. Available at https://centreforaviation.com/insights/analysis/airport-ground-handling—industry-overview-2014-part-1-liberalisation-efficiency—compensation-195301 (accessed 20 March 2017).

CAPA (2014b) Airport Ground Handling – Industry Overview 2014. Part 2: Consolidation and Alliances. 19 November. Online. Available at https://centreforaviation.com/insights/analysis/airport-ground-handling—industry-overview-2014-part-2-consolidation-and-alliances-197120 (accessed 20 March 2017).

Charles River Associates (2013) *Two-sides Market Analysis in the Context of the CAA's Airport Market Power Assessments*, Report to the CAA, London: CRA.

Charlton, A. (2009) 'Airport regulation: Does a mature industry have mature regulation?', *Journal of Air Transport Management*, 15(3): 116–20.

Cheong, K. (2015) 'Aux armes, citoyens! A revolution in airport economic regulation: A regulator's perspective', *Journal of Airport Management*, 9(4): 338–46.

Choo, Y. (2014) 'Factors affecting aeronautical charges at major US airports', *Transportation Research Part A: Policy and Practice*, 62: 54–62.

Czerny, A. (2006) 'Price-cap regulation of airports: single-till versus dual-till', *Journal of Regulatory Economics*, 30(1): 85–97.

Czerny, A., Forsyth, P., Gillen, D. and Niemeier, H.-M. (2008) *Airport slots: International Experiences and Options for Reform*, Farnham: Ashgate.

Czerny, A.I., Guiomard, C. and Zhang, A. (2016) 'Single-till versus dual-till regulation of airports: where do academics and regulators (dis)agree?', *Journal of Transport Economics and Policy,* 50(4): 350–68.

D'Alfonso, T. and Nastasi, A. (2014) 'Airport–Airline interaction: some food for thought', *Transport Reviews*, 34(6): 730–48.

Daniel, J.I. and Harback, K.T. (2008) '(When) Do hub airlines internalize their self-imposed congestion delays?', *Journal of Urban Economics,* 63: 583–612.

Department for Transport (2008a) *Decision on the Regulatory Status of Manchester Airport*, London: Department for Transport.

Department for Transport (2008b) *Decision on the Regulatory Status of Stansted Airport*, London: Department for Transport.
Department for Transport (2009) *Reforming the Framework for the Economic Regulation of Airports Decision Document*, London: Department for Transport.
De Wit, J. and Burghouwt, G. (2008) 'Slot allocation and use at hub airports, perspectives for secondary trading', *European Journal of Transport and Infrastructure Research*, 8(2): 147–64.
DotEcon (2006) *Alternative Allocation Mechanisms for Slots Created by New Airport Capacity*, London: DotEcon.
EC (1993) *Regulation (EEC) No (95/93) of European Parliament and of the Council of 18 January 1993 on Common Rules for the Allocation of Slots at Community Airports,* Official Journal L14, 22 January, Brussels: EC.
EC (1996) *Directive 96/67/EC of the European Parliament and of the Council of 15 October 1996 on Access to the Groundhandling Market at Community Airports*, Official Journal L272, 25 October, Brussels: EC.
EC (2004) *Regulation (EC) No (793/2004) of European Parliament and of the Council of 21 April 2004 amending Council Regulation (EEC) No (95/93) on Common Rules for the Allocation of Slots at Community Airports*, L138, 30 April, Brussels: EC.
EC (2009) *Directive 2009/12/EC of the European Parliament and of the Council of 11 March 2009 on Airport Charges*, Official Journal L070, 14 March, Brussels: EC.
EC (2014) *Report from the Commission to the European Parliament and the Council on the application of the Airport Charges Directive*, COM(2014)278, 19 May, Brussels: EC.
EC (2015) *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: An Aviation Strategy for Europe*, COM(2015) 598, 7 December, Brussels: EC.
FAA (2016) *National Plan of Integrated Airport Systems (NPIAS) 2017–2021*, Washington DC: FAA.
FAA (2017a) Passenger Facility Charge (PFC) Monthly Reports Airports. Online. Available at https://www.faa.gov/airports/pfc/monthly_reports/ (accessed 2 August 2017).
FAA (2017b) Slot Administration. Online. Available at https://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/systemops/surface/slot_administration/ (accessed 2 August 2017).
Forsyth, P (2008) 'Airport policy in Australia and New Zealand: privatisation, light-handed regulation and performance', in Winston, C. and de Rus, G. (eds), *Aviation Infrastructure Performance*, Washington, DC: Brookings Institution Press.
Forsyth, P. (2018) 'Pre-financing airport investments, efficiency and distribution: Do airlines really lose?' *Journal of Air Transport Management*, 67: 259-67.
Fraport (2017) *Lufthansa and Fraport Sign Agreement on Cost Savings and Further Growth*, press release, 5 July, Frankfurt: Fraport.
Fröhlich, K. (2010) *Airports as Two-sided Markets? A Critical Contribution*, Bremen: The Bremen University of Applied Sciences.
Fukui, H. (2014) 'Effect of slot trading on route-level competition: Evidence from experience in the UK', *Transportation Research Part A: Policy and Practice*, 69: 124–41.
GAO (2012) *Slot Controlled Airports: FAA's Rules Could be Improved to Enhance Competition and Use of Available Capacity*, GAO–12–902, Washington, DC: GAO.
GAO (2017) *FAA's and Industry's Cost Estimates for Airport Development*, GAO-17–504T, Washington, DC: GAO.
Gatwick Airport Ltd (2010) *Two-sided Platforms and Airports*, discussion paper, London: Gatwick Airport Ltd.
Gillen, D. and Mantin, B. (2014) 'The importance of concession revenues in the privatization of airports', *Transportation Research Part E: Logistics and Transportation Review*, 68: 164–77.

Guiomard, C. (2016) *Practical Difficulties in Airport Benchmarking – The Case of Dublin Airport,* 15 April. Online. Available at https://ssrn.com/abstract=2770070 (accessed 2 May 2017).
Graham, A. (2004) 'The regulation of US airports', in Forsyth, P., Gillen, D., Knorr, A., Mayer, O., Niemeier, H. and Starkie, D. (eds), *The Economic Regulation of Airports,* Farnham: Ashgate.
Graham, A. (2008) 'Airport planning and regulation in the UK', in Winston, C. and de Rus, G. (eds), *Aviation Infrastructure Performance*, Washington, DC: Brookings Institution Press.
Graham, A. (2013) 'Understanding the low cost carrier and airport relationship: a critical analysis of the salient issues', *Tourism Management*, 36: 66–76.
Graham, A. and Morrell, P. (2017) *Airport Finance and Investment in the Global Economy*, Abingdon: Routledge.
Halpern, N., Graham, A. and Dennis, N. (2016) 'Low cost carriers and the changing fortunes of airports in the UK', *Research in Transportation Business and Management*, 21: 33–43.
Humphreys, B. (2015) 'Davies Commission exposes pre-funding dilemma', *Aviation Strategy*, July/August: 4–9.
IATA (2017a) Single Till. Online. Available at https://www.iata.org/policy/Documents/single-till.pdf (accessed 2 May 2017).
IATA (2017b) wsg-annex-11.12. Online. Available at http://www.iata.org/policy/slots/Pages/slot-guidelines.aspx (accessed 10 May 2017).
IATA (2017c) *IATA Urges Mexico to Embrace Global Standards for Slot Management*, press release, 20 July, Geneva: IATA.
ICAO (2012) *ICAO's Policies on Charges for Airports and Air Navigation Services, Doc 9082,* 9th edn, Montreal: ICAO.
Ivaldi, M., Sokullu, S. and Toru, T. (2015) *Airport Prices in a Two-sided Market Setting: Major US Airports,* CEPR Discussion Paper No. DP10658, London: CEPR.
LeighFisher (2012) *Comparing and Capping Airport Charges*, London: LeighFisher.
LeighFisher (2016) *Review of Airport Charges 2016*, London: LeighFisher.
Littlechild, S. (2012a), German airport regulation: Framework agreements, civil law and the EU Directive, *Journal of Air Transport Management*, 21: 63–75.
Littlechild, S. (2012b) 'Australian airport regulation: exploring the frontier', *Journal of Air Transport Management*, 21: 50–62.
Lu, C.-C. and Pagliari, R. (2004) 'Evaluating the potential impact if alternative airport pricing approaches on social welfare', *Transportation Research Part E*, 40(2): 1–17.
Mackenzie-Williams, P. (2004) 'A shift towards regulation – the case of New Zealand', in Forsyth P., Gillen D., Knorr A., Mayer, O., Niemeier H. and Starkie D. (eds), *The Economic Regulation of Airports*, Farnham: Ashgate.
Madas, M.A. and Zografos, K.G. (2010) 'Airport slot allocation: a time for change?', *Transport Policy*, 17(4): 274–85.
Maertens, S. (2012) 'Estimating the market power of airports in their catchment areas – a Europe-wide approach', *Journal of Transport Geography*, 22: 10–18.
Marques, R. and Brochado, A. (2008) 'Airport regulation in Europe: is there need for a European Observatory?', *Transport Policy*, 15(3): 163–72.
Meersman, H., Pauwels, T., Struyf, E., Van de Voorde, E. and Vanelslander, T. (2011) 'Ground handling in a changing market. The case of Brussels Airport', *Research in Transportation Business and Management*, 1(1): 128–35.
Mott MacDonald (2006) *Study of the Impact of the Introduction of Secondary Trading at Community Airports*, Croydon: Mott MacDonald.
NERA Economic Consulting (2004) *Study to Assess the Effects of Different Slot Allocation Schemes*, Brussels: NERA.

Niemeier, H.-M. (2010) 'Regulation of large airports: status quo and options for reform', *International Transport Forum, Airport Regulation Investment and Development of Aviation*, Paris: International Transport Forum.

Oum, T., Zhang, A. and Zhang, Y. (2004) 'Alternative forms of economic regulation and their efficiency implications for airports', *Journal of Transport Economics and Policy*, 38(2): 217–46.

Oxera (2013) *Regulatory Regimes at Airports: An International Comparison,* A report for Gatwick Airport Limited, Oxford: Oxera.

Reinhold, A., Niemeier, H.-M., Kamp, V. and Mueller, J. (2009) 'An evaluation of yardstick regulation for European airports', *Journal of Air Transport Management*, 16(2): 74–80.

Richardson, C., Budd, L. and Pitfield, D. (2014a) 'A hierarchical cluster analysis of the financial performance of US hub airports in relation to lease agreement types', *Journal of Airport Management*, 8(1): 42–56.

Richardson, C., Budd, L. and Pitfield, D. (2014b) 'The impact of airline lease agreements on the financial performance of US hub airports', *Journal of Air Transport Management*, 40: 1–15.

Riconda & Associates, Anderson & Kreiger LLP and R.W. Block Consulting (2010) *ACRP Report 36 Airport/Airline Agreements – Practices and Characteristics*, Washington, DC: Transportation Research Board.

SH&E (2002) *Study on the Quality and Efficiency of Ground Handling Services at EU Airports as a Result of the Implementation of Council Directive 96/67/EC*, London: SH&E.

Starkie, D. (1998) 'Allocating airport slots: a role for the market?', *Journal of Air Transport Management*, 4(2): 111–16.

Starkie, D. (2008) *Aviation Markets*, Farnham: Ashgate.

Starkie, D. (2012) 'European airports and airlines: evolving relationships and the regulatory implications', *Journal of Air Transport Management*, 21: 40–9.

Steer Davies Gleave (2010) *Possible Revision of Directive 96/67/EC on Access to the Ground Handling Market at Community airports*, London: SDG.

Steer Davies Gleave (2011) *Impact Assessment of Revisions to Regulation (95/93),* London: SDG.

Steer Davies Gleave (2013) *Evaluation of Directive 2009/12/EC on Airport Charges*, London: SDG.

Steer Davies Gleave (2016) *Study on Airport Ownership and Management and the Ground Handling Market in selected non-EU Countries*, London: SDG.

Thelle, M.H., Pedersen, T.T. and Harhoff, F. (2012) *Airport Competition in Europe*, Copenhagen: Copenhagen Economics.

Toms, M. (2004) 'UK Regulation from the perspective of the BAA', in Forsyth, P., Gillen, D., Knorr, A., Mayer, O., Niemeier, H. and Starkie, D. (eds), *The Economic Regulation of Airports*, Farnham: Ashgate.

Van Dender, K. (2007) 'Determinants of fares and operating revenues at US airports', *Journal of Urban Economics*, 62(2): 317–36.

Verhoef, E. (2010) 'Congestion pricing, slot sales and slot trading in aviation', *Transportation Research Part B: Methodological,* 44(3): 320–29.

Wu, D. (2015) United States Airport Rates and Charges Regulations. Online. Available at https://dwuconsulting.com/images/Articles/150315%20US%20Airport%20Rates%20and%20Charges%20Regulations.pdf (accessed 20 May 2017).

Yang, H. and Fu, X. (2015) 'A comparison of price-cap and light-handed airport regulation with demand uncertainty', *Transportation Research Part B: Methodological*, 73: 122–32.

Zhang, A. and Czerny, A. (2012) 'Airports and airlines economics and policy: an interpretive review of recent research', *Economics of Transportation*, 1(1): 15–34.

Zou, B., Kafle, N., Chang, Y.T. and Park, K. (2015) 'US airport financial reform and its implications for airport efficiency: An exploratory investigation', *Journal of Air Transport Management*, 47: 66–78.

5 Airport operations

This chapter considers the wide range of services and facilities that airports offer in order to meet the demands of their passengers, airlines and other users. Greater competition within the airline industry combined with the more commercially focused airport industry has meant that many airport operators have abandoned their one-size-fits-all approach and instead are differentiating their offer to meet the varying requirements of their diverse users. In addition, there have been some major developments in the ways some key processes at airports are provided. This has been partly due to legal and regulatory changes, particularly in the area of security and border control, as the industry has had to adjust to new risks and threats to the business. It has also been a result of technological innovations that have been applied to security and border control and to other areas, most notably check-in. All of this is having major impacts on airport operations and management in areas including space allocation, efficiency and the mix of aeronautical and non-aeronautical revenues. These issues are considered in this chapter; the effects on service quality and the passenger experience are discussed in Chapter 6.

Provision of services and facilities

Trends towards differentiation

Airport operators bring together a wide range of services and facilities to fulfil their role within the air transport industry. Many of these are related to either the airfield or the terminal, with ground handling facilities providing the link for passengers, their baggage and cargo between the airfield and terminals. There are also a growing number of commercial facilities, including hotels, conference services, entertainment amenities and business parks, which are located outside the terminal. In addition, the facilitation of ground transport to and from the airport, including the parking infrastructure, approach roads and surface access links (e.g. direct rail, supply of taxis), takes place beyond the boundaries of the terminal.

There are many different aspects to consider when the physical airfield infrastructure and its technical capabilities are being assessed. This includes the number of runways, their length and configuration; ATC services; instrument landing, lighting and weather monitoring systems; ramp and apron space allocation, stand and gate provision; and fire, rescue and policing/security services. The main areas in the airfield (runways, apron, gates) will each have an overall capacity associated with them, and the airfield infrastructure will determine what type of airline is able to use the airport. If airlines then choose to invest in new aircraft types, for example the 500-plus passenger Airbus A380 aircraft, the airport operator may have to make changes to the airfield, including reinforcing pavements, extending runway and taxiway widths and enlarging airbridges. Alternatively, it may have to lengthen the runway to accommodate longer-range aircraft. In addition to these physical features of the airfield, slot allocation is clearly important here, but (as explained in Chapter 4) this is not under the direct control of the airport operator.

With the terminal, just as with the airfield area, there is a need for basic decisions relating to the overall design and layout. For example, choices need to be made between linear or curvilinear terminals and piers, as opposed to remote satellites, as well as determining the number of floor levels that will be used. Appropriate levels of service standards, related, for instance, to space requirements, queuing and waiting, need to be used (see Chapter 6). If airports deal with transfer traffic, they will need the sophisticated and costly passenger and handling systems required for this type of throughput. Likewise, if the airport is handling connecting cargo traffic, it will need to have efficient transhipment facilities. The terminal will contain the services related to the essential processes of security, customs and immigration as well as having commercial or non-aeronautical facilities related to the traditional offer of retail and F&B, and also perhaps newer areas including entertainment, leisure and beauty. Providing free Wi-Fi is increasingly also becoming the norm.

Historically, most airports offered a fairly common set of services and facilities in trying to serve their airlines, passengers and other users, regardless of the specific needs of the different market segments within these customer groups. Very little segmentation took place at the airports, with product differentiation being limited to separate check-in for economy and business-class passengers, and remote stands rather than airbridges for passengers travelling on charter airlines. This level of segmentation was then increased, with business travellers having access to 'fast-track' systems that guide them swiftly through various processes, including immigration and customs. At the same time, airline lounges for premium class and frequent flyer passengers became more popular. In spite of these developments, the overall focus was still predominantly on a one-size-fits-all airport for all airport users. However, in recent years stronger competitive forces have led airports to pay far greater attention to differentiating their services and facilities in order to meet the requirements and expectations of different market segments. At the same time, the range of different airline models has become more varied (e.g. alliance member, LCC, cargo specialist).

The needs and requirements of airline alliance customers are different as they want to be able to share and achieve cost economies and brand benefits from operating joint facilities at airports. They want to share check-in and office facilities and have common lounges for all alliance members. Also, where possible they want to have adjacent stand parking with alliance partners to allow for ramp transfers. However, all this may be difficult to achieve because many airports in operation today were built with airlines grouped together according to their type of traffic, most commonly domestic, short-haul and long-haul. While new terminals can be built with these different demands in mind, there is always the potential problem that alliance membership may change. When an airport has to be redesigned to cope with alliance wishes, it can also be particularly challenging to ensure no single alliance group is disadvantaged. A notable case here is Heathrow airport after the opening of terminal 5. Oneworld airlines are based in terminal 5 (and terminal 3), and then the airport redeveloped terminal 2 to provide equivalent facilities for members of the Star alliance. Skyteam members are handled in terminal 4.

To compete effectively as a hub for transfer traffic, as is the situation with airports serving alliance airlines, and others too such as Dubai, the airports need to have an attractive minimum connect time (MCT). This is the minimum interval that must elapse between a scheduled arrival and a scheduled departure for two services to be bookable as a connection. Some airports have one MCT that applies to all services, while in other cases a range of different MCTs may be in operation depending on the airline, terminal, type of passenger and route. For example, at Vienna, Frankfurt and Singapore the MCT for all routes is 30, 45 and 60 minutes, respectively, while at Delhi it is 90 minutes for domestic services and 180 minutes for domestic–international services for all operations except those in terminal 3, where the MCT is 45 and 75 minutes, respectively.

Terminal design is important when considering MCTs with multiple terminals that are set some distance apart, not being well suited to connecting traffic. Also, segregating international and domestic traffic, although efficient because of the different processes involved, hinders the speed of domestic–international transfers. In recent years a number of airports have been seeking to improve their transfer product. An analysis of the 18 largest European hubs found that on average transfer times were 10 minutes shorter in 2011 than in 2002 (Thelle *et al.*, 2012). Copenhagen airport was cited as an example of an airport that had sought to improve the quality of its transfer product by entering into a strategic partnership with its main network carrier, SAS, in 2010 with the launch of its World Class Transfer Hub initiative. A major part of this involved reducing its MCT from 40 to 30 minutes, which enabled transfers on 70 extra daily SAS flights. Screens with dedicated transfer information were introduced that showed not only the gate information, but also the walking time needed to get to the gate. In addition, a special baggage process was introduced for passengers who had short connections. The result of these various measures was that travelling time on routes via Copenhagen was reduced significantly, for example on Hannover–Helsinki from 5:50 to 3:15, on Hannover–Gothenburg from 5:30 to 2:20 and from Wergen–Bergen from 5:20 to 3:20.

Some airports now pay particular attention to premium traffic when delivering their services and facilities that go far beyond just check-in differentiation and the provision of the airline lounge. Typically, this will involve the provision of dedicated security (and maybe immigration and customs) processes or fast-track lanes for such passengers. They may even guarantee this service, for example again as at Copenhagen airport, where the fast-track system CPH Express guarantees that 99 per cent of passengers will get through the security process in less than five minutes. In some regions, for instance the Middle East, it is common to have a completely separate area for check-in, security, immigration and other processes for premium passengers. A relevant case is Bahrain airport, which has designed its premium check-in lounge to be more like a hotel-style foyer, with armchair seating and sofas that eliminate any requirement to stand and queue. Other airports, for instance Bangkok, offer a fast-track service on arrival through immigration and other processes. There is also the option of providing a whole dedicated terminal for premium traffic, such as the one at Doha. Another example is Frankfurt airport, which has a first-class terminal (in collaboration with Lufthansa) that, as well as providing dedicated processes, offers a valet service, personal assistants, upper-range catering, and bathroom, sleeping, entertainment and business facilities.

Sometimes, the whole airport may be designed with the premium passenger in mind, including airports that are heavily dependent on private jet facilities. London City airport, situated near the business and financial centre of London, is an interesting case of a larger airport being designed to appeal to airlines that serve premium passengers (as well as providing private jet facilities). Overall in 2016, 52 per cent of passengers travelled for business purposes and 57 per cent of travellers were male. Only 31 per cent were aged under 35 years, and the average income of passengers was high at £75,000. Seventeen per cent took trips lasting less than 24 hours and 21 per cent had taken seven or more trips in the previous 12 months (Lavelle, 2016). This market segment is therefore money-rich but time-poor. BA uses the airport for its specialist business-only flights to New York. There is fast surface access provided with a chauffeur service, valet parking services and there is also a paid-for (£125) personal airport concierge service. The commercial facilities are designed with business travellers in mind, and include shoeshine, upmarket fast food, and retail outlets offering merchandise, such as shirts, ties and business books. The airport was the first airport to offer in 2014 a Bloomberg Hub, which includes the Apps Bar that features six tablets pre-loaded with the Bloomberg portfolio of apps; numerous charging stations for electronic devices; free Wi-Fi; 24/7 Bloomberg television; the Media Wall with constantly updated news, data and flight information; and four Bloomberg terminals for use by subscribers to the Bloomberg Professional service.

Elsewhere, airport operators have recognised that there may be passengers who are not travelling business or first class, but who would welcome the opportunity to pay extra for some of the service enhancements that premium passengers experience. For example, it is possible to pay for the use of a lounge, as at Kuala Lumpur airport where there is a Plaza Premium Lounge with facilities including high-speed workstations and showers, which can be used for 2-, 5- and 10-hour periods. At other airports there may be specialist lounges for babies and children, such as the Babycare Lounge at Amsterdam airport which has seven semi-transparent cubicles, each with a little bed where the baby can sleep, seating for the rest of the family, and baby baths, baby changing tables, play areas and microwaves. Elsewhere, for instance at around 15 regional airports in the UK, passengers can pay between £3 and £5 to go through a fast-track security queue.

Some airports have gone one stage further, offering their regular passengers a chance to pay for privileges or enhanced comfort, including access to lounges and fast-track or priority processes on an annual basis. In particular, there are VIP clubs aimed at a limited number of passengers who want special treatment, including help through the airport or access to lounges. Membership fees for these typically vary between US$6,500 and US$10,500, and membership numbers are quite low. Then there are frequent flyer programmes aimed at passengers who require speediness through airport processes, which are cheaper (ranging from US$250 to US$1,700) and tend to have more members. A study of 110 global airports found that 10 per cent of airports offered such services, with 70 per cent having several different membership levels (ACI/DMKA, 2012). Examples include Riga International airport which has a RIX Club card that gives access to the business class facilities at the airport for an annual cost of €179. Likewise, Lyon-Saint Exupéry airport has its Privilys card which provides parking, fast-track and other services, and has three different types: pass (€60 per year), silver (€120 per year) and gold (prices vary). Many other airports offering such services are as varied as Vienna, Beijing, Nanjing, Milan and Istanbul.

LCC facilities

As highlighted in Chapter 4, there have also been considerable developments regarding the unbundling of services and product differentiation, with separate costs involved, particularly for LCC operations. This is because LCCs tend to have very different needs from the network carriers to ensure they have quick turnaround times, can raise productivity and can cut down costs. Their traditional focus on point-to-point services means that more complex transfer passenger and baggage handling systems can be avoided (Table 5.1) – although as discussed below there have been some significant deviations from the conventional LCC model in recent years. In general, they will tend to require lower capacity arrivals and departures baggage systems as they discourage checked-in bags, and fewer check-in desks as they tend to focus on online check-in. These different preferences relate solely to the terminal and ramp operations, as in terms of airfield operations the requirements have to be the same for all types of airline to conform with international operational and safety standards and regulations.

For small regional or secondary airports serving urban areas, the arrival of LCCs was often useful to fill up underutilised existing infrastructure; at the same time the airlines benefited from uncongested facilities that helped them achieve their fast turnarounds. However, such a strategy may run into problems if demand grows to such a level that new facilities are needed and the airline charges (which will often be reduced initially to encourage LCC use) and the non-aeronautical revenues will not be sufficient to support funding for further investment. Nevertheless, there are many examples of regional airports that decided to focus purely on serving the LCC market and subsequently developed the simplified facilities that these airlines required. In some cases, old disused military airports were developed primarily to serve this LCC sector. This was the case of Robin Hood Doncaster airport in the UK, Bergamo-Orio al Serio airport in Italy and Uppsala airport in Sweden. Frankfurt-Hahn, a former US airbase, is another example where initially the passenger terminal was a converted officers' club. Ryanair began services from the airport in 1999 and then in 2002 it set up a base there. However, the volatile nature of the LCC industry has also meant that a considerable number of regional airports have subsequently found themselves fighting for survival when the LCC has left or perhaps gone bankrupt, as has been the case of Clermont-Ferrand in France, Malmö in Sweden, Manston and a number of other airports. This issue is returned to below.

Table 5.1 Traditional LCC needs and requirements of airport terminals

Service/facility	LCC needs and requirements
Overall terminal design	Simple, functional with low construction/ operating costs
Check-in and baggage facilities	Lower capacity due to online check-in and fewer checked-in bags
Airline lounges	Not needed
Security	Efficient processes so they do not delay aircraft boarding
Transfer facilities	Not needed (no transfer desks or handling systems for baggage transfer)
Airbridges	Preference for steps for quicker boarding and disembarking (with front and back steps)
Airfield buses	Preference for passengers to walk to/from aircraft if possible to save costs
Office accommodation	Simple and functional

When an airport serves both full service/network carriers and LCCs, it is a difficult task to meet the different and often conflicting needs of these two types of airline. One option is to develop a specialised LCT or pier facility (Jacobs Consultancy, 2007). These have a simple design, with lower service standards than expected in conventional terminals. Limited connectivity to other terminals is required and the focus is on functionality not luxury. Certain costs, for example those associated with the runway, navigational equipment and fire/rescue, will be no different for airlines using the LCTs and so landing charges tend to be the same for all. However, within the terminal the simpler design and lack of sophisticated equipment and facilities, including airbridges, escalators, complex baggage systems and airline lounges, usually results in the airlines that use the terminal being charged a lower passenger charge.

Table 5.2 gives details of some of the LCT and other low-cost facilities. Some of the LCTs were refurbished existing facilities, including cargo or charter terminals or maintenance buildings, and some were dedicated new terminals. The refurbishment options were particularly popular in Europe in the 2000s and had the advantage of minimising investment costs. Njoya and Niemeier (2011) discussed that a reduction of operating costs in the region of 30–40 per cent can be achieved with these LCTs, with some construction costs being only a quarter of the normal price.

Finavia, the governing body of the Finnish airports, was one of the first organisations to open an LCT at the small airport of Tampere-Pirkkala airport in 2003 (Table 5.2). Marseilles has had a separate LCT (MP2) which has been operational since 2006 and was converted from an old cargo facility at a cost of €16.4 million. Ryanair was the first airline to use MP2 when it established it as its first base in France. Elsewhere in Europe, Budapest developed an LCC terminal at the cost of around €35 million, initially to accommodate Wizz Air and Sky Europe. In Lyon in France, providing an LCT involved refurbishing an existing charter facility at a cost of €1.2 million (Falconer, 2006). A different type of facility is Pier H&M (H for non-Schengen traffic, M for Schengen traffic) at Amsterdam airport. This was built at a cost of around €30 million, has a simple design with no airbridges, and functions with a 20-minute turnaround. The passengers use the normal departure lounge with all the commercial facilities before proceeding to the pier.

Table 5.2 Examples of LCC facilities and terminals

Airport	Date of opening	Type of terminal	Passenger capacity	Airport charges policy
Tampere-Pirkkala	2003	Refurbished cargo terminal	n/a	Reduced bundled passenger and ground-handling charge
Warsaw*	2004	Converted supermarket	n/a	n/a
Budapest	2005	Refurbished old terminal	n/a	Cheaper passenger charges
Amsterdam	2005	New piers off existing terminal	4	Cheaper landing charge for no airbridges
Marseille	2006	Refurbished cargo terminal	3.5	Cheaper passenger charges
Kuala Lumpur *	2006	New terminal	10	Cheaper passenger charges
Singapore *	2006	New terminal	2.7	Cheaper passenger charges
Bremen	2007	Refurbished warehouse	n/a	n/a
JFK	2008	New terminal incorporating old TWA terminal	15	No difference

Airport	Date of opening	Type of terminal	Passenger capacity	Airport charges policy
Lyon	2008	Refurbished cargo terminal	1.8	Cheaper passenger charges
Zhengzhou	2008	Refurbished international terminal	n/a	n/a
Copenhagen	2010	New pier off existing terminal	6	Cheaper passenger charges
Bordeaux	2010	New terminal	1.5	Cheaper passenger charges
Kansai airport	2012	New terminal	4	n/a
Kuala Lumpur	2014	New terminal	45	Cheaper passenger charges
Narita	2015	Refurbished cargo terminal	7.5	Cheaper passenger charges
Melbourne	2015	New terminal	10	n/a
Don Mueang	2016	Refurbished airport†	30	n/a

*Now closed or demolished.

†The old airport closed in 2006 but then reopened in 2007. In 2015 the refurbished terminal 2 was renovated, increasing total capacity from 18.5 to 30 million.

Source: Complied by author from various sources

Similarly, at Copenhagen airport a new low-cost pier facility called CPH Go opened in 2010. It is an integral part of the existing terminal (as at Amsterdam airport) with passengers having access to the same services and facilities. It has six aircraft stands, covers an area of 6,700 m^2 and has an initial capacity of 6 million passengers that can be doubled if needed. The passenger charges are considerably lower than those for the existing facilities, in 2017 DKK75.77 instead of DKK99.43. In order to maintain the efficiency of the facility, airlines using it are required to meet certain conditions, including a maximum turnaround time of 30 minutes, and 90 per cent passengers checking in online, via mobile phone or at the self-service kiosks.

In the United States, Southwest has some low-cost facilities, and at JFK airport in New York, there is a relatively new LCT for JetBlue (annual capacity 20 million passengers) which incorporated Eero Saarinen's iconic 1962 TWA terminal. Outside Europe, and particularly in the Asia-Pacific region, there is more of a scarcity of secondary or regional airports that can be used for the implementation of the LCC business model, with a few notable exceptions including Avalon airport serving the Melbourne area in Australia, and Clark serving Manila in the Philippines. Hence there has tended to be significant interest in LCTs instead.

A notable development was the opening of two major LCTs in 2006, namely Singapore Changi airport's budget terminal and Kuala Lumpur airport's low-cost carrier terminal (LCCT) (Zhang *et al.*, 2008). At each airport the passenger charges for the LCT were lower, and the rental charges at Singapore were also claimed to be half those in the main terminal. Both facilities were expanded, especially the budget terminal, which increased its capacity from 2.7 million to 7 million passengers in 2009. However, in 2012 Singapore airport announced that it would demolish its budget terminal to make way for a larger passenger building with a capacity of 16 million (terminal 4), which opened in 2017. This has been designed for quick turnarounds but has a much wider range of retail and F&B. It can also accommodate wide-bodied aircraft which was not possible with the budget terminal. There has also been a new terminal built at Kuala Lumpur (KLIA2), but its precise role remains open to debate (see Case Study 5.1).

CASE STUDY 5.1
THE DEVELOPMENT OF LOW-COST FACILITIES AT KUALA LUMPUR AIRPORT

Kuala Lumpur airport is owned by Malaysia Airports Holdings Berhad. This company operates five international airports, 16 domestic airports and 18 rural airports. It was listed on the Kuala Lumpur stock exchange in 1999 after the new Kuala Lumpur airport opened in 1998.

The initial low-cost carrier terminal (so-called LCCT) was designed for Air Asia, whose total traffic for all operations increased rapidly from just 611,000 passengers in 2002–03 to over 5 million in 2006–07. The LCCT originally had a total area of 35,290 m^2 and a capacity of 10 million passengers. The construction work was fast-tracked and the terminal opened on 23 March 2006, costing in total RM106 million. It was on a single floor and had a very simple design, with no airbridges, travellators or escalators, and a basic baggage handling system. A limited number of commercial facilities were also provided. There were no transfer facilities, so if passengers needed to change flights with other carriers they had to travel the 20 km by road to the main terminal (KLIA). As with other LCTs, the airlines paid the same landing charge but a reduced international passenger charge: RM35 compared with RM51. For a typical operation with an Airbus 319 or Boeing 737–800, this meant total charges paid for operating out of LCCT were about 70 per cent of those for the main terminal.

By 2008, the LCCT was congested and so the terminal was expanded to have a capacity of 15 million. However, because the demand continued to increase and due to the poor location of the terminal, it was decided to replace the LCCT (which had actually only been intended as a temporary solution for accommodating LCC traffic) with a terminal with larger capacity, superior facilities and greater passenger comfort. This new terminal, named KLIA2, has a capacity of 45 million passengers and is located next to the main terminal building to allow connectivity between the LCCs and other airlines. It covers an area of 257,000 m^2 with 60 gates, eight remote stands and 80 airbridges, with a 32,000 m^2 area to accommodate 225 retail outlets (Table 5.3). The opening of KLIA2 was delayed from its initial target date in September 2011 and eventually opened in May 2014. At the same time the LCCT was closed, with plans to become a cargo warehouse. The original budget was RM1.7 billion but in the end it cost around RM4 billion. The new terminal is less than 2 km away from KLIA and a rail link (with a journey time of three minutes) between the two terminals has been built.

As of 1 January 2017 the passenger charge at KLIA2 is RM11 (domestic), RM35 (ASEAN countries) and RM50 (other international countries). This is the same as with the main KLIA terminal except the other international charge for this terminal is higher at RM73. In 2016 KLIA handled 25.5 million passengers whilst KLIA2 handled 27.1 million. Air Asia was the main customer of KLIA2 but it was also served by Cebu Pacific, Jet Asia and Tigerair, although services for the LCCs Lion Air and Malindo Air were shifted to KLIA in 2016.

There remains a significant difference of opinion of the role that KLIA2 should play. In 2016 Air Asia launched a campaign to promote the terminal as Low-Cost Carrier Terminal 2 (LCCT2), in order to reinforce Kuala Lumpur's position as the leading low-cost gateway to Asia. However, in response the airport said that although it currently serves LCC, it is designed to cater for all types of airlines as it is KLIA's second terminal that supports the overall capacity, is a crucial integrated element of the airport hub system, and is not an independent LCT (Murad, 2016)

Table 5.3 Key features of the terminals of Kuala Lumpur airport

	KLIA	LCCT	KLIA2
Date of completion	1998	2006	2014
Yearly passenger capacity	25 million	15 million (after expansion)	45 million
Cost	RM10 billion	RM300 million	RM4 billion
Terminal size (sqm)	479,404	64,067	257,000
Retail space	19,425	8,898	32,000
Passenger comfort	52 passengers per m^2	234 passengers per m^2	124 passengers per m^2

Source: Compiled by author from various sources

While these LCTs have generally been welcomed by the LCCs, the same has not always been true of the full-service airlines or network carriers. The latter often argue that these terminals discriminate against carriers that operate in the main terminals, and that airports must ensure all airlines have access to the new terminals. This does assume that all airlines would want to move to the new terminal, a debatable point given the lower service standards they offer. Also, some airlines maintain that airports should be focusing on the reduction of costs for all its airline customers and there should not be differential pricing. Furthermore, it is argued that if there has to be differential pricing, it must be clearly justified by demonstrating the differential costs that exist so that the network carriers do not end up subsidising the LCCs (IATA, 2017a). This is particularly relevant as there will be some costs for processes, such as security, that will be difficult to reduce in the LCTs.

Differential pricing and cross-subsidisation concerns have meant that the network carriers have made a number of legal challenges as regards the LCTs. For example, at Geneva airport, where easyJet is a major airline, there were plans to convert an old terminal into an LCT, but Air France–KLM and other airlines objected, claiming that the lower passenger charge would give the LCCs a competitive advantage. The Swiss Federal Court rejected this argument, but nevertheless Geneva abandoned its LCT development. In France, since 2005 the French airport economic framework has allowed airports to have differentiated airport charges between different terminals, which has in turn encouraged the use of LCTs in the country (as is demonstrated by Table 5.2). However, this has not been without problems – for example it led to the 2006/07 passenger charges at the LCT at Marseilles being declared void because of accounting inconsistencies. Nevertheless, the framework was an important development as it paved the way for a similar approach within the EU Charges Directive that was agreed in 2007 (Tatibouet and Doumas, 2008) (see Chapter 4). This permits differential pricing for different facilities as long as these are based on 'transparent', 'objective' and 'clear' criteria (EC, 2009). This can be particularly complex when the airport is run on a single-till basis. Likewise, ICAO (2012: II–2) states that:

> States should assess, on a case-by-case basis and according to local or national circumstances, the positive and negative effects of differential charges applied by airports. States should ensure the purpose, creation and criteria for differential charges are transparent. Without prejudice to modulated charging schemes, the costs associated with such differential charges should not be allocated to users not benefiting from them.

LCTs have remained controversial, a notable example being Brussels airport's development of such a facility, which never actually opened because of fierce opposition and legal challenges from the other carriers serving the airports. Arguably, LCTs may be an effective and cost-efficient way of coping with increasing demand at airports, if the current terminal capacity is already well utilised. However, if there is still spare capacity in the main terminal, the more favourable option must be to try to persuade the airlines to use this terminal. Providing another terminal means that essential processes, including check-in, security and immigration, need to be duplicated. The worst-case scenario would be when a significant amount of traffic just shifts from the old terminal to the new terminal (perhaps causing congestion and capacity problems), leaving the original terminal under-utilised. This will be at a time when overall costs have increased because of the additional investment and when aeronautical revenues have dropped with reduced charges for the new terminal. Differential pricing principles based on costs may not allow the charges in the main terminal to be reduced to attract traffic back to the original terminal in this situation.

There is also a more general issue related to non-aeronautical revenues at both secondary airports and LCTs. Although the LCTs have commercial facilities, the revenue from these may be lower than would have been achieved in the main terminal because of a more limited retail offer and because the basic terminal may not create the right atmosphere and experience to encourage travellers to shop (Saraswati and Hanaoka, 2012). This is one reason why the budget terminal at Singapore was demolished and a new terminal was built. The budget terminal only had limited and basic commercial facilities, including F&B outlets, convenience stores and a few duty-free retailers. Similarly, the new Kuala Lumpur KLIA2 has a more extensive range of commercial facilities. However, all this increases the costs associated with such terminals. Hence the key challenge for airport operators in providing such differentiation is in balancing the needs of the different airlines and minimising any tension between these users, while at the same time encouraging the use of commercial facilities to offset the lower charges, and also striving to maintain high passenger satisfaction levels even with the lower service levels. The trade-off between low costs for the LCCs, maximising commercial revenues and satisfying all customers – both passengers and airlines – is a major consideration for all airports serving LCCs (Graham, 2013).

In Europe, the popularity of LCTs seems to be declining as the LCC industry becomes more mature and diversifies its business model. However, LCTs continue to be popular in Asia and the Pacific. For example, in Japan the development of the LCC sector came somewhat later than in other many other countries, and hence encouraged the opening of a new LCT at Kansai airport in 2012 and at Narita in 2015. In the Philippines there has been some discussion at LCT at both the main Manila airport (Ninoy Aquino) and the secondary one (Clark). Also, 2015 saw the opening of the first LCT in Australia at Melbourne airport and there has been some debate about whether Brisbane could have an LCT in the future. Elsewhere there are many examples of airports that handle LCCs in different terminals (e.g. terminal 3 at Dubai, terminal 1 at Mumbai, terminal 1 at Tel Aviv, terminal 3 at Paris Charles de Gaulle (CDG)) or have shifted LCCs into older terminals (e.g. as at Madrid, Milan Malpensa and Munich) but the extent of differentiation with the other main terminals can vary significantly.

As regards airports solely for LCC use, Bangkok's old main airport (Don Mueang) has become a major low-cost airport. It closed in 2006 to be replaced by the new Suvarnabhumi airport in 2006, but then reopened in 2007, initially serving regional traffic, but in more recent years it has handled low-cost traffic to alleviate congestion at Suvarnabhumi airport. In 2016, terminal 2 was refurbished and reopened, and there are further plans for more capacity for LCCs.

To illustrate the importance of LCTs and facilities, Skytrax, the international air transport review and ranking organisation (see Chapter 6), annually produces its top 10 airports within the category. The top four are facilities in Asia and the Pacific that have recently been developed (Table 5.4).

Evolving LCC and airline network models

Table 5.1 identified the traditional LCC needs and requirements of airport terminals. However, this has been changing significantly as the LCC business model has evolved with new features such as paid-for seat allocation, priority boarding, flexible business fares, long-haul flights, travel agent bookings, loyalty programmes and airline partnerships. At the same time the network carriers have been adopting many practices of the LCC model. In essence, there has been a blurring of the distinction between the network carrier and LCC model, with the evolution of many hybrid airlines (Daft and Albers, 2015).

Of particular relevance to airports is the type of airport that LCCs prefer. The traditional model tends to assume that LCCs will predominately use secondary and regional airports, allowing them suitable capacity and service levels for their model, often together with generous incentives provided by the airports. In reality, the situation is more complex than this (see Dobruszkes, 2013) – for example certain carriers such as easyJet have always served a higher proportion of larger airports. However, now there is evidence of a strong trend in LCCs increasingly moving to major airports (Dobruszkes *et al.,* 2017), notably with carriers such as Ryanair and Norwegian that used to avoid such airports. For example, Ryanair moved into Barcelona airport in 2010, Brussels airport in 2014 and Frankfurt

Table 5.4 Skytrax's top 10 best terminals for low-cost airlines, 2017

Toyko Narita – T3 Kansai – T2
Kuala Lumpur LCCT
Melbourne – T4
London Stansted
Brussels Charleroi
East Midlands
Milan Bergamo
Luton
Berlin Schonefeld

Source: Adapted from Skytrax (2017)

airport in 2017, where previously it was only operating out of secondary airports serving these cities.

This development has been driven by a number of factors, such as the convenience of the primary airport (especially for business traffic); the airline's ability to gain a pricing premium (especially outweighs the increase in costs), the maturity of demand; the need to fill and accommodate larger aircraft; the wish to compete head-on with network carriers, and the desire to feed or code-share with other airline services, especially long-haul. Major airports are now keener to welcome LCCs as well and have provided incentives to encourage this. This trend clearly has implications for the major airports in designing the facilities and services to be provided, and also for the viability of small airports, which is discussed further in Chapters 8 and 9.

A key change that is occurring, which links to the evolution of the LCC model, relates to the networks that are being provided (Fageda *et al.*, 2015). Traditionally, it was solely network carriers and their alliance or partner airlines that offered connectivity or transfer flights through hub and spoke systems for passengers and their luggage. Other airlines, particularly LCCs, tended to avoid this connectivity model and stuck to point-to-point traffic, with the exception of a few airlines such as Vueling, because it could be complex and expensive. This is primarily because all operations need to be coordinated at a hub with efficient passenger and baggage transfer processes, aircraft utilisation may be lower, and passengers need to be compensated for missed connections.

However, there has been a significant trend in recent years towards self-connection or so-called self-help hubbing, especially with LCCs. This is when passengers buy two separate tickets and build their own connection, instead of it being arranged by the airlines. Indeed, back in 2008, with their analysis of the European market, Malighetti *et al.* (2008) found that around two-thirds of the fastest indirect connections were not operated by airlines and their alliances, and these could potentially be exploited with self-connection. Clearly, there are some risks involved with self-connection as flights may be delayed and connections missed. When one ticket is booked with a network carrier, it is the airline's responsibility to find a solution. However, with self-connection the passenger is responsible for themselves and their luggage, and it may be costly and time-consuming to find an alternative flight to complete their journey. Thus self-connection only really makes sense if passengers perceive the increased risk to be offset by significant cost savings.

Since passengers buy separate tickets, self-connection is difficult to measure and there is limited knowledge of the characteristics of self-connecting passengers (Suau-Sanchez *et al.*, 2016). CAPA (2015) estimated that as many as 40 per cent of passengers at London Stansted could be self-connecting. Meanwhile, Cserep (2016) presented an estimate in 2015 of three million LCC passengers self-connecting at all UK airports, representing around 4 per cent of all passengers. Applying this share Europe-wide gave an estimate of 16 million passengers. Maertens *et al.* (2016) identified Barcelona, London Gatwick and London Stansted as the largest potential transfer European airports for low-cost connections, with Dublin and Oslo also being important airports. Moreover, Cserep (2017) identified at least 4,540 markets that could be served by LCC self-connections in 2017. In theory, such self-connection can work when an airport has a high proportion of LCCs, and particularly if there are long-haul LCCs. It can even work to support long-haul connectivity at hub airports, where a separate LCC ticket can be used as the first or last leg of the long-haul trip.

Cserep (2016) presented the results of a European survey which confirmed that a lower price was the most important factor when choosing self-connection. Other key factors included 'needed to travel a route with no through-ticket option available' and 'convenient schedule'. The most important deterrent was 'Didn't want to pick up and re-check bags at connecting airport' followed by 'worried about making the connection'. A survey in the United States found that 64 per cent of travellers were aware of self-connecting as an option and nearly 40 per cent had actually self-connected (OAG, 2016). It found that decisions were essentially based on time, money and convenience. Forty per cent of the travellers said that they would consider self-connection if it saved them at least US$100, with a further 34 per cent if it saved at least US$200. Unsurprisingly, only 30 per cent of travellers were willing to use self-connect for business trips, but the majority were willing for leisure trips. Moreover, when asked about their general concerns, 55 per cent feared that they would miss a connecting flight and would not be rebooked automatically by the airline, while 21 per cent were concerned that their baggage would not make it to the end destination.

Self-connecting can provide a number of challenges for passengers. It may be difficult to identify the most appropriate connections, particularly if they are to work in both directions. Moreover, unlike conventional connections that can all take place on the airside part of the terminal, self-connection involves going landside for baggage reclaim and checking in again, and perhaps going through other processes such as security and immigration twice, which lengthens the time needed at the airports. A travel visa may even be needed.

Nevertheless, a growing number of airlines, travel distributors and airports have been recognising the opportunities that self-connecting offers and are encouraging this development. Basically, there are two key features needed to facilitate self-connectivity. First, there needs to be a digital platform which makes it easier for the passenger to book separate tickets and which can provide protected connections with insurance. For example, this can be meta-search engines such as Kayak or Skyscanner, or niche online travel agents such as Kiwi.com that offer a mandatory insurance component to cover connections.

Second, there needs to be an adaption of the airport services and physical infrastructure to make it easier for passengers to change flights. Ideally, if possible, this should allow for the passengers to be kept airside and for their bags to be automatically transferred, as with conventional connections, although this is not usually possible. Instead, the transfer process should be made as streamlined as possible. If the costs involved with introducing such features are high, these might outweigh the benefit of additional self-connection passengers and their potential spending at the airports on retail and F&B. Indeed, not all airports, for instance Finavia (OAG, 2015), are convinced of the benefits of linking flights and facilitating self-connectivity. A key issue may be increased pressure that this puts on baggage-handling systems (Suau-Sanchez *et al.*, 2016). Overall, Cattaneo *et al.* (2017) argued that it is only going to be when improvements can be made to passenger awareness and the booking process, together with handling processes at the airports (both of which generally involves initiatives with multiple players), that further exploitation of self-connection can occur.

There are a few airports that provide so-called airport hosted transfers that offer self-connecting passengers with a level of support and security, which they would not get if they did self-connecting on their own. Some of the earliest examples were in Germany were there were initiatives at both the Berlin and Cologne/Bonn airports to encourage self-connection in the late 2000s, but these have both ceased to exist (Fichert and Klophaus, 2016). Gatwick airport is a notable airport that has a current scheme (see Case Study 5.2). Milan Malpensa offers a similar service (ViaMilano) which provides a protected connection as well as fast-track security and a €10 shopping voucher. Elsewhere at Singapore Changi airport in 2013, the LCC Tigerair (which merged with Scoot in 2017) in collaboration with the airport launched its TigerConnects initiatives to encourage connections through the airport.

CASE STUDY 5.2
SELF-CONNECTING AT GATWICK AIRPORT

Gatwick airport's largest customer is the LCC easyJet and overall it has a high proportion of LCC and charter flights. In a number of European studies the airport has also been identified as having very significant potential for developing the self-connection concept. As a consequence, in 2013 Gatwick airport introduced its service 'Gatwick Connect' which had a dedicated counter for self-connecting passengers to check in for their transfer flight. Then in 2015 it launched a new service called 'GatwickConnects'. This initially involved the co-operation of three airlines (easyJet, Norwegian and WOW) but this has subsequently expanded to over 15 airlines, including network carriers such as British Airways and Cathay Pacific. Table 5.5 presents the main features of this service. There is a self-connections desk in the baggage hall for all self-connecting passengers, and in addition passengers now have the option to book their flights through the GatwickConnects+ protected connection service (provided by the travel search engine Dohop), which also offers other benefits and discounts to passengers. The fee is absorbed into the flight booking cost and starts at £27.50 for a one-way journey (Future Travel Experience, 2015)

Table 5.5 Key features of GatwickConnects

Feature	Details
Airlines	Aer Lingus, Air Europa, Aurigny, British Airways, Cathay Pacific, easyJet, Flybe, Meridiana, Monarch, Norwegian, TAP, Thomas Cook, Thomson, Virgin Atlantic, Westjet, Wow Air
Self-connection desk	In baggage hall for passenger and baggage check-in

Feature	Details
GatwickConnects+ flight booking service	Through airport website providing a protected connection (e.g. another flight, food, overnight accommodation)
Gatwick Connects+ additional services	– An entrance pass to use Premium Security at Gatwick – A complimentary glass of wine, or a soft drink at Caviar House – Discounts for World Duty Free – Discounts for lounge entry – A Trace Me Luggage Tracker

Airport business models

LCTs are just one example of how airports are becoming increasingly diverse in what they offer their users. Other airports are concentrating on offering connecting facilities for specialist cargo operators and integrators. Examples include Leipzig/Halle airport, East Midlands airport, and Paris Vatry. Another example is Liege airport, recently branded Flexport. In addition to having reliable and secure connecting processes, these airports also have other appealing features, including good connections to motorways and no night curfews. For example, Liege airport has a long runway (3,690 m) and 80,000 m^2 of warehouses with immediate runway access. Moreover, a new logistics park, called Flexport City, with 85 hectares of land dedicated to air cargo and logistics, has been located at the airport since 2016.

Another alternative is to develop the airport as an airport city or aerotropolis serving the needs of passengers, and also of local businesses and residents – concepts discussed in Chapter 9. There is also the situation where airports can differentiate themselves by offering pre-clearance with some of the essential services. This is typically the case with flights to the United States, where passengers go through US customs, immigration and agriculture inspections at their originating airport and as a result are treated as domestic passengers when they arrive, allowing a quicker process through the US airport. Such services are offered at Dublin and Shannon in Ireland, a number of Canadian airports, and a few other locations including Bermuda, the Bahamas and Aruba. Abu Dhabi was added in 2014, which was seen as giving the airport a significant competitive advantage particularly when compared with Dubai, and it is likely that Stockholm will be the next airport to offer this service. Other possible airports include Brussels airport, Punta Cana (Dominican Republic), Narita, Amsterdam, Oslo, Madrid, London Heathrow and Manchester airports. In 2016, a further 11 new airports were identified (DHS, 2016a). Elsewhere Aruba airport has also been trialing a system that could offer European pre-clearance (see Case Study 5.4).

More generally, there has been an attempt by some to classify all airports into different business modes. For example, Boston Consulting Group (2004) identified airports as being either a primary hub, an international origin and destination (O&D) airport, a secondary hub and O&D airport, or a regional airport, while Mercer Management Consulting (2005) classified airports as primary hubs, secondary hubs, major O&Ds, or low-cost base and leisure destination airports. Jarach (2005) identified five key market positioning strategies related to primary hubs, secondary hubs, regional airports, low-cost airports and cargo airports. However, he then argued that this is a simplification of the actual situation that exists in the airport industry and explained that there is much higher variance between the market positions. He subsequently listed 19 different types that include airports acting as a county's sole gateway, airports attracting overflow traffic, greenfield airports, airports integrated within a system, and airports operating within the same catchment area.

Feldman (2009) identified nine different types of airport and ACI Europe (2010) had a somewhat similar classification. Within these classifications there were some established models and some more emerging ones. Established alliance anchor hubs were airports where many airline alliance groups connect, including Paris CDG and Frankfurt in Europe, Dallas Fort Worth in the United States, and Singapore in Asia, while a multimodal port was an airport with strong intermodal connections, including Amsterdam. ACI Europe's airport network was the established model of a coordinated airport group as is found, for instance, in Spain, Sweden and Poland. Athens airport was an example of an airport as a final destination, since it has attracted giant warehouse-size retail centres because of its location that provides easy access and parking.

London City airport was defined as an emerging model, classified as a business traffic airport by ACI Europe and a niche player by Feldman. Another niche player (defined as freight platforms by ACI Europe) was the cargo airport of Liège. Feldman's other emerging models included 'do what others can't', which covered the express 24-hour cargo hub at Cologne/Bonn, business aviation at Farnborough and Biggin Hill in London, and Helsinki with the fastest travel between Europe and Asia due to its strategic location and fast transfer times. Other models that he identified included the home fortress with satellites – giving the example of Manchester airport with its ownership of other smaller airports nearby – and the perpetual construction site, including London Heathrow. He also defined the emerging offsite or 'virtual' airport, where activities including check-in, shopping, and pre-ordering and purchasing of customised services, including parking and lounge access, take place outside the physical site of the airport. Examples included Volaris Airlines' virtual airport in Mexico City, serving Toluca airport, where passengers could complete check-in formalities in a city terminal in a shopping mall; and a similar situation with Etihad at Abu Dhabi airport, where passengers are connected to the actual airport with luxury coaches.

Within this context, Feldman also discussed how airports must embrace three crucial tenets – diversity, differentiation and innovation – needed to survive in today's airport world. In particular, he gave examples of mid-sized connecting hubs (including Brussels, Pittsburgh and Milan Malpensa) that have had to rethink their business model. Diversification through the development of commercial facilities might be essential to overcome too great reliance on aeronautical revenues. It might also involve serving various market segments with different needs (e.g. Nice and Cannes airport with network carrier, LCC and business jet traffic) or for some airports, including Singapore Changi, getting involved in the management of other international airports to compensate for a small home market. Differentiation also links to creating a brand and sense of place within the airport, discussed further in Chapters 7 and 8. Another emerging area of differential potential is the airport environmental strategy, an example being Swedavia, the Swedish airport operator, which was the first airport company to become carbon-neutral.

Innovation at airports often involves the use of technology to speed up processes and improve the passenger experience, or the introduction of passenger loyalty schemes. Among a survey of airport companies in 2011 within Europe, Feldman (2011) found that Amsterdam, Copenhagen and Munich airports were considered the top innovators, whereas the airport companies Fraport, AdP and BAA were perceived to lag behind in this area. Indeed, Munich airport has a dedicated innovation team with an innovation budget.

More generally, Jimenez *et al.* (2014) suggested there are different approaches to the airport business that link with the different models that have evolved. These are: public utility provider (infrastructure and aeronautical services); multi-modal interface (transport network); commercially orientated (retail and non-aeronautical services), or consumer-orientated; airport city (real estate development); or global business (consultancy and managerial services). For the aviation trade the differentiation factors can be availability of slots, dedicated infrastructure, integrated services and incentive programmes. They also include network provision and intermodal integration, which are factors relevant to individuals at the airport as well (e.g. travellers, visitors, employees). These individuals are also influenced by low fare access, airport convenience, airport experience and destination attractiveness (see Chapter 8).

Meanwhile, Kalakou and Macário (2013) identified the main elements that need to be considered when analysing business models: key partners; key activities; key resources; value proposition; customer relationships; customer channels; and customer segments. They looked at 20 airports that they organised into five categories (primary hub, secondary hub, business, low-cost and cargo) and found that there was a pattern with the elements for the primary and secondary hub airports, but not for the business, low-cost and cargo airports. In a somewhat similar approach Frank (2011) defined the 11 elements in her business model matrix that she used as being: the customer value proposition; the rule changing; the regulators; the key profit formula; the stakeholder rewards; the governance mix; the reform opportunity costs; the key resources and processes; the network value; the risks; and the externalities. So, in summary, there has been some interesting discussion and analysis concerning airport business models, but it is limited and much less advanced, especially when compared with the airline industry, and could be developed further.

Security and border control issues

This section now focuses on some more specific, key processes that take place at airports. Developments within the airfield area are by nature rather technical (and beyond the focus of this book), so the emphasis here is on passenger facilities within the terminal.

Of prime importance are the number of activities at airports involved with the protection and well-being of passengers. In this context, airport security needs to be differentiated from airport safety. Airport security is concerned with preventing illegal activities, including terrorism, as opposed to airport safety, which is related to ensuring aircraft are safe, for example by not allowing dangerous goods on board and ensuring there are no hazards on the runway. Only airport security is considered here, as there have been very significant changes in that area in recent years. Table 5.6 summarises the main activities associated with airport security.

Pre-9/11 common minimum standards for airport security were set by ICAO in the Chicago Convention Annex 17. In some parts of the world these were also incorporated into regional standards, as was the case with the European Civil Aviation Conference (ECAC) and its document 30. However, the problem with these standards was that there was no binding mechanism to ensure they were implemented properly, and consequently the level of security offered at airports throughout the world varied enormously. After the Lockerbie disaster of 1988 improved measures had been recommended, including 100 per cent hold baggage screening and baggage reconciliation, but as these were not mandatory requirements they were not adopted everywhere. The turning point for many countries came after 9/11, when much more binding legislation was introduced.

Impacts of 9/11

While security at airports has always been a very important aspect of operations, the events of 9/11 led to its coming under even closer scrutiny, with many additional security measures being introduced. Suddenly, particularly in the United States, airport security became a national concern and high-profile issue that received a considerable amount

Table 5.6 Main security activities at airports

Badge regime
Reliability check on applicants for obtaining badges
Checks on access of staff to restricted areas
Checks on passengers and hand baggage
Baggage reconciliation
Checks on hold baggage
Checks on cargo/airmail
Armed protection landside
Armed protection airside
Protection on parked aircraft

of media attention. Globally, the most immediate effect was the adoption by ICAO in 2002 of an Aviation Security Plan of Action. For this three-year programme it was agreed that regular and mandatory audits of member states would be conducted to identify and correct deficiencies in the implementation of ICAO security-related standards. In addition, new mandatory security standards were agreed, including locking flight deck doors, sharing information about potential security risks, and ensuring security measures were implemented in a non-discriminatory manner.

The most sweeping changes occurred in the United States, where traditionally security measures were relatively lax compared with many other airports. Congress quickly developed the Aviation and Transportation Security Act, signed by President Bush on 19 November 2001. This set a number of important deadlines regarding security that had to be met by the end of 2002 and transferred direct responsibility for security to the federal government with the setting up of the Transportation Security Administration (TSA). Then in 2003, overall control was moved from the Department of Transportation to the Department of Homeland Security (DHS), which had been set up to coordinate all security measures in the United States. Previously, security at airports had been undertaken by private security company staff who were often underpaid and poorly qualified; the Act provided for these to be replaced by a federal workforce of initially 28,000 properly trained staff. However, there were numerous complaints that the new security procedures and rules were inconveniencing passengers and that this significant 'hassle' factor was putting passengers off flying or encouraging them to travel by different modes of transport (Rossiter and Dresner, 2004).

Such fundamental changes to the country's airport security system were costly to implement. The security costs incurred by the airports rose from US$556 million in 2000 to US$619 million in 2001, an increase of 11 per cent. They were estimated to have increased to US$853 million, a large 38 per cent rise, in 2002. The TSA authorised US$1.5 billion for 2002 and 2003 to allow airports to meet FAA-mandated security expenses. By 2013, TSA spending on airport security had increased to nearly US$8 billion (Gillen and Morrison, 2015). A US$2.50 per sector security fee was also introduced to cover some of the costs of the TSA – this has now increased to US$5.60. The Act gave airports the flexibility to use public money, obtained through passenger taxes, for airport investment (so-called AIP funds – see Chapter 4) to pay for any additional security-related activity required. In 2002 the FAA authorised US$561 million of these funds to airports for security projects related to the events of 9/11 (GAO, 2002). Additionally, a number of US airports had to redesign many of their commercial facilities in order to conform with the new security measures, which led to a decline in non-aeronautical revenues. For example, new restrictions on the movements of meeters and greeters limited their access to certain retail and F&B outlets, and a number of car parks had to close. In short, the establishment of the TSA has had far-reaching impacts on US airport costs, passenger travel habits and flow patterns through the terminal (Raffel and Ramsay, 2011).

Outside the United States, much attention was also paid to improving security methods at airports and numerous changes were made. ACI research undertaken shortly after 9/11 attempted to quantify the security costs directly attributable to the terrorist attacks and found, for example, that Paris CDG airport estimated this to be US$20 million, Munich airport provided a figure of US$5.3 million, Nairobi US$3.4 million and Tokyo Narita US$2.6 million. In Europe, specifically post 9/11, there was general agreement that security measures should be harmonised throughout the region, and in 2003 Regulation 2320/2002 (based on the recommendations outlined in ECAC document 30) and various complementary implementing regulations came into force (EC, 2002). This covered common security rules and the appropriate compliance monitoring mechanisms. The measures included unannounced airport inspections by independent EU inspectors, 100 per cent staff searches in restricted areas, improved staff background checks, and more stringent baggage screening methods including limiting personnel 'screen-time'. Each state had to have a national security programme in place (although in most countries these already existed as a result of Lockerbie). In 2008, new legislation (Regulation 300/2008) was approved within Europe with the aim of clarifying, simplifying and further harmonising the existing rules of the 2320/2002 legislation (EC, 2008). This was thought necessary because it was generally agreed that the original legislation was produced under great political and time pressure in response to the 9/11 events, and could in hindsight have been more flexible and less heavy-handed. Gillen and Morrison (2015) estimated that the European airport security costs increased from €2.8 billion in 2002 to €5.7 billion in 2011.

The liquids and electronic devices problem

Since 9/11 there have been a number of terrorist events and threats that have had an impact on airport security – for example the attempted shoe bomb incident in 2001 that led to the removal of shoes at passenger screening – but by far the most significant development has been the changes related to liquids, aerosols and gels (LAGs). This happened after 10 August 2006, when the security level at all UK airports was raised to critical because of an alleged terrorist plot involving the detonation of liquid explosives carried in sports drinks bottles onto as many as 10 transatlantic services. At that time all hand baggage became prohibited and 100 per cent passenger searches were undertaken. Gradually, these restrictions were slightly relaxed and in October 2006 the EC agreed Europe-wide rules (Regulation 1546/2006) that came into force at the beginning of November (EC, 2006). This allowed passengers to carry LAGs on board again as long as they were in containers no larger than 100 ml and in a clear plastic bag. Duty-free purchases could continue to be taken on board if they were in standard tamper-evident bags (STEBs), but only from an EU or European Economic Area (EEA) airport. Meanwhile ICAO, in consultation with the EU and US security authorities, started working towards a globally acceptable framework to harmonise all the restrictions on LAGs and agree standards on STEBs.

The most difficult area for any kind of global agreement is in persuading countries to recognise, and have confidence in, the security arrangements that take place elsewhere. If this could happen, then transfer passengers would be allowed to take their purchased goods in STEBs onto their next flight. This did not occur in the EU, which meant that many unsuspecting transfer passengers had their duty-free purchases confiscated (see Chapter 7). Instead, in July 2007 the EC introduced Regulation 915/2007 (EC, 2007) which gave unilateral recognition to non-EU countries that implemented ICAO guidelines on LAGs restrictions, supply chain security and STEBs. Croatia, Malaysia, Singapore and the international airports of Canada and the United States were subsequently approved, which meant that transfer passengers from these countries did not have their liquid purchases over 100 ml confiscated.

These LAGs restrictions were envisaged as temporary, to be lifted when there was suitable technology to screen LAGs for explosives. As a result, a two-stage relaxation of the rules within the EU was agreed in 2010. The deadline for phase 1 was set for 29 April 2012, when it would have been possible to screen passengers bringing LAG from non-European countries and transferring within a European airport. However, the US government had not agreed to this relaxation and stated that it would require extra screening on US-bound flights. Certain governments and airports within Europe, in countries including the UK, the Netherlands and France, expressed their concerns that the LAGs screening technology to be introduced remained underdeveloped and untested operationally. Furthermore, airports in some countries stated that they would not enforce the new restrictions. All of this would have led to a patchy, confused and disruptive situation for passengers when the deadline was reached, so at the last minute the phase 1 policy was postponed. Subsequently, in July 2012 the April 2013 deadline for phase 2, for the screening of all LAGs and the total removal of the LAGs ban, was also postponed. As of 2017, the LAGs ban had not been removed but detection trials, with equipment that can detect a wider range of substances than previously, was being tested at certain EU and assessed to ensure that the new technology does not create bottlenecks for security queues when it is finally introduced.

However, at the same time as a possible relaxation of the LAGs rules in the near future, travellers and security providers at airports have also had to face some new uncertainty concerning a ban on laptops and tablets in cabin luggage with some airlines on certain routes. This electronic devices ban was introduced in March 2017 by the US and UK governments on travel from select Middle East and Africa destinations. It was suggested that this ban could become widespread in Europe but by July 2017 most of the restrictions had been lifted.

Passenger body scanners and cargo processes

On 25 December 2009 there was a failed attempt to bring down a Northwest Airlines transatlantic flight from Amsterdam to Detroit with a plastic bomb hidden in the underwear of a passenger, which had not been identified by the metal detectors at the airports. This demonstrated that airport security was facing new types of threat that could not be prevented totally with the current technologies employed at the airports. As a consequence, there was consideration as to whether body scanners that use imaging technology to detect both metallic and non-metallic items should be used more extensively at airports. These can replace or supplement traditional passenger screening processes which were mostly focused on the detection of metallic threats using walk-through metal detectors, together with full body manual pat-downs.

The use of such equipment – which can be based on either X-ray backscatter or millimetre wave technology – has raised a number of concerns. First, the effectiveness of such scanners to image all hidden items on the human body is questioned, along with the high costs involved with this technology (well in excess of €100,000 per machine) and the resulting slowing down of processes. More controversial are the issues related to potential radiation dangers to passengers and airport workers, and privacy requirements of passengers.

A number of countries, including Russia, the United States, Canada, Australia, Japan, Nigeria, India, South Africa, Kenya, China and South Korea, now use scanners or are seriously considering using them. They are also used at some European airports. However, initially within Europe there were many different national operational standards and procedures. As a result, in November 2011 the EC adopted a legal framework on security scanners (EC, 2010a). This does not make it mandatory for airports to use body scanners, but if they wish to do so they must adhere to strict operational and technical conditions. To address health concerns, only non-ionising millimetre wave radiation scanners (not X-ray backscanner methods) may be used. To protect passengers' privacy and human rights, the images cannot be stored, copied or printed, with only authorised access to these images being allowed. Passengers must be informed if they are to have a scan and have an option to opt out and be subject to an alternative method of screening. In spite of this framework there continued to be much debate within Europe concerning the benefits, risks and drawbacks related to body scanners with some very active passenger rights groups, especially in Germany, calling for the banning of such machines.

Meanwhile in the United States, the TSA finalised its policy on the use of scanners in 2016, generally accepting their use, after three years of multiple challenges, primarily concerning privacy and health issues (DHS, 2016b). Opposition had previously led to the removal of the X-ray backscanner devices which had been in use between 2008 and 2013. It was reported in 2016 that scanner use in the United States was widespread, with 793 machines deployed at 157 airports.

Most of the security incidents that have resulted in airports acting in a predominantly reactive manner by introducing new layers of security regulations have been related to passenger activity or concerned with modifying airport design, as with airport forecourt areas after the car bomb attack at Glasgow airport in 2007. However, in October 2010 there was an attempt to hide two improvised explosive devises (home-made bombs) in printer cartridges on air cargo consignments bound for the EU. As a result, in August 2011 the EU adopted new tighter regulations, effective from February 2012, related to securing incoming air cargo and mail from non-EU countries.

The most recent security events have involved suicide bombers in landside, public areas. The security of such areas is usually regulated by national governments and falls under the responsibility of the police and other law enforcement entities, just as for any other similar public space, such as train stations. The industry, therefore, has argued that any new security measures should be seen in the context of public space security rather than aviation security, and that the moving of screening procedures to the entrances of airports is not a viable option as it presents a new target for terrorists (ACI Europe, 2016). Table 5.7 summarises the main events related to airport security since 9/11.

Table 5.7 Key events related to airport security since 9/11

Date	Event	Main impacts
September 2001	9/11 US terrorism attacks	Establishment of the US TSA and more stringent security controls worldwide
December 2001	Shoe bomb attempt on a transatlantic service	Introduction of specific security measures to improve screening of shoes
August 2006	Terrorist plot to use liquid explosives on several transatlantic services	Restriction of liquids, aerosols and gels in hand baggage
June 2007	Car bomb attack on front of Glasgow airport terminal	Greater use of vehicle barriers at terminal forecourts and vehicle free secure zones
December 2009	Underwear bomb attempt on a transatlantic service	Increased use of security scanners
October 2010	Two improvised explosives attempts in air cargo consignments bound for EU	Stricter controls on mail and cargo from third countries to the EU
January 2011	Suicide bomber in international arrivals hall of Moscow's Domodedovo airport	More stringent public space security
March 2016	Suicide bombers in check-in area of Brussels airport	More stringent public space security
June 2016	Suicide bombers with gun attacks at security checkpoint in Istanbul Ataturk airport	More stringent public space security

Financing security

One of the major consequences of all these tighter security controls has been a sharp increase in the costs of security. This raises a controversial question concerning how the security should be funded. One option is to apply 'user pays principles', where funding will be obtained directly from airport users. However, airports and airlines normally argue that governments should pay, reasoning that as terrorist acts are targeted at states, it is the responsibility of states to finance countermeasures to protect the travelling public, i.e. that security should be treated as a public good to be funded from general tax revenues. They also argue that the inconsistent approach to funding security, particularly in

Europe, distorts competition. For example, the airport operator designs the security measures at airports such as Athens and Helsinki, whereas this is done by the government in Amsterdam and Lisbon, and is shared between these two and the airlines in Munich. As regards the provision of security services, virtually all terminal protection is provided by the government through the police, while in many cases checks on passengers and luggage are under the control of the airport operators. However, for other security activities, including staff access checks/badge control, aircraft protection and cargo checks, a wide range of different organisations, including the airport operator, the airline, the police, or a subcontractor, may play a role. The situation may well vary between airports in the same country. For example, in a sample of 19 main airports in the UK, 14 airport operators provided some or all passenger checks, 11 did the hold baggage checks and 15 the access control. Elsewhere these services were outsourced (LeighFisher, 2017).

A study by the Irish Aviation Authority/Aviasolutions (2004) described how European airports (the 15 EC states at the time plus Switzerland, Norway and Iceland), while having a mix of different security providers, could be categorised overall into two basic models: a centralised model, where most of the main security activities are the responsibility of the state via a government body (including CAA, Ministry of Transport or police force); and a decentralised model, where most of the activities are provided by the airport operator under the supervision of a relevant government body, including the CAA. In this case they may be provided directly or outsourced to a third party. At some airports where the security costs are borne by the government, they may be paid for by a security tax or funded out of general taxation. Elsewhere, where security is paid for by the airport operator, this will be covered by normal airport charges or special security fees usually based on passenger numbers. Amongst a sample of 50 worldwide airports in 2016, 39 airports had these specific charges that can account for up to a third of all charges levied (LeighFisher, 2016). Often there may be a combination of these different types of funding – but with both taxes and charges the passenger is ultimately the main financier of security.

Within Europe, security costs for the airports have increased from around 9 per cent of total operating costs pre-9/11 to around 20 per cent now. This has primarily been due to new security infrastructure and equipment together with the use of more security staff. As a result, it has become more common to have the separate security charges. However, there has been some concern about the transparency of such charges, whether they are cost-related and non-discriminatory and whether there is sufficient consultation with airport users. This led in Europe in 2009 to a proposal for a directive on aviation security charges to address these issues, but this was never adopted. The airlines and airports often compare the situation in Europe, where in many cases the air transport industry and its customers bear the majority of the security costs, with the US case where less than half of the TSA funding comes from the passenger security tax. By comparison in Mexico airport security is financed entirely by the government, whereas in Canada the users bear the entire costs (Prentice, 2015). Stakeholders in other countries, for example Australia and New Zealand, have also put pressure on their governments to cover more of the increased security costs. Worldwide, ICAO's charging principles emphasise the need for consultation, cost-relatedness and non-discrimination with security charges (ICAO, 2012). Generally, the fact that there seems to be little or no transparency concerning exactly how much national governments are spending on aviation security from general tax revenues, and how much passengers and airlines are paying for aviation security through airport charges, appears to be a global issue (Gillen and Morrison, 2015; Morrison and Rodenburg, 2018).

Another issue related to airport costs and the provision of security services concerns the role and impact played by different passenger types. Until recently they were very much viewed as having a passive role, but it has been argued, for example by Kirschenbaum (2013), that passenger behaviour towards security checks is complex and more research is needed to incorporate the human factor aspect of security, in order to understand behaviour and its impacts on the security process.

Risk-based processes

In recent years the security processes at the airports have proved to be one of the most difficult aspects of the passenger experience to improve. The security checks discussed above operate on the principle of using the same processes for all passengers – using the assumption that they all pose a similar security risk. Hence the security resources are evenly distributed across all passengers. As passenger numbers grow, managing such processes without intensifying the inconvenience for passengers will become increasingly challenging.

However, there is an alternative approach: passenger profiling, where passengers of higher risk are identified and then more of the resources and security attention are directed at them. At the same time, the processing of low-risk passengers can become speedier, although there still can be some random checks. As a consequence, there has been considerable debate as to the merits and effectiveness of passenger profiling techniques and the extent to which they can improve the passenger's experience of security and reduce the perceived hassle factor.

Experience with this risk management approach is limited, the most widespread use arguably being in Israel where it has been implemented for many years. There are many features of such an approach, including using technology in a more targeted manner and having a stronger intelligence focus by increasing the amount of passenger information that is shared between different relevant bodies and countries.

Passenger profiling can be undertaken in a number of ways. This can be done through interview techniques that allow the trained profiler to screen the passenger's personality, background and various details of their journey. It can also be undertaken through behaviour pattern techniques where the trained profiler will detect suspicious people by observing any irregular behaviour or unusual body language of the passengers. Then there is passenger profiling based on databases of passenger information, especially information from intelligence authorities, but this can be difficult to get in a timely manner and can raise personal data protection issues. Overall, while these different methods indicate that passenger profiling has the potential to make screening more effective than using the same process for all passengers, it nevertheless remains very controversial because of issues related to possible discriminatory treatment or violation of passenger privacy rights, as well as being challenging to implement successfully. Indeed, a key issue with implementation is that it requires flexibility on the part of regulators, airports, airlines and passengers, coupled with trust between states and between agencies within states (Wong and Brooks, 2015).

Passenger name records (PNRs) are data collected by airlines that can be used to identify passengers worthy of special attention. These records contain basic information on the passenger and their itinerary, as well as additional details concerning passenger frequent flyer membership, seat numbers and meal preferences. Since 9/11 a growing number of governments have requested this information from airlines in an effort to combat serious international and organised crime and terrorism. Countries including the United States, Canada, Australia, New Zealand and South Korea are already using PNR data. However, this raises important data protection issues and in the EU, for example, the airlines cannot legally provide PNR data until there is agreement on a clear data protection framework. This has meant that the exchange of PNRs has had to be considered on an individual country basis. Of major significance in this area in Europe was the EC publishing its global approach to the transfer of PNRs to third countries in 2010 (EC, 2010b). Subsequently an agreement was reached between the EU and Australia in 2011, and the EU, the United States (replacing the provisional deal agreed in 2007) and Canada in 2012. However, within the EU there was no harmonisation regarding the obligations of airlines to transmit PNR data until a directive to serve this purpose was introduced in 2016 (EC, 2016).

There is also advanced passenger information (API) which contains details including date of birth, nationality, gender and address in the destination country. This is more limited in scope and its primary purpose is to improve border control and irregular immigration. Since 2003 the United States (and Canada since 2006) have required this type of data to be sent in advance, which has been very controversial within Europe, again because of privacy and data protection concerns. Many other countries, including Australia, China, India, Japan, New Zealand, Mexico, South Korea, Russia, Turkey and the UK, also require API data. IATA estimated that 39 countries in total now require API with a further 32 planning this in the future. Overall the practice as regards PNR and API use varies considerably throughout the world and as a result industry bodies, such as IATA, have been pushing for more harmonisation (IATA, 2017b).

Biometric identification and registered passenger schemes

Recent advances in technology have meant that biometric identification can be used in essential processes including security and immigration. Biometric identification involves using unique physical characteristics to ensure a passenger or member of staff is known and is allowed to proceed, for example, through a gate or door. Such techniques can be as simple as a specialised identity card, or as sophisticated as the recognition of retina or iris patterns, fingerprints or speech. This technology concentrates on the individual passenger rather than the more traditional approach of focusing much more on the passenger's baggage. The industry has been developing the technology needed for such biometric processes for some time with the aim of speeding up processing times as well as improving their effectiveness of checks and preventing identity theft.

There are two types of biometric identification: physiological biometrics (which relies on recognition, for example of fingerprints, retina or iris patterns); and behavioural biometrics (which is associated with aspects of behaviour including signature and voice). Using biometrics for security or border checks can increase the efficiency of the process, save time and enhance customer service. Also, there is no risk of losing, copying, forgetting or having the biometrics stolen. An important use for biometrics is in machine-readable travel documents, including passports and visas. A biometric passport or ePassport has the passport's critical information stored on a tiny computer chip. In the past decade or so, many countries have issued ePassports with most having passenger information and a digital photo stored on the chip, as this facial recognition was the global standard that ICAO agreed to adopt in 2003 (along with voluntary additional fingerprint or iris recognition). Biometrics can also be used for employees, especially to check the identity of those who are entering sensitive and restricted areas.

Some passengers can volunteer (sometimes at a cost) to provide their personal and biometric information to be included in a 'registered passenger', 'registered traveller' or 'trusted traveller' scheme suitable for frequent flyers. These are designed to reduce delays at the airport and to enhance the passenger experience by allowing certain processes to be expedited while maintaining acceptable levels of security and border control. The passenger's background is investigated and if they are approved they will usually receive a smart card that contains their biometric information for use at the airport – as at Singapore airport with the IACS scheme that uses fingerprint recognition. Likewise, at Hong Kong airport there is a frequent visitor card that can be provided free to any visitor who has travelled through the airport three or more times in the past month and allows them to experience quicker immigration clearance. Some schemes offer more, including the Privium scheme at Amsterdam airport. This uses iris recognition and offers three types of membership. Privium Plus (€215 per annum) provides fast-track security border control plus other enhancements, including priority parking, discounts on valet parking, business-class check-in for many airlines and access to the Privium lounge. Privium Basic (€121) offers just the expedited security border control, whereas Premium Partner (€75) is available to partners or dependent children.

In the United States there is an initiative called the TSA Pre™ which is a risk-based security project. If offers a five-year US$85 membership to receive expedited security screening benefits, for example without the removal of items such as shoes, laptops, liquids, belts and light jackets. In 2017, over four million passengers were members and 200 airports and 37 airlines were involved with the initiative. It works by having passenger information embedded in the barcode of the passenger's boarding pass, which allows access to the fast-track security. However, arguably the most significant development has been IATA and ACI coming together in 2013 to agree an initiative called Smart Security to plan for airport security in the future (see Case Study 5.3).

CASE STUDY 5.3
THE SMART SECURITY INITIATIVE

Smart Security is a joint initiative agreed by IATA and ACI, and supported by ICAO in 2013. It recognises that the current security model is no longer sustainable in the light of traffic growth, evolving security threats, and passengers' increasing dissatisfaction with queues and intrusive screening measures. It has a purpose to improve the security process with more focus on using resources where risk is greatest, using new technology and biometrics and integrating passenger information into the checkpoint process. One-size-fits-all security concepts are considered inappropriate and involving all relevant stakeholders is viewed as essential for success.

The goals of Smart Security are (ACI/IATA, 2016: 4):

Strengthened security

- Increase unpredictability
- Better use of existing technologies
- Introduce new technologies with advanced capabilities
- Focus resources based on risk and advanced information

Increased operational efficiency

- Increase throughput
- Maximise equipment and space utilisation
- Optimise staffing resources
- Optimise cost per passenger

Improved passenger experience

- Reduce queues and waiting times
- Use technology for a less intrusive and disruptive search
- Reduce divestment requirements

Since 2013 individual components of the project have been trialed and evaluated in partnership with governments, airports, airlines and service providers. Involvement has included the European airports of Geneva, Amsterdam, Heathrow and Gatwick as well as other airports such as Doha and Melbourne. Results have indicated significant improvements in operational efficiency and some passenger satisfaction survey ratings have risen as a consequence. Several of the trial concepts are now permanently installed and fully operational. In 2016, Atlanta airport also agreed to be the first US airport to participate in the Smart Security project.

The components that were trailed included (ICAO, 2016):

– Centralised Image Processing (CIP) that moves screeners away from the checkpoint and delivers images to a central location. This provides airports with increased ability to optimise the use of X-ray machines and increase the efficiency of X-ray operators. The trials demonstrated significant efficiency improvements, as well as reductions in total passenger processing time, on average 30 seconds per passenger at some airports.
– Checkpoint environment and management enhancements that includes greater automation (for example with the tray-handling systems), resource optimisation and automated checkpoint performance monitoring solutions.
– Body scanners, either as primary or secondary measures for passenger screening.
– Advanced screening technologies for cabin baggage screening that provides effective threat detection but also reduces the burden for passengers. Already dual/multi-view X-ray technology, rather than the traditional single-view equipment, has improved the situation but there are now newer technologies such as computed tomography and X-ray diffraction.

The Smart Security roadmap consists of three overlapping waves with the first wave focusing on components that are already matured. The second wave concentrates on the next generation of screening technologies whilst the third wave covers risk-based processes. In 2016 there was movement towards the second wave, whilst still keeping the first stage ongoing.

Keflavik airport in Iceland is an example of an airport that has adopted Smart Security principles. Security was particularly challenging at this airport as passenger numbers had grown from around two million in 2010 to nearly nine million in 2017. In 2015 it began a complete revamp of the security checkpoint, focusing on optimising resource utlilisation, adapting facilities and upgrading screening equipment and systems. Specific improvements included CIP and parallel loading, with the latter allowing several passengers to prepare for security at the same time, and then proceed at their own pace. These changes meant that in July 2017, 92 per cent of passengers waited less than five minutes in security and 99 per cent less than 10 minutes at the airport (Airlines International, 2017).

Check-in and boarding processes

The final part of this chapter discusses developments associated with the check-in and boarding processes. There are now a number of ways that passengers can check in for their flight instead of using the traditional check-in desk. First came self-service check-in kiosks at airports, then remote methods including the internet and mobile phones.

Check-in kiosks at airports began appearing about 20 years ago. They were installed by the airlines primarily for their own use – the so-called dedicated or proprietary kiosks. This was an inevitable development as the airline industry saw how self-service technologies in other industries, such as banking, had lowered costs, increased productivity and reduced customer waiting time. At the same time, better use could be made of the scarce space at airports. This was followed by the development of the common-use self-service (CUSS) check-in kiosks that allowed the airlines to share self-service resources. There had been a similar trend with the traditional check-in desks when common-use terminal equipment (CUTE) was introduced in the early 1980s. The earliest CUSS check-in kiosks were installed at Vancouver and Narita airports in 2002. By 2006 around 29 per cent of all passengers used some type of self-service kiosk (Baker, 2007). Overall, over 90 per cent of airports now have some kind of self-service kiosk (see Table 5.8).

Initially, the airlines (and later the airline alliances) developed dedicated desks to differentiate themselves from others and to give themselves a competitive advantage – particularly for their frequent flyers. The kiosks were branded with their name and identity. However, there was no common standard for these dedicated kiosks and so investment and maintenance costs proved to be high – particularly when the airport being served was not a major base for the airline. Hence the CUSS kiosk was developed. This allows the costs to be shared between different airlines and fewer airport counter staff are required. However, the airlines lose individual influence over the check-in process and the costs they incur, and will no longer be able to differentiate this aspect of their product. For the airports, the CUSS system provides more flexibility – just as the CUTE system did when it was introduced – and allows terminal space to be used more efficiently. This may enable a higher volume of passengers to be handled without the necessity of expanding the terminal. The check-in facilities can be placed in the most convenient places in the terminals and spread out if necessary to avoid crowding. In theory, space no longer needed for check-in can be used for retail opportunities, although it may require considerable reconfiguration of the overall space to place these new facilities in an appropriate location. In most cases the airport operator owns the CUSS kiosks and then charges the airlines (or includes CUSS use in other charges, including for CUTE facilities), but in rare cases it may be the airlines themselves or the handling agents.

For the passenger, both types of kiosk provide an opportunity for easier and faster check-in, but the CUSS system gives more flexibility to check in anywhere regardless of the airline and can thus eliminate any confusion arising from multiple dedicated terminals. Kiosks can be placed not only in the traditional check-in areas, but also within other places in the terminal and off-terminal sites, including car parks, train stations, car rental return facilities, hotels and cruise ships, which can reduce check-in queues in the terminal and give passengers extra convenience and control. For example, for Hong Kong airport there are check-in and baggage drop facilities at Hong Kong and Kowloon railway stations, and at the SkyPier ferry ports as well as a few other off-airport locations. Similarly Abu Dhabi airport has four remote check-in facilities, namely City Terminal, Abu Dhabi International Airport Expo, Park Rotana Hotel and Crowne Plaza Yas Island Hotel, with the first two providing bag drop as well.

Self-service kiosks have become much more sophisticated in the services they offer. Most of the original self-service kiosks could not deal with passengers' bags. Often, once self-service check-in was completed, passengers had to queue up at individual airline desks to check in their luggage, which was a major disadvantage of the machines. However, this problem has been overcome by bag drops (either assisted or totally self-service) and self-tagging. For instance, Gatwick airport currently has the world's largest self-service bag drop zone in its North Terminal for its airline customer easyJet. The facility, which came into operation in 2016, has 48 bag drop units in a 5,000 m^2 bag drop area. Common-use self-service bag drops are offered at some airports, giving airlines the advantage of cost-sharing and airports better capacity utilisation, just as with the CUSS kiosks. Meanwhile, self-tagging has increased significantly in the past few years and for some airlines, such as Qatar, Air France/KLM, Iberia and Alaska Airlines, it is now possible to home-print the tags. A more recent development has been permanent digital tags to replace the paper-based tags, for example the so-called Qantas Q bag tag that can be used for domestic flights.

Many of the new generation check-in machines can also read travel documents, including passport and visas, allow meal and seat selection, and handle transfer flights, re-booking flights and reporting missing luggage. They also offer opportunities to streamline passenger flows and enhance operational efficiency by being integrated with the other passenger-processing technologies involved with security and border control activities, such as checking travel documents. Potentially, they can also provide revenue opportunities, such as enabling passengers to download digital content (e.g. the latest films) before they board the flight.

However, remote (online and mobile) check-in has also become a very popular alternative. This costs even less for the airlines as they do not need to install kiosks and/or use

Table 5.8 Airport use of self-service technology, 2013 and 2016

Technology	Use in 2013 (per cent)	Use in 2016 (per cent)
Check-in via kiosk	84	91
Bag drop (assisted)	52	61
Bag tag printing at kiosk	38	51
Information services at a kiosk (e.g. flight status, gate info)	34	31
Bag drop (fully self-service)	13	26
Self-boarding (unassisted e-gate)	10	19

Source: Adapted from SITA (2016a)

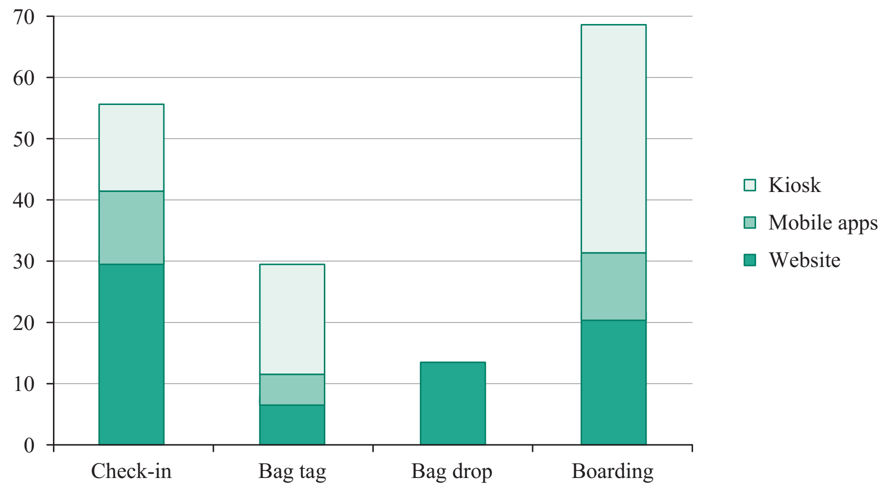

Figure 5.1
Passenger use of technology at airports, 2016 (%)
Source: Adapted from SITA (2016b)

CUSS, and the passengers print their own boarding passes in the case of online (PC) check-in using their own paper. Many airlines actually offer both remote check-in and self-service kiosks, typically giving passengers the chance to print out their boarding pass from the kiosk having already checked in remotely. However, some airlines, especially LCCs such as Ryanair, do not provide this option.

For some time, there has been a debate as to whether self-service kiosks will only be an interim solution to improving the check-in process, which eventually will not be needed, as checking in remotely using PCs or mobiles is cheaper for airlines and more convenient for passengers. However, such remote technology may not always be available to travellers, particularly if they are away from home. Until there is more widespread use of reusable permanent baggage tags they are also likely to play a vital role for passengers with hold baggage.

In addition to check-in, technology is increasingly being used for other passenger processes at the airport, including transfer kiosks, automated e-gates for check points and self-boarding gates. There are also ongoing developments with baggage processing such as radio frequency identification (RFID) for baggage tracking (which IATA is requiring for all its members by 2018 with its resolution 753), and paperless and streamlining processes for cargo. Moreover, tablets are now commonly been used by dispatchers and loaders to capture real-time load data to keep track, for example, of aircraft loaded weight and baggage location.

Table 5.8 shows the airport use of passenger and bag self-service technology and how it has changed between 2013 and 2016. Check-in via kiosks is now available at over 90 per cent of airports. Nearly two-thirds of airports have assisted bag drops, but less than a third have fully self-service bag drops. Bag tag printing at kiosks is possible at around half the

Table 5.9 IATA's Fast Travel Programme

Process	Key features	Airport readiness by 2018
Check-in	Automated, online, mobile and self-service kiosks	60% stating that mobile check-in will the primary check-in method
Bags ready-to-go	Home printing, self-tagging and bag drops	90% offering assisted bag drop
Document check	Self-service kiosks	72% offering information services via kiosks
Flight re-booking	Online, mobile and self-service kiosks	61% offering passenger self-service tools to solve disruption problems
Self-boarding	Automated boarding gates	53% implementing self-boarding gates
Bag recovery	Online, mobile and self-service kiosks	33% offering self-service lost bag registration

Sources: IATA (2017c); SITA (2016c)

airports, but the availability of other services at a kiosk is not so common. Only a fifth of the airports have self-boarding. Between 2013 and 2016 use of all these technologies increased, with the exception of kiosk information services where it remained fairly constant – being available at around a third of all airports.

Figure 5.1 shows passenger use of the different technologies. Using the internet for check-in is the most popular method, whilst the kiosk is more popular for bag tags and boarding cards. Mobile apps are currently not used so often but it is this technology that is expected to experience the fastest relative growth in the future.

Since 2004, the airline organisation IATA has been actively encouraging the use of technology with its Simplifying the Business (StB) initiative to streamline processes and reduce complexity and cost. This has involved a variety of interested parties including airlines, airports, travel agents, technology providers and global distribution systems. Some of the early focus related to areas including e-ticketing, self-service kiosks, barcoded boarding passes and RFID for baggage management.

Of particular relevance to the discussion here is the passenger facilitation programme, which focuses on the security, border protection, immigration and customs processes with the aim of improving the passenger's end-to-end experience. It included improving the quality of passenger data transferred from airlines to governments, improving passenger flows at security checkpoints using risk-based approaches, and improving border crossing through the promotion of automated border control using biometric identification. A key programme, Fast Travel, covers a number of self-service processes that have the potential to speed the passenger flows through airports. Table 5.9 identifies the six key features of the Fast Travel programme and also presents some survey data from SITA (2016c) indicating how ready airports will be in offering these services by 2018.

There is a target to offer 80 per cent of global passengers the complete self-service suite of Fast Travel solutions by 2020. This share, as of June 2016, was 41.3 per cent with three airlines (Lufthansa, Alaska Airline and Air New Zealand) offering all options to at least 80 per cent of their passengers (IATA, 2017c). A notable airport example is Terminal 4 at Singapore Changi airport which opened in 2017 and has a complete suite of self-service and automated options for check-in, bag-drop, immigration clearance and boarding, supplemented biometric facial recognition technology to eliminate manual identification. Aruba airport (see Case Study 5.4) is also an interesting example of an airport that has trialled a number of these self-service processes, and has gone further by streamlining the passenger checks that need to be made.

CASE STUDY 5.4
ARUBA AIRPORT HAPPY FLOW

Aruba Airport Happy Flow is a collaborative initiative of the governments of Aruba and the Netherlands, the Schiphol Group, KLM, Aruba Airport Authority and Vision Box (who provided the infrastructure). Aruba airport handled 2.73 million passengers in 2016. The initiative was launched in 2015 initially as a two-year pilot with two aims:

1. To streamline passenger processing and improve the passenger experience;
2. To test the first pre-clearance border control process from the Americas to the EU-Schengen area.

It uses facial recognition to secure and streamline passengers' journey through the airport. It thus removes the need for passengers to present their passport and boarding pass at multiple stages of the airport journey. It works by having a photo taken when the passenger checks in at a self-service kiosk and this is then verified against the passport, allowing the border control checks to be made. This information, called the passenger data envelope, is sent automatically to all relevant airport stakeholders. Then at the passenger touch points such as bag drop, border control and boarding, passengers have their face recognised by a camera, rather than having to produce any documents. Hence it uses what is called a 'Single Token' by which passengers can repeatedly identify themselves throughout the steps of the airport process, with an end-to-end so-called passenger flow orchestra platform.

The concept has the ability to significantly speed up the processes and evidence shows that on average processing time at boarding decreased from 10.6 seconds per passenger in September 2015 to 8.1 seconds in October 2016. Since it provides a real-time overview of the passengers' individual clearance processes, it also can be used by the airport to efficiently monitor passenger flows, and by others, for example, to track the location of their passengers.

At first only a limited group of KLM passengers travelling with an EU passport were invited to participate in the pilot, but eventually during the pilot passengers from over 36 different countries used Happy Flow. Further development of the concept could include the integration of the security checkpoint as well, or the introduction of the Happy Flow process at Amsterdam airport. In fact, the Schiphol Group and KLM have undertaken a feasibility study to explore if and how Happy Flow could be implemented in Amsterdam. Moreover, in 2017, in declaring that the pilot scheme was as a success, Aruba Airport Authority and Vision Box announced a further agreement to sustain the position of Happy Flow as a global leader, and to extend the development of the concept with an initiative called Gateway 2030 by establishing a seamless travel Centre of Excellence (Anika, 2017; Steenbergen, 2017).

In summary, there are a number of current and future developments concerning passenger processes that are having, or have the potential to have, a major impact on the airport and its passengers. More rigid security procedures can cause disruption to journeys and affect the passenger experience by increasing the hassle factor associated with passing through an airport, reducing opportunities for passengers to use the commercial facilities. Also, increased reliance on technology can have important implications for airport operations and delays if there are malfunctions or breakdowns. On the other hand, more risk-based approaches and biometric identification procedures with border control may speed up certain processes. Likewise, changes in the way passengers check in, drop off their baggage and proceed through the gates, may also improve the passenger experience. From the airport operator's viewpoint there are also major impacts. Self-service and automated procedures, while expensive to install initially, are likely to have lower operational costs, which may be a substantial benefit depending on the airport operator's direct involvement with such processes. They may give the airport an opportunity to reduce congestion, increase capacity utilisation and improve passenger flows. They may also free up space for commercial opportunities, depending on the layout of the terminal, and increase the dwell time for passengers to shop. In short, all aspects of terminal planning will need to consider these changes. Issues related to the passenger experience are developed further in Chapter 6.

References

ACI/DMKA (2012) *ASQ Best Practice Report: Airport Loyalty Programmes*, Montreal: ACI.
ACI/IATA (2016) *Smart Security Blueprint*, version 4, Montreal/Geneva: ACI/IATA.

ACI Europe (2010) *An Outlook for Europe's Airports*, Brussels: ACI Europe.

ACI Europe (2016) *Airport Landside Security*, position paper, May, Brussels: ACI Europe.

Airlines International (2017) Smart Security benefits being realized in Iceland, 7 August. Online. Available at http://airlines.iata.org/news/smart-security-benefits-being-realized-in-iceland? (accessed 1 June 2017).

Anika (2017) 'Exclusive partnership and pioneering Centre of Excellence at Aruba Airport', *Free Zone Aruba News*, 15 August. Online. Available at: http://www.freezonearuba.com/free-zone-aruba-news/exclusive-partnership-and-pioneering-center-of-excellence-at-aruba-airport/ (accessed 16 August 2017).

Baker, C. (2007) 'Checking in', *Airline Business*, July: 38–40.

Boston Consulting Group (2004) Airports – Dawn of a New Era. Online. Available at: http://www.bcg.com/documents/file14335.pdf (accessed 30 March 2012).

CAPA (2015) Redefining Airport Hubs: (Self)-Connectivity: The next vital piece in the Industry's Advancement. 29 May. Online. Available at https://centreforaviation.com/insights/analysis/redefining-airport-hubs-self-connectivity-the-next-vital-piece-in-the-industrys-advancement-225855 (accessed 25 May 2016).

Cattaneo, M., Malighetti, P., Paleari, S. and Redondi, R. (2017) 'Evolution of the European network and implications for self-connection', *Journal of Air Transport Management*, 65: 18–28.

Cserep, K. (2016) *The Future of Self-Connect and the Implications for the Dutch Aviation Sector*, Airneth Conference, 18 May, The Hague.

Cserep, K. (2017) *Win or Lose: The Airport Opportunity in the Growing Self-Connecting Passenger Market*. Online. Available at https://www.icf.com/resources/white-papers/2017/growing-self-connecting-passenger-market (accessed 29 May 2017).

Daft, J. and Albers, S. (2015) 'An empirical analysis of airline business model convergence', *Journal of Air Transport Management*, 46: 3–11.

DHS (2016a) *DHS Announces 11 New Airports Selected for Possible Preclearance Expansion following Second Open Season*, press release, 4 November. Online. Available at: https://www.dhs.gov/news/2016/11/04/dhs-announces-11-new-airports-selected-possible-preclearance-expansion-following (accessed 30 May 2017).

DHS (2016b) *Passenger Screening Using Advanced Imaging Technology*, final rule, docket no. TSA-2013–0004, Washington DC: Department of Homeland Security.

Dobruszkes, F. (2013) 'The geography of European low-cost airline networks: a contemporary analysis', *Journal of Transport Geography*, 28: 75–88.

Dobruszkes, F., Givoni, M. and Vowles, T. (2017) 'Hello major airports, goodbye regional airports? Recent changes in European and US low-cost airline airport choice', *Journal of Air Transport Management*, 59: 50–62.

EC (2002) *Regulation (EC) No 2320/2002 of the European Parliament and of the Council of 16 December 2002 Establishing Common Rules in the Field of Civil Aviation Security*, Official Journal L355, 30 December, Brussels: EC.

EC (2006) *Regulation (EC) No 1546/2006 of the European Parliament and of the Council of 4 October Amending Regulation (EC) No 622/2003 Laying Down Measures for the Implementation of the Common Basic Standards on Aviation Security,* Official Journal L286, 17 October, Brussels: EC.

EC (2007) *Regulation (EC) No 915/2007 of the European Parliament and of the Council of 31 July Amending Regulation (EC) No 622/2003 Laying Down Measures for the Implementation of the Common Basic Standards on Aviation Security*, Official Journal L200, 1 August, Brussels: EC.

EC (2008) *Regulation (EC) No 300/2008 of the European Parliament and of the Council of 11 March on Common Rules in the Field of Civil Aviation Security and Repealing Regulation (EC) No 2320/2002*, Official Journal L97, 9 March, Brussels: EC.

EC (2009) *Directive 2009/12/EC of the European Parliament and of the Council of 11 March 2009 on Airport Charges,* Official Journal L070, 14 March, Brussels: EC.

EC (2010a) *Communication from the Commission to the European Parliament and the Council on the Use of Security Scanners at EU airports*, COM (2010) 311 final, Brussels: EC.
EC (2010b) *Communication from the Commission to the European Parliament and the Council on the Global Approach to Transfers of Passenger Name Record (PNR) Data to Third Countries*, COM(2010) 492 final, Brussels: EC.
EC (2016) *Directive 2016/681 of the European Parliament and of the Council of 27 April 2016 on the use of passenger name record (PNR) data for the prevention, detection, investigation and prosecution of terrorist offences and serious crime*, Official Journal L119/132, 4 May, Brussels: EC.
Fageda, X., Suau-Sanchez, P. and Mason, K.J. (2015) 'The evolving low-cost business model: Network implications of fare bundling and connecting flights in Europe', *Journal of Air Transport Management*, 42: 289–96.
Falconer, R. (2006) 'The low-cost challenge for airports', *Communique Airport Business*, June–July: 21–22.
Feldman, D. (2009) 'Thinking outside the box', *Airport World*, 15 November. Online. Available at: http://www.airport-world.com/publications/all-online-articles/item/717-thinking-outside-the-box (accessed 30 March 2012).
Feldman (2011) 'Leading the way', *Airport World*, 28 September. Online. Available at http://www.airport-world.com/publications/all-online-articles/item/1029-leading-the-way (accessed 30 March 2012).
Fichert, F. and Klophaus, R. (2016) 'Self-connecting, codesharing and hubbing among European LCCs: From point-to-point to connections?', *Research in Transportation Business and Management*, 21: 94–98.
Frank, L. (2011) 'Business models for airports in a competitive environment. One sky, different stories', *Research in Transportation Business and Management*, 1: 25–35.
Future Travel Experience (2015) *Gatwick Airport takes a Lead on Offering Welcome Protection to Self-Connecting Passengers*, October. Online. Available at http://www.futuretravelexperience.com/2015/10/gatwick-airport-offers-protection-to-self-connecting-passengers/ (accessed 29 May 2017).
GAO (2002) *Using Airport Grant Funds for Security has affected some Development Projects*, Washington, DC: General Accounting Office.
Gillen, D.W. and Morrison, W.G. (2015) 'Aviation security: Costing, pricing, finance and performance', *Journal of Air Transport Management*, 48: 1–12.
Graham, A. (2013) 'Understanding the low-cost carrier and airport relationship: a critical analysis of the salient issues', *Tourism Management*, 36: 66–76.
IATA (2017a) Low Cost Facilities and Services. Online. Available at https://www.iata.org/policy/Documents/low-cost-facilities.pdf (accessed 30 May 2017).
IATA (2017b) Passenger Data Exchange: The Basics. Online. Available at http://www.iata.org/iata/passenger-data-toolkit/presentation.html (accessed 30 May 2017).
IATA (2017c) Fast Travel Fact Sheet June 2017. Online. Available at https://www.iata.org/pressroom/facts_figures/fact_sheets/Documents/fact-sheet-fast-travel.pdf (accessed 30 May 2017).
ICAO (2012) I*CAO's Policies on Charges for Airports and Air Navigation Services – Doc 9082*, 9th edn, Montreal: ICAO.
ICAO (2016) *Capacity Building: ACI Smart Security Programme,* Africa-Indian Ocean Aviation Safety, Security and Facilitation Symposium, 27 June.
Irish Aviation Authority/Aviasolutions (2004) *Study on Civil Aviation Financing (summary of final report)*, Dublin: Irish Aviation Authority/Aviasolutions.
Jacobs Consultancy (2007) *Review of Dedicated Low-Cost Airport Passenger Facilities,* London: Jacobs Consultancy.
Jarach, D. (2005) *Airport Marketing: Strategies to Cope with the New Millennium Environment*, Farnham: Ashgate.
Jimenez, E., Claro, J. and de Sousa, J.P. (2014) 'The airport business in a competitive environment', *Procedia-Social and Behavioral Sciences,* 111: 947–54.

Kalakou, S. and Macário, R. (2013) 'An innovative framework for the study and structure of airport business models', *Case Studies on Transport Policy,* 1(1): 2–17.

Kirschenbaum, A.A. (2013) 'The cost of airport security: The passenger dilemma', *Journal of Air Transport Management,* 30: 39–45.

Lavelle, B. (2016) *London City Airport: Aviation Market Research,* University of Westminster Air Transport Forecasting and Market Research Course, October.

LeighFisher (2016) *Review of Airport Charges 2016, London: LeighFisher.*

LeighFisher (2017) *UK Airport Performance Indicators 2015/2016*, London: LeighFisher.

Maertens, S., Pabst, H. and Grimme, W. (2016) 'The scope for low-cost connecting services in Europe – Is self-hubbing only the beginning?', *Research in Transportation Business & Management*, 21: 84–93.

Malighetti, P., Paleari, S. and Redondi, R. (2008) 'Connectivity of the European airport network: "self-help hubbing" and business implications', *Journal of Air Transport Management,* 14(2): 53–65.

Mercer Management Consulting (2005) Profitable Growth Strategies in the Airport Business. Online. Available at http://www.garsonline.de/Downloads/051124/Doering%20-%20Presentation.pdf (accessed 30 March 2012).

Morrison, G. and Rodenburg, K. (2018) 'Key aspects in aviation security', in N. Halpern and A. Graham (eds), *The Routledge Companion to Air Transport Management,* London: Routledge.

Murad, D. (2016) 'Malaysia Airport quashes Air Asia's LCCT2 plans', *The Star,* 13 June. Online. Available at http://www.thestar.com.my/news/nation/2016/06/13/malaysia-airports-disagree-with-klia2-as-low-cost-terminal/ (accessed 30 May 2017).

Njoya, E. and Niemeier, H.-M. (2011) 'Do dedicated low cost passenger terminals create competitive advantages for airports?', *Research in Transportation Business and Management*, 1(1): 55–61.

OAG (2015) *Finavia does not see the Value Proposition of Creating Self-Connectivity as an Airport*, press release, 27 July. Online. Available at: http://oagaviation.jp/Industry-News/finavia-does-not-see-value-proposition-creating-self-connectivity-airport (accessed 24 May 2017).

OAG (2016) Self-Connection: The Rise and Roadblocks of a Growing Travel Booking Strategy. Online. Available at https://www.oag.com/blog/airline-passengers-embrace-self-connection (accessed 24 May 2017).

Prentice, B.E. (2015) 'Canadian airport security: The privatization of a public good', *Journal of Air Transport Management*, 48: 52–59.

Raffel, R. and Ramsay, J. (2011) 'Aviation security in the United States', in J. O'Connell and G. Williams (eds), *Air Transport in the 21st Century, Farnham: Ashgate.*

Rossiter, A. and Dresner, M. (2004) 'The impact of the September 11th security fee and passenger wait time on traffic diversions and highway fatalities', *Journal of Air Transport Management,* 10(4): 225–30.

Saraswati, B. and Hanaoka, S. (2012) 'Space allocation for commercial activities in low-cost airport terminals', *Journal of Airport Management*, 6(4): 397–411.

SITA (2016a) *2016 Airport IT Trends Survey*, Geneva: SITA/ACI.

SITA (2016b) *2016 The Passenger IT Trends Survey*, Geneva: SITA/Air Transport World.

SITA (2016c) *The Future is Connected*, Geneva: SITA.

Skytrax (2017) The World's Best Airport Terminals for Low Cost Airlines. Online. Available at http://www.worldairportawards.com/Awards/best_lowcost_airports.html (accessed 28 May 2017).

Steenbergen A. (2017) *Aruba Happy Flow: The First Biometric Single Token Solution*, ICAO TRIP Regional Seminar Antigua, January–February.

Suau-Sanchez, P., Voltes-Dorta, A. and Rodríguez-Déniz, H. (2016) 'Measuring the potential for self-connectivity in global air transport markets: Implications for airports and airlines', *Journal of Transport Geography*, 57: 70–82.

Tatibouet, Y. and Doumas, E. (2008) 'Regulation of low-cost carrier facilities at French airports', *Journal of Airport Management*, 3(1): 4–6.

Thelle, M.H., Pedersen, T.T. and Harhoff, F. (2012) *Airport Competition in Europe*, Copenhagen: Copenhagen Economics.

Wong, S. and Brooks, N. (2015) 'Evolving risk-based security: A review of current issues and emerging trends impacting security screening in the aviation industry', *Journal of Air Transport Management*, 48: 60–64.

Zhang A., Hanaoka, S., Inamura, H. and Ishikura, T. (2008) 'Low-cost carriers in Asia: deregulation, regional liberalisation and secondary airports', *Research in Transportation Economics*, 24(1): 36–50.

6 Airport service quality and the passenger experience

Challenges for airport operators

Chapter 5 discusses how airports are differentiating their offer to meet requirements of their diverse customers and identifies developments related to the main processes. However, in order for airports to change in this manner and meet the demands of current and future users, there needs to be a good understanding of the service quality provided, and the factors that are important for the overall passenger experience.

Providing satisfactory levels of service for users can be particularly challenging for airport operators because of a number of factors. First, there is usually an uneven spread of demand. For many airports, a terminal will look and feel very different on a quiet Tuesday in winter compared with a busy summer Saturday in the school holidays. Likewise, passenger flows in the early morning or evening at an airport dominated by short-haul business traffic will be considerably greater than at other times of day. This is very likely to play a major role in influencing the passenger's perception of the quality of service provided.

The overall service is produced as a result of the combined activities of various different organisations, including airlines, handling agents, customs and immigration officials, concessionaires and so on. These different bodies may have different ultimate objectives and even conflicting views on what determines satisfactory or good service. As a result, the airport operator has only partial control of all the processes that make up the final product or service. Areas of responsibility therefore have to be very clearly identified and the airport operator must define a common goal for all as regards service quality. Even for individual activities, responsibilities may be shared that will increase the complexity. For instance, for check-in an airport operator may provide the equipment while airlines or handling agents actually man the desks.

A further problem is that at many airports, the airport product has to appeal to a very heterogeneous range of passengers unless specialised terminals or products are offered (see Chapter 5). Some passengers may want to get through the airport as quickly as possible with a minimum of distractions, while others enjoy the opportunity of being able to shop and take refreshments. Business and leisure passengers may also have very contrasting requirements. It may even be that the same passenger will have different needs depending on when they are travelling, being a lone business traveller during the week but then travelling for leisure reasons with the rest of the family at the weekend.

In designing airfield facilities, there are many technical specifications to consider that relate primarily to the safe passage of aircraft and their passengers and freight. As a result, the airport operator usually has limited freedom to vary these specifications. However, with the terminal there is more flexibility. The LOS offered to the passenger will be related to two aspects of capacity: static and dynamic. Static capacity relates to the storage potential of the different areas of the terminal. Hence the LOS related to this will be defined as the number of passengers the area will accommodate at any one moment at a defined LOS – for example, a value such as 1.7 m^2 per passenger. By contrast, dynamic capacity is the maximum processing or flow rate of persons through a subsystem in the terminal per unit time. In this case the LOS will be defined as waiting time, such as 90 per cent of passengers being processed in 7 minutes or less, or alternatively 180 passengers being processed per hour.

An airport terminal will be a function of the planned LOS: the lower the acceptable LOS, the greater the capacity. IATA has well established LOS standards that are related primarily to space, queuing and waiting standards. These are listed in its airport development manual, which has widespread use within the airport industry (IATA/ACI, 2016). This used to have six levels of service: A (excellent), B (high), C (good), D (adequate), E (inadequate) and F (unacceptable); typically, most airports designed facilities to operate at level C. However, this manual was changed in 2014 (in collaboration with ACI) by introducing a new 'space-time' concept or matrix, that seeks to find the optimum balance between available space and acceptable waiting times without over-designing or under-providing facilities.

There are now two key variables, namely space per passenger and maximum waiting time, rather than just space per passenger, and the concept consists of four categories, namely: under-provided, sub-optimum, optimum and over-design, rather than the previous letter categories. With the more diverse standard of facilities that are needed at modern airports, the updated parameters provide a range of values for space and maximum waiting time that allows an airport to tailor its service level more to the market and region it serves. There are a number of different terminal sub-systems: public departure hall, conventional check-in (economy and business), self-service check-in kiosks, passport control (emigration and immigration), airside departure concourse, baggage reclaim, customs control, public arrival hall and transfer security. An example of the standards for security and passport control are 5–10 minutes optimum waiting time and 1.0–1.2 m^2 optimum space per passenger. For check-in the optimum waiting times are 1–2 minutes; for self-service boarding pass and tagging; 1–5 minutes for bag drop desk; and 10–20 minutes for check-in desk. Table 6.1 provides more information of the standards for a check-in desk.

Table 6.1 LOS standards for a check-in desk (with queue width 1.4–1.6 m)

	Over design	Optimum	Sub optimum
Space (m^2 per passenger)	>1.8	1.3–1.8	<1.3
Waiting time: Economy class (minutes)	<10	10–20	>20
Waiting time: Business/first class (minutes)	<3	3–5	>5

Source: Adapted from IATA/ACI (2014)

Rather than using the IATA standards, airports may instead devise their own, based on their specific services and facilities and their unique mix of users. These individual standards will be set and revised in the light of actual user levels of satisfaction. However, in most cases these are not significantly different from those suggested by IATA/ACI.

Measuring service quality

Different types of measurement

At many airports, measuring the quality of service is just part of the overall quality management system that has become all about the continuous process of identifying customer needs, assessing their level of satisfaction and taking corrective action when necessary. All employees and all processes are considered to contribute to the long-term success of this system. Such an approach is now considered to be a critical element in many service businesses, and is viewed as giving companies a competitive edge and as a way to increase customer confidence. Potential benefits include increased employee motivation and enhanced communication and teamwork within the organisation, with increased productivity and efficiency. Theoretically, the 'cost of quality' does not have to be expensive, as good quality management, through quality appraisal and prevention schemes, aims to minimise the costly situation when the service is unacceptable and has to be rectified.

In some cases, airports have chosen to certify their quality management system and gain external recognition by using the ISO 9001 standards. The latest version is ISO 9001: 2015. The ISO standard does not tell the airports how they should set up their system, but simply gives guidance on the elements that should be included. Certification involves inspection by an independent registration body. Vienna airport was the first airport to receive ISO 9001 accreditation for the total organisation in 1995. There are now many airports that have ISO 9001 certification for some or all of their activities. Recent accreditations include Algiers airport which became the first airport in Africa to obtain the award in 2015, followed by Cairo airport in 2016 and Enfidha-Hammamet airport in Tunisia in 2017. Elsewhere, Rio Galeao became the first Brazilian airport to receive the award in 2016 and Clark airport was the first airport in the Philippines in 2017. There are also awards given by external bodies in recognition of their approach to quality management, including the European Foundation for Quality Management (EFQM) excellence awards and the Malcolm Baldridge Award in North America. The ISO 9001 standard is one of many that airports may seek, including ISO 14001 for environmental management and ISO 20000 for IT service management.

Airports use both objective measures of their service quality (related to service delivery performance) and subjective measures (related to customer perceptions). Objective indicators are connected to the LOS standards, linking to both the static and dynamic measures of capacity and assessing the service delivered. They cover areas including flight delays, availability of lifts, escalators and trolleys, and operational research surveys of factors including queue length, space provision, waiting time and baggage reclaim time. To be accurate, these measures need to be collected regularly and at varying time periods when different volumes and types of passengers are being processed through the airport. The advantages of these are that they are precise, easy to understand and can be related to the levels of service standards.

Most large airports regularly observe and monitor their service delivery performance (e.g. waiting time and queue length for essential processes). However, if there is a certain issue related to one aspect of airport operations or one part of the airport terminal, they may want to undertake additional *ad hoc* research. Mystery shoppers may be used for assessing the overall passenger experience in the terminal overall or the quality of the commercial facilities. Other methods may include tracking, when passengers are monitored throughout their journey in the terminal to see where they spend their time and where they are held up with bottlenecks. This may help shed light on how available time influences retail spend, and on any other issues related to passenger flows that have not been identified through other research methods. Developments such as near field communication (NFC) or Bluetooth technology have greatly improved the ability of an airport to efficiently undertake such tasks.

However, the objective measures of service quality can cover only a limited range of issues and service dimensions. For instance, while they can measure the reliability of equipment, they cannot tell whether consumers feel safe, assured and satisfied with their use of the equipment. Similarly, a passenger's perception of the time they have spent waiting in a queue may be very different from the actual waiting time. Time and availability measures give no indication of the proportion of passengers receiving poor service and so are not really focused on the passenger experience. Such measures also do not identify priority areas, for example whether or not the availability of a lift that may be covered by a service delivery measure is crucial.

Subjective measures looking at passenger satisfaction ratings are also ideally needed. These measures will enable the quality of service to be assessed through the eyes of users rather than airport management. There are a number of different types of subjective measures, the two key methods being routine comment/complaints feedback (through social networks such as Twitter and Facebook, letters, phone calls, e-mails), and customer surveys. Airports may also undertake in-depth interviews, focus groups or online panel discussions that give them a chance to discuss certain issues in more depth than could be achieved with a survey. In this case, more qualitative information will be gathered that will typically investigate opinions and attitudes.

As regards the benefits of routine feedback, this information is cheap and immediate. If the comments are favourable they may also provide a positive public relations opportunity. The airport operator, however, has very little control over this type of feedback. The comments will not come from a representative sample of travellers at airports and will usually reflect only extreme views, since users tend not to be motivated to comment unless they feel very strongly about their experience at the airport. Hence, while such feedback may be able to identify a weakness that can be rectified swiftly, it is not systematic or scientific enough to be used for quality improvement programmes or target-setting.

In the latter case, consumer surveys are more suitable. Typically such surveys will ask passengers about their usage of facilities and services and their opinion of them in terms of comfort, congestion, cleanliness, value for money and so on. Also, if passenger profile information is collected, the survey findings can be used to investigate relationships between usage and satisfaction of services with demographics, attitudes and experiences of travellers. Consideration has to be given to the sample size, interview time and most appropriate place to survey. Departing passengers may be keen to participate while waiting in their departure lounge having completed all the major essential processes, but tired arriving passengers may be less cooperative – being anxious to find their luggage and return home. The main drawback of surveys is, of course, their high cost. The results are also not so immediate as feedback comments, and may require careful interpretation. Moreover, passenger perceptions often take some time to adjust once changes have been introduced at an airport, so there may be a lag effect with surveys which does not affect objective measures.

Technological developments have also enabled airports to use simpler forms of passenger feedback, when passengers just select a limited number of options related to their satisfaction in the form of a happy/sad face emoji or traffic light buttons at various locations at the terminal. The advantage of this method is that airport management can view feedback very rapidly, often with just a 24-hour delay. At Dublin airport there were 11 such consoles in 2015 that recorded over 700,000 responses (Harrison, 2015). This method can even provide immediate feedback, as at London City airport which has 60 at 16 locations across the terminal, at key stages of the journey, including check-in, security search, toilets, passport control and baggage reclaim. This means, for example, if the dissatisfied button is pressed in the toilet area three times in the space of 15 minutes, cleaning staff will receive an alert via a text message. Another advantage of this type of feedback is that if passengers are dissatisfied it allows them to express this view immediately and by doing so can reduce their level of frustration.

As well as taking into account passengers' views of quality of service, airports need to consider their other customers. Airline, concessionaire and tenant surveys may be undertaken to identify the needs of the respective customer groups and to gauge their satisfaction with the airport operator. However, at most airports there is usually a regular dialogue between airlines, concessionaires, tenants and other service providers, so additional information through more formal surveys may not be necessary. Also, the smaller number of organisations involved with all but the largest airports, compared with passenger or employee groups, means that airports may be able to survey all or most of the target population rather than having to select a representative sample.

As with economic performance, airports now appreciate that it is equally important to make comparisons and to benchmark themselves against other airports as well as with their past performance. To serve this purpose, in some countries there may be national surveys. For example, in the UK the consumer organisation Which? undertakes a survey of UK airports involving more than 10,000 passengers, whilst in North America the organisation J.D. Power also produces some comparative assessment of US and Canadian airports. However, many airports want to make international comparisons as well that can be particularly problematic because of the lack of consistency or common format of each airport's consumer survey. The sample size can also vary significantly. There are, though, a couple of surveys that cover a sample of airports in a consistent manner. The most comprehensive and well established survey is the ACI Airport Service Quality (ASQ), discussed in Case Study 6.1.

In addition, there is the online Skytrax airport customer satisfaction survey, based on nearly 14 million passengers from 105 countries and covering more than 550 airports, which is used to produce their 'best airport rankings'. The survey covers 39 service and performance parameters, including facility comfort, location of bathrooms, and the language skills of the airport staff. In 2017 the top 10 airports were Singapore (1), Tokyo Haneda (2), Seoul Incheon (3), Munich (4), Hong Kong (5), Doha Hamad (6), Centrair Japan (7), Zurich (8), Heathrow (9) and Frankfurt (10), with the best improved airport being Soekarno-Hatta Jakarta airport. The survey results are used as one factor that Skytrax uses to categorise certain member airports with 1–5 star ratings. Skytrax also publishes customer reviews and 1–10 grading of individual airports, which look at areas such as airport cleanliness, waiting times, airport shopping, restaurants/cafes, Wi-Fi connectivity and staff service.

However, it is important to note that the ASQ and Skytrax findings are not always consistent, making it somewhat difficult for airport management to react. For example, Munich airport did not appear in any of the most recent ASQ top rankings. By contrast, it was ranked fourth overall in the Skytrax 2017 survey. It was also the only main hub airport in Europe that had 5-star ranking from Skytrax (the other five being Hamad, Hong Kong, Seoul, Singapore and Haneda). Yet in terms of customer ratings based on 187 Skytrax reviews, the overall score was just 5 out of 10.

In spite of these problems, making inter-airport comparisons can enable airport operators to learn from best practice elsewhere. The results, if favourable, can also be used as a marketing tool to promote the airport and give it a competitive edge. However, a number of factors need to be considered when making such comparisons. For example, certain airports, including small airports and single-terminal airports, inherently tend to perform better in quality-of-service surveys. This is not just because smaller airports seem more personal, but also because they are usually served by smaller national or regional populations that may view their airport as a local asset and have a much greater pride in it. Some passenger types are likely to complain more than others, particular business and frequent travellers.

CASE STUDY 6.1
ACI AND SERVICE QUALITY

The ACI ASQ passenger survey dates back to 1993. It was initially undertaken by IATA with its Global Airport Monitor, which had just 30 airports and a sample size of 80,000 in its first year. In 2004 and 2005, IATA and ACI joined forces to produce similar research, the ALTEA survey, but from 2006 this survey has been undertaken solely by ACI. The 2016 survey involved over 330 airports worldwide, covering more than half of the world's 7.6 billion annual passengers, and over 75 per cent of the world's 100 top airports were surveyed.

Each year over 550,000 passengers are surveyed with a requirement for each airport to have a minimum of 350 responses per quarter to ensure a representative sample – although in practice most airports survey considerably more passengers. It is a self-completion survey with questionnaires being distributed to passengers at the departure gate. The questionnaire is available in 41 languages. There are 34 service quality aspects included which cover areas including check-in, passport/personal ID control, security, airport facilities, the airport environment and overall satisfaction. There are five scores ranging from 5 (excellent) to 1 (poor). Table 6.2 presents some of the key results of the survey. ACI also offers additional analysis for the airports in their so-called comprehensive insight report that provides an assessment of the participating airport's strengths and weaknesses and gives deeper insight into the factors that drive both passenger satisfaction and dissatisfaction.

Table 6.2 Overall passenger satisfaction levels: best-performing airports from ACI's 2016 Airport Service Quality survey by airport size and region

	First place	Second place	Third place
Region			
Africa	Mauritius	Durban	Cape Town
Asia-Pacific	Seoul Incheon	Delhi Mumbai Singapore	Beijing Haikou

	First place	Second place	Third place
Europe	Sochi	Moscow Sheremetyevo	Dublin Malta Porto Zurich
Latin America and Caribbean	Guayaquil	Nassau Punta Cana	Aruba Quito
Middle East	Abu Dhabi	Amman	Dubai
North America	Indianapolis Jacksonville Toronto Billy Bishop	El Paso Ottawa Tampa	Austin Dallas Love Field Edmonton Halifax San Antonio Winnipeg
Number of passengers (millions)			
2–5	Guayaquil Jaipur Sochi	Srinagar Toronto Billy Bishop	Langkawi Ottawa
5–15	Hyderabad Tianjin	Chanchum Hohhot	Amman Chiang Mai Cochin Indianpolis Jacksonville
15–25	Haikou	Sanya Seoul Gimpo	Denpasar
25–49	Taipei Taoyuan	Shenzhen	Hangzhou
>40	Seoul Incheon	Delhi Mumbai Singapore	Beijing

Source: Adapted from ACI (2017)

In addition to this main survey, ACI also offers its ‘unique’ survey which is a one-time run of the survey, and also a regional survey for airports of fewer than two million annual passengers. This latter option is cheaper for participating airports and the passengers are only surveyed twice a year. Currently around 40 airports are participating in this programme. ACI has also recently launched an arrivals survey and a staff survey.

An example of how airports use the ASQ passenger survey is provided by Heathrow airport (Ellis, 2016). It has three groups of airports: EU hubs, EU comparators and global comparators. It compares itself with the EU hubs with a clear target of leading within this group, whereas it benchmarks itself with the EU comparators to improve specific attributes. In addition, it monitors its performance against the established and emerging hubs in the global comparator group to learn from the 'best in class'. The ASQ results can also be used for target-setting within the economic regulatory system, as is the case in Ireland, and during the consultation for economic regulation, as with the Paris airports.

Understanding service quality

A number of researchers have used some of these various measures of service quality to undertake more in-depth analysis of ASQ concepts and the factors affecting performance. Many assume, as in conventional service industry literature, that service quality refers to the difference between customers' expectations and their perception of the actual service received. Standard models, such as the popular SERVQUAL model that divide service quality into five key dimensions, namely tangibles, reliability, responsiveness, assurance and empathy, have been used by some (e.g. Pabedinskaitė and Akstinaitė, 2014).

However, others have devised airport specific dimensions as these generic dimensions have not proved suitable for the airport environment. An approach developed by Fodness and Murray (2007), by undertaking both a qualitative and quantitative analysis of airport users, produced an ASQ model based on function (effectiveness and efficiency), diversion (productivity, décor, maintenance) and interaction. This has been applied to a few other airports; for instance Lubbe *et al*. (2011) used it for Johannesburg airport. Meanwhile, Yeh and Kuo (2003) distinguished between six dimensions (comfort, processing time, convenience, courtesy of staff, information visibility and security) and Pantouvakis and Renzi (2016) used three (servicescape and image, signage and services). Bezerra and Gomes (2015; 2016) used factor analysis on a service quality survey undertaken at a Brazilian airport and identified seven key dimensions (check-in, security, convenience, ambience, basic facilities, mobility and prices). Elsewhere, Gupta *et al*. (2013) looked at service quality at Dubai airport by considering customer satisfaction, customer loyalty, cultural diversity, highly mobile population and competition with other Middle Eastern airports.

Some researchers have tried to develop an overall service quality index for an airport by taking into account the relevant importance of the different aspects of airport operators. For instance, Correia *et al*. (2008) used the example of São Paulo airport in Brazil to assess the statistical relationship between overall passenger satisfaction and individual scores in different areas, while Rhoades *et al*. (2000) surveyed airport directors in North America to gauge their opinion on the most important factors. Yeh and Kuo (2003) surveyed travel agents in Asia to help formulate their index. With a rather different approach, Bogicevic *et al*. (2013) used a content analysis of traveller comments on an airport review site and found that the main key 'satisfiers' in the airport context were cleanliness and a pleasant environment to spend time in. By contrast, security checks, confusing signage and a poor dining offering were identified as major 'dissatisfiers'. Some of this research has found very significant disparity in the perception of different travellers, for example Lubbe *et al*. (2011) (business vs leisure; frequent vs infrequent passengers) and Pantouvakis and Renzi (2016) (nationality groups). Overall, the research literature indicates that consistency is somewhat lacking when it comes to applying service quality concepts and theory to the airport industry, which is undoubtedly not helped by the complex nature of airport services and the many stakeholders involved.

Airlines and delays

The focus so far has primarily been on passengers, so now airlines are considered. A crucial measure of airport performance for airlines is the level of delays. This is a complicated area, as there are many factors leading to flights being delayed that are outside the airport operator's remit (e.g. *en route* ATC, bad weather, technical problems with the aircraft). It is inevitable that aircraft will deviate from the published schedule, which adds an unpredictable element to the time at which any given flight will wish to use the runway. Maximum runway throughput can be achieved only with queuing of aircraft (on the ground for departing flights, or through speed control and stacks in the air for arriving flights) so that there is always an aircraft ready to use the runway. Airports that are operating close to their runway capacity are therefore likely to impose additional delays on flights and exacerbate delays originating from other causes. An airport with spare runway capacity has more scope to accommodate delayed aircraft without disrupting other flights and may be able to avoid queuing aircraft in most cases.

Table 6.3 Schedule time: Amsterdam–London, 1985–2017

From	To	Year	Depart	Arrive	Aircraft type	Sector time (hours: minutes)
Amsterdam	London Heathrow	1985	1200	1200	DC9	1:00
Amsterdam	London Heathrow	2005	1130	1200	B737	1:30
Amsterdam	London Heathrow	2017	1015	1045	B737	1:30
Amsterdam	London Luton	2017	1210	1220	A320	1:10
Amsterdam	London City	2017	1125	1130	E90	1:05

Sources: OAG Flight Guide/ABC World Airways Guide

Shortcomings in terminal capacity can also delay aircraft. If there are insufficient stands available, arriving aircraft may be held on the taxiways or apron before they are able to unload. At the day-to-day level, this may be an airline operational decision to await the availability of a preferred gate or avoid bussing passengers from a remote stand. In the longer term, however, airports have the opportunity to expand or upgrade facilities to address these problems. Congestion within the terminals may lead to passengers who have checked in failing to reach the aircraft in time, thus delaying departure; flights may also be held awaiting crew or transfer passengers, creating a knock-on of delays from one flight to another. In the United States, it is common practice for the last flight of the day from a hub to be held much longer than earlier ones as it does not present reactionary problems for subsequent flights and enables as many passengers as possible to get home that night.

The airlines can take account of expected queuing times related to shortages of airport runway capacity in planning their schedule. This enables them to maintain a similar level of punctuality performance at congested airports, but at the expense of longer

Table 6.4 Major European airports with longest delay, 2016

Airport	Average delay per departure (minutes)	Average delay per arrival (minutes)
London Gatwick	19.2	20.2
London Luton	18.6	16.3
Malaga	16.3	13.5
Barcelona	15.6	16.9
Palma de Mallorca	15.3	12.2
Alicante	15.2	16.4
Rome Fiumicino	14.6	*
Tel Aviv/Ben Gurion	14.5	19.4
Manchester	13.7	12.9
Paris CDG	13.6	*
Cologne Bonn	13.4	11.9
Brussels	13.2	11.7
Venice	13.2	*

Airport	Average delay per departure (minutes)	Average delay per arrival (minutes)
Lisbon	13.2	12.7
Porto	13.1	13.3
Milan Malpensa	13.0	12.3
Edinburgh	12.8	12.3
Prague	12.7	11.6
London Stansted	12.7	12.6
Birmingham	12.4	*

*Not in top 20 airports. In addition, the following airports experienced average arrival delays: Istanbul Sabiha (21.1), London Heathrow (12.7), Madrid (11.5), Istanbul Ataturk (11.3).

Source: Adapted from Eurocontrol (2017)

scheduled flight times and the resultant increase in costs from poorer utilisation of aircraft and crew. Considering the Amsterdam–London Heathrow routes, it can be seen that a morning flight from Amsterdam to Heathrow, scheduled for 1 hour in 1985, had increased to 1 hour 30 minutes by the year 2005, and remained this schedule time in 2017 (Table 6.3). At the less congested airports of London City and Luton, the scheduled flight times in 2017 were less. Airlines thus include a contingency allowance for delays in their schedule.

This means that published comparisons of schedule performance tend to understate the total time wasted compared with the theoretical minimum journey time, and airlines can improve their punctuality performance by extending their scheduled journey times. Comparisons between airports and airlines therefore have to be treated with caution but generally there is evidence to suggest that delays are increasing. For example, specifically within Europe in 2016, the share of flights delayed on departure (by 5 minutes or more) was 42.5 per cent compared with 39.6 per cent in 2015 and 35.5 per cent in 2012. Likewise, the comparable figures for arrivals were 37.7 per cent (2016), 35.8 per cent (2015) and 34.4 per cent (2012). There was an average all-cause departure delay of 11.3 minutes per flight, which was an increase of 0.9 minutes in 2015. Delays due to airline factors represented on average 3.13 minutes per flight, followed by ATC (0.76 minutes *en route*; 0.76 minutes at airport), airport (0.42 minutes) and the weather (0.36 minutes) (Eurocontrol, 2017). Table 6.4 shows delay figures for 2016 for the worst affected European airports for both arrival and departures. Some of the worst performing airports for both departures and arrivals were the London airports of Gatwick and Luton and the Spanish airports Malaga, Barcelona, Palma de Mallorca and Alicante.

Globally, OAG (2017) reported that in 2016 Newcastle airport in the UK had the best on-time performance for airports offering less than 5 million annual seats, Birmingham for medium airports (5–10 million seats), Surabaya Jakarta for large airports (10–20 million seats) and Toyko Haneda for major airports (>20 million seats).

Delays are a very difficult area for the airport operator to assess because of the many factors that are beyond its direct control. Nevertheless, it needs to ensure when delays occur, for whatever reason, that they are dealt with in a timely and appropriate manner (e.g. efficient snow clearance of the runway after a snow storm). There are numerous technological and operational issues which need to be considered that go beyond the scope of this book. However, it was worth noting the important development of Airport-Collaborative Decision Making (A-CDM) that aims to improve the overall efficiency of operations at an airport, with a particular focus on aircraft turnaround and pre-departure sequencing processes. This is achieved by the real-time sharing of operational data and information between the main stakeholders, including airport operators, airlines, ATC and handling agents. It aims to optimise the interactions between these organisations and can lead to better punctuality, for example by reducing taxi-ing time. It can also reduce emissions and produce fuel savings. Munich, Brussels and Paris CDG airports were the first to become A-CDM compliant in 2011. By mid-2017 the number of European A-CDM airports had risen to 26 with 15 additional airports having initiated the process. In Asia, especially Japan and China, and other regions, there has also been considerable interest in A-CDM with a few airports already implementing it to some varying degree. A notable example is Singapore airport, where A-CDM was introduced in 2016. In the United States there is also a similar concept called Surface-CDM.

Service quality and regulation

As discussed in Chapter 4, the existence of some form of price cap or other type of economic regulation potentially could lead to a decline in quality as the airport operator tries to reduce its costs to fit in with the requirements of the regulator. As a result, at a number of airports there are formal conditions related to service quality contained within the regulatory framework, although elsewhere the approach may be more informal. For example, in the direct negotiations between Copenhagen airport and its airlines, quality of service is a central discussion point. At Hamburg airport, where there is a price cap, there is a quality monitoring regime, but this does not involve mandatory quality standards. Evidence is collected from passenger surveys and delivery measures.

The UK regulatory system was the first to introduce more formal quality of service requirements linked to pricing in 2003, with a system of rebates for airlines if the airports did not meet certain targets or standards. These targets were based on measures of quality of service related to both airlines and to passengers. The airline measures were largely related to existing service-level agreements, with the passenger measures based on BAA's Quality Service Monitor (QSM). When the service quality conditions were introduced at Heathrow and Gatwick in 2003, a required measure to assess aerodrome congestion delay was omitted. This was difficult to define because of the difficulties in finding an acceptable measure of congestion that related only to factors under the control of the airport operator (as opposed to weather, airline operational factors and so on). This measure was finally introduced in 2006, when it was decided that rebates would be payable to airlines when 'material events' occurred that were the responsibility of the BAA or of its contractual agents (including NATS, which provided air traffic control) and that caused a 'material' or significant operational impact in terms of the number of movements lost or deferred. Material events included industrial action; closure of runways or other areas; failure of equipment; and when bad weather had been forecast and materialised but relevant bad weather equipment (e.g. related to fog, ice or snow) had not been used. A material operational impact was defined as causing a deferment (or loss) of more than four cumulative movements.

Since these initial service quality conditions were introduced, the scheme has remained largely unchanged, although it has been reviewed and modified at each regulatory review. Indeed in 2008 positive financial incentives or rewards in the form of bonuses were added. Table 6.5 shows the current situation for the regulatory period 2014–19 at Heathrow airport – using terminal 5 as an example (excluding the aerodrome congestion term). The maximum amount of rebate currently payable is 7 per cent of aeronautical charges income with the maximum level of bonuses being 2.24 per cent.

Table 6.5 Service quality elements included in the regulation of Heathrow terminal 5, 2014–19

	Performance measure	Standard
Departure lounge seat availability	QSM score	3.8
Cleanliness	QSM score	4.0
Way-finding	QSM score	4.1
Flight information	QSM score	4.3
Central security search	Time <5 min Time <10 min	95 per cent 99 per cent
Transfer security search	Time <10 min	95 per cent
Staff security search	Time <10 min	95 per cent
Arrivals reclaim	Bag reclaim belts availability	99 per cent
Passenger sensitive equipment (general and priority)	Time availability	99 per cent

	Performance measure	Standard
Track Transit System	One car availability	99 per cent
Stands	Time availability	99 per cent
Jetties	Time availability	99 per cent
Fixed electrical ground power	Time availability	99 per cent
Pre-conditioned air	Time availability	98 per cent
Stand entry guidance	Time availability	99 per cent

Source: Adapted from CAA (2014)

Following on from the London experience, a number of other airports have also had service quality conditions built into their regulatory processes. For instance, for AdP at Paris, this was introduced when the airport was partially privatised in 2006. In the latest regulatory period (2016–20) there are 10 indicators, chosen because they cover areas where the airport company has considerable control and responsibility. There are five related to availability of equipment and energy, two related to satisfaction with cleanliness and orientation, and three covering overall satisfaction ('excellence') with transfers, departures and arrivals. Unlike the Heathrow targets that are the same for all years, these targets rise gradually every year. As with the UK system, there are financial penalties, and rewards for the excellence measures.

Another example is Dublin airport (Table 6.6). Most of the targets are based on ACI ASQ measures with the exception of passenger search and baggage system measures. The Spanish airport company, AENA, has also become subject to economic regulation and service quality conditions between 2017 and 2021 as a result of its partial privatisation in 2015. Here there are 17 indicators, again some based on ASQ scores and others on operational performance. Eleven of these are included in a system of incentives and penalties. Budapest is another privatised airport in Europe which is subject to service quality conditions related to both objective and subjective measure of service quality.

There are also a few examples elsewhere. In India, the ACI ASQ measures are used as targets for passenger satisfaction (with a target of 3.5 for overall satisfaction) for Delhi, Mumbai, Hyderabad and Bengaluru in the concession and build, operate, transfer (BOT) contracts with the airports. Service delivery standards were also agreed that had to be achieved within a certain time frame (one to five years) after privatisation. By way of illustration, these are shown for Mumbai airport in Table 6.7.

Table 6.6 Service quality elements included in the regulation of Dublin airports, 2015–19

Service quality measure (per cent weight in price cap rebate)	Target (measurement source: DAA) (per cent)	Service quality measure (per cent weight in price cap rebate)	Target (measurement source: ACI) (per cent)
Security passenger search time <30 min (1.50)	100	Ease of way-finding (0.25)	3.9
Percentage time outbound baggage system unavailable >30 min (0.75)	0	Flight information screens (0.25)	3.9
Percentage time inbound baggage system available (0.25)	99	Cleanliness of airport terminal (0.25)	3.9
		Cleanliness of washrooms (0.25)	3.5
		Comfort of waiting/gate area (0.25)	3.3
		Courtesy/helpfulness – airport staff (0.10)	3.8
		Courtesy/helpfulness – security staff (0.15)	3.8
		Overall satisfaction (0.25)	3.9
		Internet/Wi-Fi (0.25)	3.1

Source: Adapted from Commission for Aviation Regulation (2014)

Table 6.7 Service quality targets in the Mumbai airport concession agreement

Performance area	Performance target	Target
Transfer process	Minimum connect time	Dom/Int: 60 min Int/Int: 45 min
Terminal services	Handling of complaints	100 per cent response with 2 days
	Response to phone calls	5 per cent answered within 20 seconds

Performance area	Performance target	Target
	Availability of flight information	98 per cent available
	Automated services	98 per cent available
	Lifts, escalators	98 per cent available
	Repair completion	95 per cent high priority within 4 hours, 95 per cent others within 24 hours
	Baggage trolleys	100 per cent availability
	Cleanliness	Satisfactory rating for 95 per cent of all inspections
	Availability of wheelchairs	100 per cent within 5 min
	Assistance for disabled	100 per cent within 5 min
Check-in	Maximum queuing time	Business class: 5 min Economy class: 20 min
Security check	Waiting time in queue	95 per cent of passengers wait less than 10 min
Customs and immigration	Checking time in queue	95 per cent of passengers less than 20 min
Baggage delivery	Time for bag delivery from aircraft arrival	Domestic: First bag 10 min, last bag 30 min International: First bag 15 min, last bag 40 min
International passenger arrival process	Time taken from aircraft arrival to kerbside	95 per cent of passengers less than 45 min
Passenger boarding bridges	Passengers served by bridges	90 per cent of passengers
Runway system	Delays due to arriving/departing aircraft	Average annual delay per aircraft: 4 min or better
Car parking	Average time to find parking space	95 per cent of drivers take less than 5 min
	Average time to depart from parking space	95 per cent of drivers take less than 5 min

Performance area	Performance target	Target
Taxis	Maximum waiting time	95 per cent of passengers wait less than 5 min
Gate lounges	Seating availability	Seats for 80 per cent of gate lounge population
Cargo services	Average dwell time	Maximum process time 24 hours

Source: Adapted from Airports Authority of India (2006)

When the Australian airports were privatised in 1997 and 1998 (see Chapter 2), a regulatory framework comprising a package of measures was introduced. This covered aeronautical charges and financial accounting reporting. It also contained specific quality reporting requirements, unlike the UK situation immediately after privatisation. The quality monitoring programme in Australia was introduced to assist in the review of prices at the airports, to improve transparency of airport performance and to discourage operators from abusing their market power by providing unsatisfactory standards. The Airports Act 1996 provided for the regulator, the Australian Competition and Consumer Commission (ACCC) to monitor the quality of services against criteria defined by the ACCC. It stipulated that records had to be kept in relation to quality of service and that the ACCC should publish the results of the quality of service monitoring exercise. When price regulation was replaced with price monitoring at the major airports in 2002, it was decided that the monitoring process of the ACCC should continue to complement the price monitoring. This measuring of quality of service along the lines of the ACCC monitoring could be incorporated into the airport–airline agreements that have been developed since price monitoring replaced formal regulation (see Chapter 4).

The ACCC reports on a selection of objective measures from the airport operators and subjective survey satisfaction data from airport users including passengers and airlines. The ACCC then aggregates the data ratings from all sources to provide an overall view of the quality of service provided by each airport operator. Table 6.8 summarises the information that is currently monitored.

As discussed in Chapter 4, the light-handed regulation that exists for major Australian airports has encouraged commercial (typically five-year) agreements with the airlines which are increasingly involving a performance dimension. In the past the use of penalties for delays or service failures has not been that common. However, the current agreements between Sydney airport and its airlines, which were signed in 2015, contain a set of key service quality performance indicators with a rebate mechanism, and the airlines have proposed that such practices should now also be adopted in the agreements at Melbourne, Brisbane and Perth.

Table 6.8 Information sources used by ACCC to monitor service quality at Australian airports

	Objective measures	Passenger surveys	Airline surveys	Landside operator surveys
Airport access facilities	√	√		√
Car parking service facilities	√	√		
Baggage trolleys	√	√		
Check-in services and facilities	√	√	√	
Security inspection	√	√		
Baggage handling	√	√	√	
Customs and immigration	√			
Flight information	√	√		
Public areas and amenities	√	√		
Gate lounges and seating	√	√		
Airport management responsiveness			√	√

Source: Adapted from ACCC (2014)

The passenger experience

The concept

In recent years there has been increased attention on the ‘passenger experience’ when considering service quality, passenger satisfaction and other related issues at airports. Some airports are using it as a key differentiator of their offer rather than relying on ‘good’ service provision as indicated with their service quality measures. In essence, as Boudreau *et al.* (2016) explained, the airport experience is a net impression of all of the experiences a passenger has in an airport as judged by a passenger’s individual standards, expectations and perceptions.

DKMA (2014) identified nine reasons for why focusing the passenger experience is important:

1. Growing non-aeronautical revenue;
2. Passengers who have a great experience are more relaxed, spend more and want to come back;
3. Airports increasingly compete with each other and also with alternate modes for passengers;
4. A great passenger experience makes a good impression, enhancing the reputation of the city/state/country;
5. A great passenger experience makes it difficult for regulators to argue that you are doing a bad job;
6. Focusing on the customer gives all staff a clear goal and a clear understanding of the aims of the organisation;
7. Staff who are committed to providing a great passenger experience tend to help their colleagues more;
8. Staff and passengers who are proud of their airport look after it better and are less likely to dirty it;
9. A great passenger experience keeps media onside and helps marketing/publicity for the airport.

However, research on the passenger experience and the development of it as an established concept is still in fairly early stages. Like service quality it is a complex phenomenon that is difficult to define. Inappropriately, it is quite often approached by considering what airport management deem as important to passengers, rather than fully exploring the experience from the perspective of the passenger. The passengers' viewpoint is particularly important as they have become more informed and empowered travellers with a greater need for personalisation and customisation, whilst at the same time desiring more automation and digital services. Clearly, there are some parts of the airport journey that passengers have more negative or positive views about than others. In a major global passenger survey SITA (2016a) somewhat unsurprisingly found that security had the highest number of negative emotions, followed by bag collection and passport control, whilst general dwell time had the highest number of positive emotions (Figure 6.1).

So while assessing service quality places much emphasis on individual processes and services, treating each very much independently, a passenger experience approach is more about examining what a passenger actually perceives and experiences as they proceed through the airport, and their overall satisfaction, especially in terms of achieving a smooth and seamless journey. Passengers do not always rationally consider different activities separately.

For the terminal environment, Popovic *et al.* (2009) discussed how the airport experience is all about the activities and interactions that passengers encounter at an airport, with these activities being divided between the necessary processes and discretionary activities. In addition, Harrison *et al.* (2012) proposed a conceptual framework for the airport experience from the three key perspectives of airport management, passenger and public.

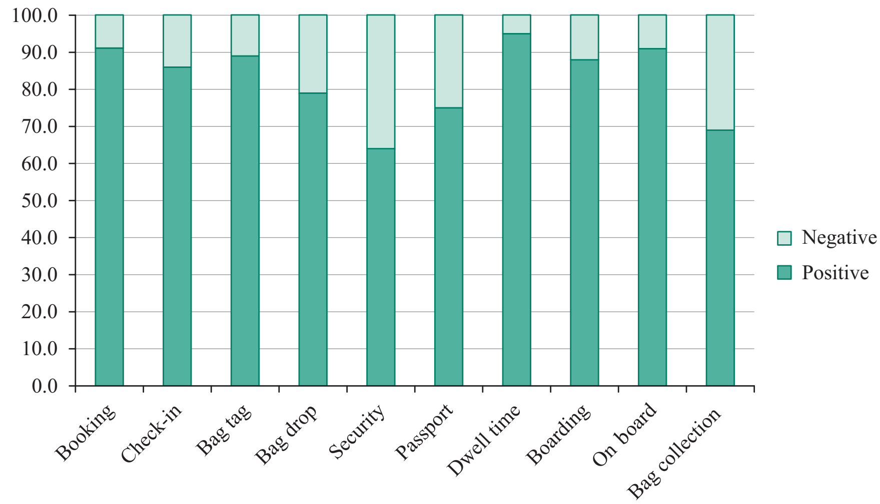

Figure 6.1

Passengers feeling positive or negative emotions during the airport journey (%)
Source: Adapted from SITA (2016a)

In further work, Harrison *et al.* (2015) extended their examination of the passenger experience in the terminal by looking at the relationship between time sensitivity and the degree of passenger engagement. They defined a new passenger segmentation model, namely airport enthusiast (engaged and non-time sensitive), time filler (non-engaged and non-time sensitive), efficiency lover (non-engaged and time sensitive) and efficient enthusiast (engaged and time sensitive).

With a broader approach, Wattanacharoensil *et al.* (2015) proposed a theoretical framework for the creation of the airport experience in relation to tourism by integrating the perspectives of sociological, psychological and service marketing and management. They identified 10 key components that needed to be considered within the airport experience context, namely sociological – sense of place, social interaction; psychological – airport anxiety, fairness, past memory; and service marketing and management – service encounter, servicescapes and sensescapes, commercial and rentals, concept of co-creation, destination image. They explored these by considering Hong Kong and Bangkok airport. In further research using passenger reviews on Skytrax, Wattanacharoensil *et al.* (2017) investigated the airport experience as a process, phenomenon and as an outcome, in terms of general and fairness perception, emotion and memory. Whilst all of this research has provided some useful conceptualisation of the airport experience, the term passenger experience still remains rather vague and imprecise and it is rather unclear what the key defining characteristics are.

From a more practical viewpoint, Lees (2017) argued that the key elements to enhancing the passenger experience are physical layout, wayfinding and signage, stakeholder engagement, employee organisation, and technology. Building more terminal infrastructure can bring about significant improvements but can be costly, and so where possible making the

Table 6.9 Examples of outcomes and measures with an outcome-based approach

Outcomes	Users experience no or minimal flight delays	Passengers experience a speedy and reliable journey through the airport	Passengers are satisfied with the levels of service and comfort provided	Passengers have the right information and care
Measures/ Outputs	On-time performance, availability of airline operational elements (e.g. stand and jetty availability)	Security queues, border control queues, baggage times	Cleanliness, seat availability, Wi-Fi availability	Quality of wayfinding, flight information, staff availability and helpfulness

best use of the existing infrastructure is better. The wayfinding is very important here and features like digital signage, interactive wayfinding and electronic communication can be very useful. Other stakeholders must also be totally engaged and the employee organisation must be focused on the delivery of the passenger experience. He also included technology, especially sensor technology, as it plays a key role (as discussed later) in refining the physical layout and signage, and engaging and effectively using stakeholders and staff.

Many specific and diverse airport examples of the application of the concept of passenger experience to real-life situations exist. A notable case is Los Angeles airport, which introduced a new passenger experience programme in 2016. The key elements of this so-called LAXceptional Xperience initiative were identified as: guest first; happy guest; informed guest; ambience and feeling; engaged employees and partners; guest delight; and policy integration (Yamamoto and Paternoster, 2017).

Linking service quality and the passenger experience

As explained above, focusing on the passenger experience is all about concentrating on areas perceived as significant to passengers (even if the services are not actually undertaken by the airport operator), rather than how services are being delivered, which is the key role of conventional service quality assessment. In essence, assessing the passenger experience involves taking a subjective holistic perspective of the various encounters that passengers face in their airport journey, whereas with service quality it is more about measuring variables using specific criteria.

Within this context there has been increasing debate, particularly at Heathrow airport but also at a few other airports such as Sydney, as to whether outcome-based service quality measurement is a better approach to adopt. This approach focuses on considering what airports are actually delivering to users rather than how they deliver it, and so, arguably, is closer to the passenger experience concept. The outcomes refer to a range of high-level consumer objectives that are the most important aspects of the airport service that consumers value, and from which performance measures can be developed and used as a basis for setting target and incentives. Table 6.9 provides some examples of possible outcomes and how they could be linked to current performance measures.

For the next regulatory period for Heathrow airport beginning in the year 2020, the CAA has stated that it will adopt an outcome-based approach, which has in fact already been used for some other regulated industries in the UK, such as water, to strengthen the link with consumer preferences and priorities. Nevertheless, the current balance between key services provided to airlines (such as stand and pier availability, pre-conditioned air and fixed ground power) and elements provided directly to passengers (e.g. cleanliness and way-finding) (see Table 6.10) is expected to remain. In implementing this outcome-based framework, the CAA (2017) has identified five key principles:

1. It should be informed by robust consumer research.
2. The structure should include outcomes, measures, targets and incentives.
3. The new Consumer Challenge Board should play a key role in the development of the framework.
4. It should build on the current service quality system.
5. Performance reporting should be comprehensive and targeted at consumers.

The CAA has also stated that the outcomes should be simple and easy for consumers to understand and each should have one or more associated performance measures (objective and subjective) that indicate progress towards the outcome. As before, there will be targets and the majority of targets should have financial incentives, both positive (reward) and negative (penalty). The incentives should be clear and reasonably easy to understand, and justified and calibrated with respect to consumer priorities and willingness to pay.

Even without any outcome-based approach to service quality, airport operators clearly need to understand the main drivers that influence a passenger's experience and their satisfaction with the airport. Linking satisfaction levels to service quality measures can also provide greater insight into the passenger experience. For example, an analysis of ACI's ASQ in 2008 found that the highest scores for the top 10 airports in the ASQ overall satisfaction table were for cleanliness of terminal, helpfulness of staff, ambience of airport, availability of toilets, efficiency of check-in staff, feeling safe and secure, and wayfinding. By contrast, the lowest scores were for shopping facilities, F&B facilities, banking facilities, IT facilities, value for money with commercial facilities, and opening hours of commercial facilities (CAA, 2009). However, it is difficult to generalise, as for each individual airport the most important factors will vary. A case in point is at Lisbon airport, where the critical factors appeared to be ambience, cleanliness of airport, availability of washrooms, helpfulness of staff, thoroughness of security, comfortable waiting/gate areas, business lounges, and arrivals passport inspection. Much lower importance was given to walking distances, parking and internet access (Madeira, 2011).

The implication is that improving areas with low service quality scores may not necessarily improve overall satisfaction and meet passengers' needs. Quite simply, the best way of achieving this is by focusing on areas that are regarded as less than satisfactory, but at the same time important to the customer. For example Kramer *et al.* (2013) described how the results of the ASQ survey can be divided into four categories with different priorities. These were called lower priority (low importance score, low ASQ score), primary concern (high importance score, low ASQ score), review level of commitment (low importance score, high ASQ score) and key selling points (high importance score, high ASQ score). The Boston Consulting Group (BCG, 2016) used this approach with a survey of passengers from 56 countries. The results showed that low satisfaction/low importance included transfer areas; low satisfaction/high importance included security, gate holding area, retail area, arrival immigration, bag collection; high satisfaction/low importance included bag drop, airport lounge, departure immigration; and high satisfaction/high importance included check-in and prejourney.

ORC International (2009) adopted a similar approach in its 'key drivers of satisfaction' analysis for four UK airports: London Heathrow, London Gatwick, London Stansted and Manchester. For the pre-departure experience, the areas of greatest importance were the ease and time getting from the boarding gate onto the plane, the information provided on flight times and departure gates, cleanliness and maintenance of airport facilities, and ease of getting around the airport. Satisfaction in these areas was also relatively good and so did not suggest that major improvements would have to be made. Likewise, areas that had lower levels of satisfaction, for example the amount of seating and availability and helpfulness of staff, were not considered to be so important and so could be given lower priority.

The involvement of all stakeholders

With increased attention on the passenger experience in recent years, it has been argued that too little attention has been given to the overall door-to-door experience, including transport to/from the airport. All too often, because of the limited control and involvement the airport operator has with certain services or facilities, some areas may be overlooked. However, from a passenger perspective they all contribute to the end-to-end journey experience and so should be considered, as in the end the overall experience is ultimately determined by the weakest link in the system and collaboration amongst stakeholders is crucial. As Table 6.10 demonstrates, this approach involves taking a more holistic approach to service provision and using performance measures for other providers (e.g. airlines, government agencies) with greater transparency of information (Department for Transport, 2007; CAA, 2009). Internally as well, rather than considering the performance of each department of the airport operator separately, within a passenger experience concept they need to be viewed together to provide that smooth and seamless journey.

Some information concerning providers is available, but not in a consistent manner. This includes airline delay data and border control data. For example, in the United

Table 6.10 The passenger experience

	Getting to/from airport	Getting through airport	Taking off and landing	Getting to destination
Main activities	Driving to airport and parking Using public transport	Outbound: Check-in and bag drop Security check Immigration check Getting to gates Shopping, drinking and eating Inbound: Immigration check Baggage reclaim Customs check Transfer: Dedicated processes	Outbound: Push back Taxi to runway Take off Inbound: Landing Taxi to stand Disembark	Hiring car Using public transport
Typical delivery accountability	Government departments and organisations, airport operator, commercial operators	Airport operator, airlines, handling agents, commercial retailers, government agencies	Air traffic control, airlines, handling agents, airport operator, slot coordinator	Air traffic control, airlines, government organisations, commercial operators

Source: Adapted from Department for Transport (2007)

States, the Customs and Border Protection Agency (CBP) monitors and makes available on the internet the flight processing time (wait time) for arriving flights at 44 of the busiest international airports. The flight processing time is the length of time from flight arrival to the time the last passenger on the flight is screened by CBP officers in the primary processing area. Average and maximum processing times are provided per hour for both US and non-US citizens, as well as the average number of arriving passengers and the average number of booths open. However, in recent years, a few airports have started to provide a wider range of data related to targets for their service providers. For example, as well as information concerning its own performance, London Gatwick shows on its website details by individual airline and handling agent related to the 95 per cent 35-minute last baggage delivery target for small/medium aircraft and 50-minute target for large aircraft. It also provides data concerning the Border Force agency responsible for passport control checks. There is a UK Home Office target of 95 per cent of EU passengers being processed in 25 minutes or less and 95 per cent of other passengers being processed in 45 minutes.

In the UK during the recent discussions about outcome-based service quality regulation, there has been some consideration about whether the performance of other key stakeholders such as ATC, surface access providers, airlines, ground handlers and border control agencies should play a greater role, as they too will influence the passenger's outcomes. The operators of Heathrow and Gatwick supported this view, with Gatwick providing evidence that within its commitment framework with its airlines (see Chapter 4) it had specific targets with financial incentives for airlines to meet last bag delivery times and this has led to a significant reduction in passenger complaints. However, in contrast the airlines had serious reservations, arguing that such a broader approach for passenger outcomes was inappropriate, as it risked diluting the focus on the regulated airport with market power, which is the key aim of the regulation, and that these other activities are best left to competitive forces and commercial negotiations, or control by other government bodies as is already the case with the border agencies.

Understanding and enhancing the passenger experience

ACI Europe recently produced some detailed guidelines concerning passenger services at European airports (ACI Europe, 2014). It defined three levels of passenger experience in its so-called pyramid of passenger perception levels. At the bottom of the pyramid is the required level covering all basis and mandatory elements. The second level is related to what passengers expect of an airport, whereas at the top 'valued' level there are features that surprise passengers and create a 'wow factor'. Over time some of the elements have to be revisited, for example in the past free Wi-Fi might have been highly valued but it is increasingly becoming the expected norm. It was argued that these three different levels are in turn influenced by three interrelated factors, namely the look and feel of the premises, efficient and passenger-focused processes, and encounters between people. Table 6.11 provides some examples.

This approach can also be used to consider different parts of the passenger journey. Examples of the valued elements include:

- Home (home printed bag-tags, off airport baggage collection, off-airport check-in)
- On the move (door-to-door transport services, check-in/bag drop at curb, car park or station, intermodal tickets)
- Terminal (smartphone navigation and process updates, permanent bag-tags and boarding passes, surprising concepts for waiting passengers)
- Transfer (direct transfers for late arrivals, transfer hotels or sleeping cabins, surprising concepts for waiting passengers)
- Security/border control (trusted traveller programmes, automated border control, automated document scanning)
- Baggage claim (personal bag arrival time information, arrival duty free, self-service kiosks for lost/delayed bags)

Progressing up through different levels of experience or need is somewhat similar to Maslow's well-known model of human behaviour which contains a pyramid or hierarchy

Table 6.11 Different levels of the passenger experience

Level of passenger experience	Required	Expected	Valued
Detail	Basic services and mandatory processes. Does not create passenger satisfaction but dissatisfaction if not in place	Standard expected services and facilities creating satisfaction	Differentiation or major development that creates a 'wow factor'
Premises	Cleanliness Signage Basic facilities	Good flow of facilities Ambient and pleasant Natural wayfinding Short walking distances	Stressless environment Outstanding architecture Surprising solutions
Processes	Facilities support airport operations Flows understandable	Processes automated as much as possible Service available when needed	Seamless flow Innovative solutions
People	Staff and assistance available in all critical places	Friendly service Airport helpers and floorwalkers	Excellent hospitality Situational awareness of passenger needs

Source: Adapted from ACI Europe (2014)

of needs with the most basic physiological needs (air, food and water) at the lowest level, and self-fulfilment at the top. Boudreau *et al.* (2016) also relate airport passenger experience to this theory by having five levels, namely physiological, safety, social, esteem and finally self-actualisation. The top two levels are fairly equivalent to some of the valued elements mentioned above, namely esteem (priority service at kerbside, valet parking, frequent flyer lounges) and self-actualisation (best-rated grounds/gates/terminal facilities, entertainment, meditation gardens).

Qualitative research, involving in-depth interviews, online panels and focus groups, as well as accompanied trips, can be particularly useful to understand the main factors affecting the passenger experience in terms of the end-to-end journey. For example, qualitative research in the UK divided the issues that seemed important to passengers into six broad themes: end-to-end reliability and efficiency; information and communication; customer care; facilities and entertainment; airport design and maintenance; and cost (Sykes and Desai, 2009). Across all six themes, respondents emphasised the need for a passenger-focused service that incorporates personal control and fairness. Overall, the study concluded that the passenger experience was affected by many interrelated variables, including a range of softer factors that could not be measured with the typical service-quality measures used by airports. For example, queue times and lengths cannot show how queues are managed and how the queuing experience affects the rest of the journey. These findings support the view for more outcome-based measures.

This study also recognised the varying needs of different passenger groups – a common characteristic identified in most research. At a very general level, business travellers tend to want to get through airports as efficiently as possible with a degree of comfort. While the same can hold true for certain groups of leisure passengers, others may look at the airport in a different way, as part of their leisure experience. For example, in the above-mentioned survey of passengers at London Heathrow, London Gatwick, London Stansted and Manchester airports (ORC International, 2009), it was found that 84 per cent of business passengers compared with 63 per cent of leisure passengers expected to wait only 10 minutes or less at passport control, with comparable figures of 57 versus 38 per cent and 58 versus 30 per cent for security and check-in/fast bag drop, respectively. A survey of business passengers at Heathrow found that after accessibility and range of flights, the third most important factor was waiting times, which were particularly important for those travelling in the premium classes and frequent flyers (London Economics, 2008).

An increasing number of airports are also now segmenting their passenger market by travel needs and requirements, in order to more fully understand the passenger experience. For example, Copenhagen airport (2012) used a four-group segmentation:

- Experience (excited traveller seeking experiences, personal contact and wide range of commercial facilities, loves atmosphere of airport)
- Efficiency (experienced traveller wanting efficiency and short waiting times, likes automated check-in and uses shops and lounges if delayed)
- Selection (independent traveller wanting relaxed and calm atmosphere, does not have much need for personal service)
- Attention (attention-seeking traveller wanting simplicity, comfort and assistance, arrives early, prefers personal services at check-in and is among first at the gate)

Swedavia used a somewhat similar segmentation which included 'efficient commuters' ('I travel to get from A to B'), and 'positive life enjoyers' ('Our holiday starts rights at the airport'. Brisbane airport has used 'airport enthusiast', the 'efficiency lover' and the 'time filler'. Denver airport used a six segment classification (Boudreau *et al.*, 2016: 66):

- Explorers (optimists, love travel, open-minded, like to share thoughts and opinions)
- Elites (frequent travelers, value status, career and family oriented, demanding, want access to options)
- Experts (think travel is routine, see themselves as experts and advice givers, not easily impressed, and want a streamlined and productive experience)
- Escapists (welcome travel as a treat and a break, infrequent travelers, excited and optimistic, appreciative)
- Aspirers (stressed by real life, struggle to maintain balance in interests, careers, and children, but will indulge on occasion)
- Early birds (infrequent, anxious, find travel stressful and filled with unexpected hassles, want it over with as quickly as possible)

In addition, much of the research consistently identifies wayfinding and information provision as being very influential in affecting the passenger experience. Gresham, Smith and Partners *et al.* (2011) discussed the need to investigate why passengers get lost in order to develop a wayfinding strategy that works to meet the specific needs of users. They then developed wayfinding guidelines that cover all the main areas of the passenger experience. Wayfinding information sources for passengers can include self-help tools (including maps, leaflets and touchscreen interactive kiosks) as well as information on mobile apps supplied by beacons (see discussion below). They can also include staffed facilities including information counters and walking staff, an example being the Changi Experience Agents at Singapore Changi airport, who speak many languages and have the support of an iPad. Similarly, Heathrow airport has a 'Meet and Assist' team of walking uniformed staff. Elsewhere in the United States at Grand Rapids airport they too have human ambassadors, but in addition there are therapy dogs to help relieve the stresses associated with travel, as there are at Los Angeles airport. San Antonio airport has a Pups and Planes programme. Other airports such as Las Vegas McCarran airport have gone one step further by having virtual assistants that are actually life-size holograms. Meanwhile, Amsterdam airport has been testing a robotic guide called Spencer which was initiated by KLM to decrease the number of missed flights due to passengers getting lost. Indianapolis and Edmonton airports in North America have also been trialling robots.

Other innovations include large video walls to aid wayfinding and entertain passengers. For example, Orlando airport will be installing such a wall that spans 475 metres and comprises more than 700 55-inch LCD screens to create a continuous wall. It will show flight information, destination time and weather, security and gate information as well as games to entertain younger travellers. Other airports such as Frankfurt airport have a large video wall primarily to entertain passengers, with one feature being a glimpse of behind the scenes operations at the airport. Los Angeles has a 72-foot 'Time Tower' and a 120-foot long array of screens termed the 'Story Board'.

As discussed in Chapter 5, technology is playing a major role in the provision of key processes such as security, border control and check-in, but in reality its influence is far broader than this by affecting the whole passenger journey (Barich *et al.,* 2015) as recognised by IATA/ACI's recent New Experience in Travel and Technologies (NEXTT) initiative. Indeed, the idea of a 'smart' airport is increasingly becoming a popular concept. Many airports have their own apps and mobile internet and have done so for some time now – Dallas Fort Worth airport introduced its first mobile website in 2009, the same year that Paris AdP launched its first iPhone app (Martin-Domingo and Martin, 2016). Increasing use of smartphones and tablets has provided an opportunity for airports to have digital interactions with passengers. For example, in 2016 only 30 per cent of airports provided navigation/wayfinding with apps but this is estimated to increase to 91 per cent by the end of 2018 (SITA, 2016a). There are also very significant opportunities to promote and provide information about non-aeronautical facilities and payment with such electronic devices. This is discussed in Chapter 7.

Providing Wi-Fi is another key service. Interesting connectivity strategies at airports are moving from free Wi-Fi (currently offered at 74 per cent of airports) down to 54 per cent in 2019, when a hybrid system which offers time-limited free Wi-Fi with paid access for additional usage is planned to increase from 23 per cent in 2016 to 37 per cent in 2019 (SITA, 2016b). Other digital opportunities are being explored as well, for example, Dubai airport announced in 2017 that it would be offering the ability to stream films and TV shows for free to watch on passengers' electronic devices while they are waiting for flights. Apps can also be used to entertain children as shown in Case Study 6.2.

CASE STUDY 6.2
USING MOBILE APPS TO ENTERTAIN CHILDREN AT HEATHROW AIRPORT

In 2016, during the summer school holiday period, Heathrow airport launched a brand new character Mr Adventure, from the popular Mr Men and Little Miss children books which have totalled over 250 million sales. The aim was to entertain the children from having Mr Adventure throughout the airport in new signage just for children in the security area, in the free play areas in all terminals and on 'kids eat free' menus available in every terminal. The airport also hosted themed activities and workshops, and involved Mr Adventure with posing for photos and handing out activity booklets, sticker sheets and jelly sweets.

Following on from this, in summer 2017 Heathrow airport welcomed a new travelling character Little Miss Explorer. Both characters featured in a new 'Around the World with Mr. Adventure' interactive augmented reality app, which was designed to entertain children as they navigated through Heathrow's terminals. Using any digital device, the children could help Mr Adventure and Little Miss Explorer find five badges hidden around the terminals. The digital device's camera identified when a child had reached each badge's hiding place and played a 3D animated video, which enabled the child to photograph/video themselves with the characters. When all five digital badges were found, it was possible for the children to collect iron-on badges from information desks around the terminals. The two characters also made appearances in the terminals to talk to the children and help find the badges and again the airport hosted themed craft activities and workshops, and had staff hand out themed biscuits and stickers. AQ1

One of the benefits of recent technological developments is that they have provided much more effective tracking, and guiding of, passengers and their bags through the terminal, with a variety of different means such as NFC, RFID and Bluetooth beacons. In the near future, wearables such as Google glasses and smart watches are also expected to play a significant role.

An increasingly popular innovation has been Bluetooth beacons that broadcast signals that can be detected by the apps on passenger mobile devices in proximity to the beacon.

These beacons can trigger operations, notifications, open web pages, or push advertisements to devices. This can not only improve the passenger experience by providing real-time information, personal updates and interactive navigation maps and directions about their progress through the passenger journey based on their location, but it can also help generate additional commercial revenues as well as overcoming facility bottlenecks, more effectively allocating physical and human resources and monitoring employee activities (ACI/IATA, 2016).

Miami airport was one of the first airports in the world to fully exploit such beacon technology in 2014, and then in 2015 Hong Kong airport was one of the first airports to trial beacons in Asia, with 50 in terminal 1. Many other examples now exist; for instance Doha Hamad airport introduced over 700 beacons in 2016 and Gatwick airport installed 2,000 in 2017. Such technology can be used to integrate with airport loyalty schemes, as at Nice airport, and also help visually impaired passengers, as at San Francisco airport.

References

ACCC (2014) *Guideline for Quality of Service Monitoring at Airports*, Canberra: Australian Competition and Consumer Commission.

ACI (2017) *Airports Council International announces winners of the 2016 Airport Service Quality Awards*, press release, 6 March, Montreal: ACI.

ACI Europe (2014) *Guidelines for Passenger Services at European Airports*, Brussels: ACI Europe.

ACI/IATA (2016) *Airport Terminal Beacons Recommended Practice*, Montreal/Geneva: ACI/IATA

Airports Authority of India (2006) *Operation, Management and Development Agreement Between Airports Authority of India and Mumbai International Airport Private Limited,* Delhi: Airports Authority of India.

Barich, F., Ruiz, L. and Miller, J. (2015) 'Enhancing the passenger experience through an integrated approach to self-service opportunities', *Journal of Airport Management*, 10(1): 49–63.

BCG (2016) The connected airport: The time is now. Online. Available at:http://img-stg.bcg.com/BCG-Connected-Airport-Jan-2016_tcm9-145248.pdf (accessed 1 June 2017).

Bezerra, G.C. and Gomes, C.F. (2015) 'The effects of service quality dimensions and passenger characteristics on passenger's overall satisfaction with an airport', *Journal of Air Transport Management*, 44: 77–81.

Bezerra, G.C.L. and Gomes, C.F. (2016) 'Measuring airport service quality: A multidimensional approach', *Journal of Air Transport Management*, 53: 85–93.

Bogicevic, V., Yang, W., Bilgihan, A. and Bujisic, M. (2013) 'Airport service quality drivers of passenger satisfaction', *Tourism Review*, 68(4): 3–18.

Boudreau, B., Detmer, G., Tam, S., Box, S., Burke, R., Paternoster, J. and Carbone, L. (2016) *ACRP Report 157: Improving the Airport Customer Experience*, Washington, DC: Transportation Research Board.

CAA (2009) *The Through Airport Passenger Experience: An Analysis of End-to-end Journeys with a Focus on Heathrow*, London: CAA.

CAA (2014) *Economic Regulation at Heathrow from April 2014: Notice granting the Licence,* CAP 1151, London: CAA.

CAA (2017) *Guidance for Heathrow Airport Limited in preparing its business plans for the H7 price control*, CAP 1540, London: CAA.

Commission for Aviation Regulation (2014) *Determination on Maximum Levels of Airport Charges at Dublin Airport 2014 Determination*, Dublin: Commission for Aviation Regulation.

Copenhagen Airport (2012) *CPH and Society 2011*, Copenhagen: Copenhagen Airport.

Correia, A., Wirasinghe, S. and de Barros, A. (2008) 'A global index for level of service evaluation at airport passenger terminals', *Transportation Research Part E*, 44(4): 607–20.

Department for Transport (2007) *Improving the Air Passenger Experience*, London: Department for Transport.

DKMA (2014) Why Focus on Improving the Passenger Experience. Online. Available at http://www.dkma.com/en/images/downloads/customer-service/Why%20focus%20on%20the%20passenger%20experience.pdf (accessed 1 June 2017).

Ellis, D. (2016) *How Heathrow uses its Market Research*, University of Westminster Marketing and Market Research Seminar, London, November.

Eurocontrol (2017) *CODA Digest 2016: All-Causes Delays and Cancellations to Air Transport in Europe – 2016*, Brussels: Eurocontrol.

Fodness, D. and Murray, B. (2007) 'Passengers' expectations of airport service quality', *Journal of Services Marketing*, 21(7): 492–506.

Gresham, Smith and Partners *et al.* (2011) *ACRP Report 55: Wayfinding and Signing Guidelines for Airport Terminals and Landside*, Washington, DC: Transportation Research Board.

Gupta, A., Arif, M. and Williams, A. (2013) 'Measuring customer service: A case study of Dubai International Airport', *Journal of Airport Management*, 7(4): 363–75.

Harrison, A., Popovic, V. and Kraal, B. (2015) 'A new model for airport passenger Segmentation', *Journal of Vacation Marketing*, 21(3): 237–50.

Harrison, A., Popovic, V., Kraal, B.J. and Kleinschmidt, T. (2012) *Challenges in passenger terminal design: A conceptual model of passenger experience*, In Proceedings of the design research society (DRS) 2012 conference, Chulalongkorn.

Harrison, V. (2015) 'Delivering a first class travel experience for passengers', *Journal of Airport Management*, 9(4): 317–26.

IATA/ACI (2016) *New Level of Service Concept*, Geneva/Montreal: IATA/ACI.

Kramer, L., Bothner, A. and Spiro, M. (2013) *ACRP Synthesis 48: How Airports Measure Customer Service Performance,* Washington DC: Transportation Research Board.

Lees, E. (2017) Enhancing the Passenger Experience. Online. Available at https://www.icf.com/resources/white-papers/2017/growing-self-connecting-passenger-market (accessed 29 May 2017).

London Economics (2008) *Imagine a World Class Heathrow*, London: London First.

Lubbe, B., Douglas, A. and Zambellis, J. (2011) 'An application of the airport service quality model in South Africa', *Journal of Air Transport Management*, 17(4): 224–27.

Madeira, C. (2011) 'Building retail practices for the new Lisbon airport', *Journal of Airport Management,* 6(1): 40–50.

Martin-Domingo, L. and Martín, J.C. (2016) 'Airport mobile internet an innovation', *Journal of Air Transport Management*, 55: 102–12.

OAG (2017) *On-time Performance results for Airlines and Airports*, Luton: OAG.

ORC International (2009) *Research on the Air-Passenger Experience at Heathrow, Gatwick, Stansted and Manchester Airports*, London: ORC International.

Pabedinskaitė, A. and Akstinaitė, V. (2014) 'Evaluation of the airport service quality', *Procedia-Social and Behavioral Sciences*, 110: 398–409.

Pantouvakis, A. and Renzi, M.F. (2016) 'Exploring different nationality perceptions of airport service quality', *Journal of Air Transport Management*, 52: 90–98.

Popovic, V., Kraal, B.J. and Kirk, P.J. (2009) *Passenger experience in an airport: an activity-centred approach*, In IASDR 2009 Proceedings, Seoul.

Rhoades, D., Waguespack, B. and Young, S. (2000) 'Developing a quality index for US airports', *Managing Service Quality*, 10(4): 257–62.

SITA (2016a) *The Future is Connected*, Geneva: SITA.
SITA (2016b) *2016 Airport IT Trends Survey*, Geneva: SITA/ACI.
Sykes, W. and Desai, P. (2009) *Understanding Airport Passenger Experience*, London: Independent Social Research.
Wattanacharoensil, W., Schuckert, M. and Graham, A. (2015) 'An airport experience framework from a tourism perspective', *Transport Reviews*, 36(3): 318–40.
Wattanacharoensil, W., Schuckert, M., Graham, A. and Dean, A. (2017) 'An analysis of the airport experience from an air traveler perspective', *Journal of Hospitality and Tourism Management*, 32: 124–35.
Yamamoto, B. and Paternoster, J. (2017) 'Aligning the airport community to improve LAX guest satisfaction: Every journey begins with a very important first step', *Journal of Airport Management*, 11(3): 243–57.
Yeh, C.-H. and Kuo, Y.-L. (2003) 'Evaluating passenger services at Asia-Pacific international airports', *Transportation Research Part E*, 39(1): 35–48.

7 Provision of commercial facilities

Importance of commercial facilities

A major development in the evolution of the airport industry has been an increase of focus on non-aeronautical or commercial revenues. This chapter discusses the generation of non-aeronautical revenues by looking at the market for commercial services and assessing how the facilities can be planned and managed. It considers the factors that influence commercial performance. Most of the emphasis is on individual consumers who buy commercial goods/services at airports, although many businesses, including airlines, handling agents and other agencies, also generate rent and property income for airports.

A number of factors have contributed to the growth in dependence on non-aeronautical revenues. First, moves towards commercialisation and privatisation within the industry have given airports greater freedom to develop their commercial policies and diversify into new areas. A more business-oriented approach to running airports has also raised the priority given to commercial facilities. Such facilities were traditionally considered to be somewhat secondary to providing essential air transport infrastructure for airlines. Managers are now eager to adopt more creative and imaginative strategies and to exploit all possible aeronautical and non-aeronautical revenue-generating opportunities.

In addition, airlines have been exerting increasing pressure on the airport industry to control the level of aeronautical fees that are being levied. A more competitive environment and falling yields have forced many airlines to focus on major cost-saving initiatives, including outsourcing, reductions in staff numbers and pegging the level of wages. Increasingly, airlines are demanding that airports adopt such cost-cutting and efficiency-saving measures themselves, rather than raising their charges to the airlines. Thus airport charges have become subject to more and more scrutiny from the airlines – particularly from the LCCs. In addition, the ability of some airports to increase aeronautical charges is now, more than before, restricted by formal government regulation which has often been introduced at the same time as privatisation (see Chapter 4). The impact of these pressures on the level of aeronautical charges, either from the airlines themselves or from regulatory bodies, has encouraged the airports to look to alternative ways of increasing their revenues and growing their businesses by giving greater attention to commercial facilities. In effect, the airports have had to broaden their horizons considerably in managing their businesses.

At the same time, increasing numbers of people are travelling through airports and making more frequent trips. Hence passengers are becoming more sophisticated and experienced airport shoppers, and are generally much better informed, especially by being engaged online. As a result of this, airport shoppers are becoming more demanding not only in the quality of service that is provided, but also in the range and value for money of the commercial facilities on offer. This reflects general trends in the high street, where consumers have become more discerning, with quality, value and choice at the top of their priorities, and the impact of the additional choice of digital and online shopping.

However, it is difficult to determine entirely whether the raised expectations at airports have been caused by a genuine need or desire of consumers for expanded facilities, or whether airports' drive to maximise their commercial income by becoming more like shopping centres has merely changed the expectations of passengers. It is true, though, that at many airports the market is maturing and passengers are seeking something different from their shopping experience. It is also true to say that the increased emphasis on commercial facilities has not been welcomed by all the travelling public, with significant groups of passengers, particularly those from the business community, often desiring a quick route through the airport as uncluttered as possible from the distraction of numerous shops and F&B outlets.

Moreover, increasing airport competition, especially between airport hubs, has played a role in the development of non-aeronautical revenues. The main reason why a passenger will choose a certain airport will normally be the nature of air services offered by that airport and the convenience of the airport's location (see Chapter 8). Consideration of the retail and other commercial facilities is very likely to be secondary. Transfer passengers may, however, be more influenced by the commercial facilities if they cannot perceive any significant difference between the convenience and quality of the choice of connecting flights at different airports. Certain airports, including Amsterdam Schiphol and Singapore Changi, have run high-profile marketing campaigns emphasising the quality and good value of the commercial facilities on offer to transfer passengers. Other airports have gone a stage further. In the Middle East a number of the airports, including Abu Dhabi and Dubai, try to use their duty- and tax-free shops as a way of capturing competing traffic, particularly by using incentives such as raffles with high-value prizes, including luxury cars (see Case Study 7.2).

The market for commercial facilities

Who buys at airports?

The airport environment is a unique location for shopping and other commercial facilities. The main shoppers, the passengers, make up a large captive market. They often tend to be more affluent than the average and they may have time on their hands to have a quick meal or snack. They may spend spontaneously to acquire a last-minute essential or discount purchase for a holiday, or souvenirs and gifts while returning. They may even spend just to dispose of the last of their foreign currency. Airport retailing is, however, fundamentally different from high street retailing, as passengers are going to the airport to catch a flight rather than to shop. Consequently, passengers will be far less familiar with the airport shopping environment than with their neighbourhood shops, and this, coupled with a fear of missing the flight and the stress associated with the check-in, immigration and security processes, may impose a considerable sense of anxiety on passengers.

To fully harness the commercial development potential of the airport traffic, the range of facilities on offer and even the product selection should match very closely the preferences and needs of the specific passenger types at the airports. To achieve this aim, airports, together with their retailing and F&B partners, have increasingly been devoting more resources to getting to know their customers. At the most basic level, this involves an analysis of the air services offered and the O&D of travellers. Even this detail of information about the market, which is automatically collected at airports, is the envy of most high street retailers. In addition, duty- and tax-free retailers can obtain information about travellers from their boarding passes, shown when purchases are made, known as point-of-sale (POS) data. In many cases this is supplemented by market research, of varying degrees of sophistication, which will investigate the demographic, geographical and behavioural features of passengers. This has been significantly helped by digital commercial strategies, which enable much richer and real-time information to be gathered, that not only support detailed passenger profiling and spend analysis, but also allow the tracking of passenger flows in the commercial area, for example with beacon or Wi-Fi enabled technology. Such research will often aim to determine who shops at airports and what they buy, who does not shop at airports and why, and attitudes towards the range of facilities on offer and the value for money of the products. Such research needs to be updated regularly, as customer demands and perceptions change continually. New services and routes may bring new types of passengers to specific airports.

Various categories of passenger have different spending profiles and preferences. Leisure or charter passengers have traditionally been favourites for impulse buys and the use of F&B facilities. They are encouraged to check in early, which gives them extra dwell time to shop. Long-haul leisure passengers tend to spend more than short-haul leisure travellers, again often because they have more time at the airport. Regular business travellers typically have a shorter dwell time and are less likely to browse in shops. Indeed, in a passenger survey by DKMA (2014), it was found that 48 per cent of business passengers spent more than 75 minutes in the airport, compared with 67 per cent for leisure passengers. The widespread adoption of airline lounges for business and first-class customers has further discouraged business passengers from having spare time to visit the main terminal shops. As a result, these travellers make purchases relatively infrequently – although their average spend on a purchase tends to be high. Business travellers also tend to make high use of certain facilities, including banks, car hire and airport hotels, and when they use F&B services their spending is less constrained as it is covered by company expenses. They may also use facilities because it is convenient to do this in their busy schedule – for example, buying a new tie for work. Research confirming this includes Fuerst *et al.* (2011) who found a negative influence of business travellers on unit commercial revenues, while Castillo-Manzano (2010) observed a positive effect with passengers on vacation.

There is considerable debate concerning the spending patterns of LCC passengers, particularly as many airport operators seek to compensate for the reduction in aeronautical revenues by offsetting these with higher non-aeronautical revenues from the increased number of LCC passengers. These passengers are not necessarily budget spenders, tend to be more evenly spread through time, and are particularly good users of the F&B services because of the lack of free in-flight refreshments. They also tend to use car parking because of the relative remoteness of some secondary airports. However, the evidence concerning commercial income from LCC passengers is patchy and inconsistent. For example, Graham and Dennis (2007) contended that LCC passengers are not necessarily budget spenders on commercial facilities, but whilst Gillen and Lall (2004) found that LCC passengers favourably contributed to non-aeronautical revenues, Castillo-Manzano (2010) observed the opposite. Lei and Papatheodorou (2010) also observed lower non-aeronautical spend for LCC passengers. So, generally, it is difficult to generalise about the spending of LCC passengers because it depends very much on their specific demographics, but it is certainly true to say that not all of these types of passengers are budget spenders.

Then there are transfer passengers. They are unlikely to make use of facilities including banks and post offices, and obviously will not need car hire or car parking facilities. They may want to make some retail purchases, particularly if the duty- and tax-free prices are competitive, but this will be possible only if there is sufficient time between flights. It is hard for an airport to maximise the commercial opportunities from transfer passengers if it also wishes to maximise its efficiency as a hub by providing swift connections. At most major hubs, there will also be passengers who spend a considerable length of time in the airside area. Various airports have developed some quite imaginative airside facilities to appeal to these passengers. For example, Singapore Changi airport has a swimming pool, sauna, gym and cinema, and if transfer passengers stay for longer than five hours they can arrange a bus tour of Singapore – an initiative adopted by a number of other airports. Amsterdam airport has an art gallery and casino. An increasing number of airports are also providing pampering, fitness and health services including reflexology, massage and spa treatments, which are particularly appealing to passengers with time to spare when they are transferring.

Nationality will influence spending and shopping behavioural patterns. For example, Scandinavians, who have relatively high duties and taxes, are favourites for buying duty- and tax-free products at airport shops. The Japanese have also tended to have a high spend per passenger, which has traditionally been due partly to the buying of gifts to take home to friends and relatives. Americans, although very fond of shopping generally, are not usually expected to do their shopping at airports and so their average spend is much lower. Interestingly, at Frankfurt airport in 2016, five nationalities, namely Chinese, Russian, South Korean, Vietnamese and Japanese, generated around 28 per cent of the retail revenue while accounting for less than 7 per cent of all passengers. Compared to average duty-free spend, Vietnamese passengers spent ×8.6 as much followed by the Chinese (×6), Koreans (×3.1), Russians (×2.5) and Japanese (×1.9). By contrast, passengers from the United States, Germany, Turkey, UAE and

India accounted for around 29 per cent of all passengers but only generated approximately 19 per cent of retail revenue (Fraport, 2017).

Factors including nationality, as well as age, occupation, gender and socio-economic group, in addition to psychographic and behaviour variables, can be used to produce different passenger classifications – a few are provided in Table 7.1. Some years ago, Manchester airport segmented its market into six different types. First there was the airport shopaholic, typically a young, happy female on a charter holiday. Next there was the agitated passenger, a young and frustrated middle-income traveller. Then the unfulfilled shopper, a young professional on business or leisure trips. And the value-seeker, a student or pensioner on an annual trip to Europe. The final two categories were the unlikely shoppers, who were frequent business travellers; and the measured shoppers, who were older male travellers. Each of these groups had different characteristics and spending behaviour.

An assessment of motivation is also important because the primary reason for passengers to come to airports is not to shop, and consequently the motivation to shop at airports will be very different than for other types of shopping. Distinctions can be made between entertainment shopping (gifts/novelty purchases), purposive shopping (confectionery, books, toiletries), time-pressed shopping (last-minute/emergency purchases), convenience shopping (wide choice of known brand names), essential shopping (restaurants/cafeterias, foreign currency exchange, insurance) and lifestyle shopping (high-quality international brand purchases) (Institute for Retail Studies, 1997). Echevarne (2008) described a similar classification devised by Pragma Consulting/ARC Retail Consultants. There was travel necessity (books, toys, music, confectionery), souvenirs (local produce, T-shirts, ornaments), gifts for those at home or destination, personal self-treat (designer label clothing, watches, jewellery, accessories), convenience (tie for executive), exclusive

Table 7.1 Passenger segmentation related to shopping behaviour at selected airports

Amsterdam Schiphol	Lisbon	Brussels	London Heathrow	Manchester	Taipei
Satisfied atmosphere-tasters	Shopaholics	Mood shoppers	Mass market leisure flyers	Shopaholics	Mood shoppers
Certainty-seekers	Supporters	Apathetic shoppers	Young upmarket leisure flyers	Agitated passengers	Apathetic shoppers
Active pleasure-seekers	Pure convenience	Shopping-lovers	Older upmarket leisure flyers	Unfulfilled shoppers	Shopping-lovers
Trendy shoppers	Minimalists		Time-starved frequent business flyers	Value-seekers	Traditional shoppers
Exclusivity-claimers	Controlled value-seekers			Unlikely shoppers	
Well-to-do functionals	Unlikely shoppers			Measured shoppers	

Sources: Maiden (2000); Geuens *et al.* (2004); Agbebi (2005); Madeira (2011); Martens (2012); Chung *et al.* (2013)

opportunity to buy (reduced prices or unique merchandise in the duty-free shop) and trip enhancement (sunglasses for holiday). An increasing number of other researchers (e.g. Perng *et al.*, 2010; Chung, 2015; Lin and Chen, 2013) have been looking at the impact of passenger motivation, preferences and behaviour to get a more modern-day understanding.

Most airport commercial facilities historically have been provided for passengers – or perhaps their pets, as in the case of the 'Park, Bark and Purr' before boarding facilities at Sydney airport. However, many airports have now recognised the commercial opportunities that exist with other consumer groups who use the airport, and have introduced facilities wholly or partially for their needs. The airports have thus exploited their commercial potential of being business or commercial centres that generate, employ and attract a large number of visits – rather than just providing facilities for passengers who choose to use the airport. For example, staff employed by the airport operators and by the airlines, handling agents, concessionaires and government agencies may wish to use airport commercial facilities, particularly as they may not be able to combine a visit to their local shops and their working life at the airport. A survey of a US west coast international airport found that 45 per cent of employees used the F&B facilities daily and 26 per cent used them weekly. Equivalent figures for retail were 4 and 18 per cent, respectively (LeighFisher, 2012). Workers from nearby office complexes or from airport industrial estates may find the airport facilities useful. Popular services include supermarkets, banking services, hairdressers, chemists and dry-cleaners. Some of these services may be used by arriving passengers, another potential market subsegment.

Airports may also be attractive to the local residential community as an alternative shopping centre – especially if the airport is relatively uncongested and easily accessible with good road and rail links. Sometimes local residents will be encouraged to come to the airport by free parking, or a certain period of free parking, if a purchase is made. The growing popularity of the use of initiatives to encourage public transport use at airports, however, may be in conflict with such commercial strategies. For certain large airports with severe surface access problems, encouraging additional visits to the airport will be the last policy they want to adopt. Opposition may also be voiced by nearby local shopping centres, as has been the case at London Gatwick airport and shopping facilities in the neighbouring town of Crawley. Airports may be particularly popular as alternative shopping centres if there are legal restrictions on shopping hours imposed on the high street. For example, Frankfurt airport was one of the first airports to develop its landside shops into a shopping mall concept, benefiting from downtown shopping hour limits that were only relaxed in the mid-1990s.

Accompanying visitors, known as 'meeters and greeters', 'well-wishers' or 'farewellers and weepers' will also need F&B services and, perhaps, additional facilities, including florists, gifts and souvenir shops. Car parking revenue can be generated from them. International and long-haul flights for passengers who are travelling for leisure purposes generally tend to attract the most meeters and greeters. Indeed, at Los Angeles airport 30 per cent of passengers were accompanied by meeters and greeters in 2016 (Unison Consulting, 2016). However, much smaller numbers existed at Heathrow airport, where only around 1 per cent of business passengers had people waving them off, whereas for leisure this was around 4–5 per cent (CAA, 2015), but nevertheless these may still generate commercial revenue for the airport.

Air travel continues to hold a unique fascination for certain people, and for these enthusiasts there can be specialist shops where unique merchandise can be sold. Viewing platforms, tours and exhibitions can also be provided on a commercial basis, and can have a dual purpose in acting as a public relations function or service to the community. For instance, Munich airport visitors' park is one of Bavaria's most popular day-trip destinations, consisting of an interactive multimedia centre, an observation hill, a children's playground, an interactive airport museum, historic aircraft and airport tours. Other airports, for example Dusseldorf and Zurich, also provide airport tours. In addition, visitors may also be attracted to airports if leisure facilities are provided. A notable example is Kuala Lumpur airport, where among the leisure facilities within the boundary of this airport is a Formula 1 motor-racing track. Stockholm Arlanda airport has even become a popular destination for weddings, where there have been over 400 weddings in some years, either in the VIP lounge or control tower.

For the business community, conferences and meeting facilities can be provided. The good transport links that airports generally possess can make them ideal for international business events. These facilities can be shared by business passengers, local businesses and other customers. A rare survey in 2011 showed that just over two-thirds of the airports provided business, conferencing and/or event facilities (Halpern *et al.*, 2011). Manchester airport actually has a conference centre within its Runway Visitor Park which contains one of the old Concorde aircraft. Some airports may also hold events related to aviation, such as air shows, or unrelated events, such as car races or shows, which are further discussed in Chapter 8.

Many airports have expanded beyond the boundaries of the traditional airport business by using neighbouring land for hotels, office complexes, trade centres, light industries, freight warehousing, distribution and logistics centres and business parks. If such development occurs, the airport is often called an airport city. Way back in 1994, Amsterdam airport defined itself as an airport city, and later adopted this concept at Brisbane airport which it partially owned. Many other airport cities also now exist. If the airport city continues to develop outwards, the boundaries between the airport and its surrounding urban area may become increasingly blurred, and a new urban form known as an aerotropolis can emerge. This is discussed further in Chapter 9. In summary, Table 7.2 lists the main markets for commercial facilities.

Geographical characteristics

Overall, Middle Eastern airports generate the highest commercial revenues per passenger (US$16.60) followed by Europe (US$10.20). These figures compare with a global average of US$8. The relatively high value in Europe is due to a number of general factors, including the large international traffic volumes and the relatively high income per capita. European airports have also led the way in terms of commercialisation and privatisation trends, with the development of non-aeronautical revenues being one of the most notable outcomes of these more advanced evolutionary stages of the airport industry (Figure 7.1). In Europe in 2016, retail was the most important single item, followed by car parking (Figure 7.2).

Non-aeronautical revenue per passenger for North American airports is much less than in Europe – averaging less than US$6. These airports are dominated by domestic passengers

Table 7.2 The different markets for commercial facilities at airports

Market segment	Facilities provided
Passengers (departing/arriving, terminal/transfer, low-cost/full-cost, business/leisure, different nationalities, ages, etc.)	Wide range of retail, F&B and other essential and leisure services dependent on passenger type
Workers at the airport and in surrounding areas	Convenience shops, banks, chemists and other essential services
Local residents	Shops, F&B, leisure services
Visitors – meeters, greeters, farewellers	F&B, gift and souvenir shops
Visitors – air transport enthusiasts	Specialist aviation shops, tours, visitor terraces, exhibitions, F&B
Local businesses	Office/meeting facilities, land for business development/light industry

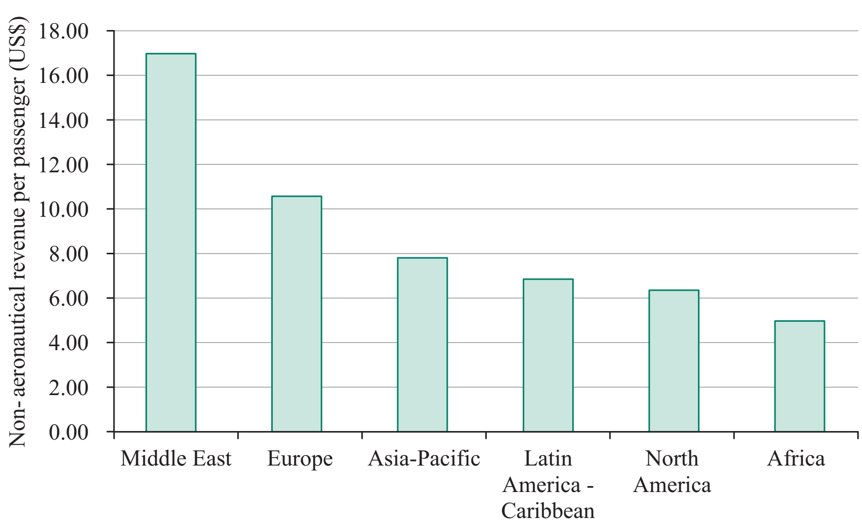

Figure 7.1
Non-aeronautical revenue per passenger at ACI airports by world region, 2015 (US$)
Source: Adapted from ACI (2017)

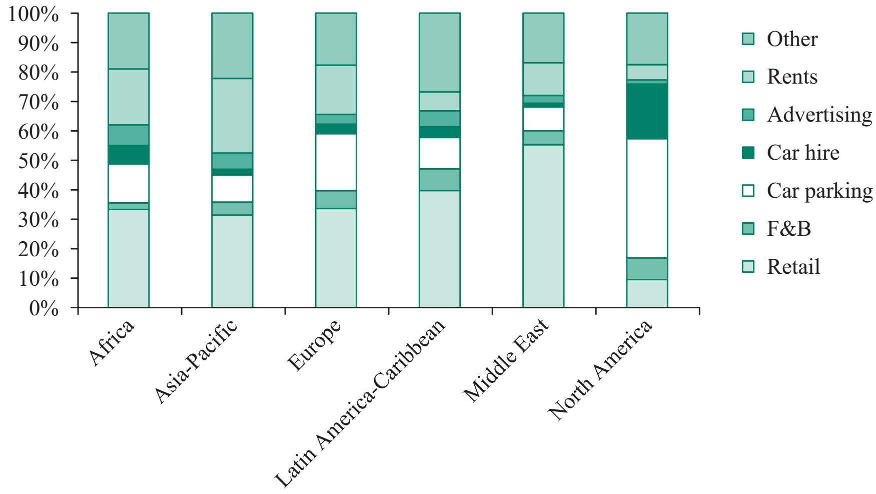

Figure 7.2
Non-aeronautical revenue at ACI airports by revenue source, 2015
Source: Adapted from ACI (2017)

who spend less. Also at hub airports, emphasis is placed on swift, efficient connections rather than providing passengers with the time to browse and shop. Dependency on the car and the lack of adequate public transport access to many airports means that the two single most important non-aeronautical sources are car parking and car hire. Retail is much less important and proportionally F&B is much more significant. Also, duty- and tax-free sales are not very significant at most North American airports, with the exception of certain airports including San Francisco, Los Angeles and Honolulu which handle a large proportion of Asian traffic.

By contrast, in Asia duty- and tax-free income is much more important and there are arrival duty- and tax-free shops at many of the major Asian airports (with Russian airports increasingly introducing these too). Airports including Singapore Changi, Kuala Lumpur's Sepang and Hong Kong's Chek Lap Kok are known worldwide for their extensive commercial facilities. In addition, the passenger profile at a number of Asian countries which have been developing rapidly in recent years (e.g. Indonesia and the Philippines) has changed as the traditional upper-class high-spending Asian nationals have been joined by a large volume of Asian travellers who are of a younger average age and are from fast growing middle classes. Inbound passengers in this area are also now a much more diverse, more cost-conscious group of travellers. Elsewhere in Africa and in Latin America there generally tends to be less reliance on non-aeronautical income. This is partly because many of the airports in these regions have relatively small numbers of passengers and also because the spending power of the local population is more limited. Furthermore, the airport management, often closely tied to its government owners, may have neither the expertise nor the commercial pressures to fully exploit the non-aeronautical opportunities at these airports.

Approaches to the provision of commercial facilities

Most airports have come a long way since they provided just the generic newspaper, book and gift shop, the traditional duty-free shop with its internationally branded products and the bland F&B services with no recognisable identity. It was way back in the 1980s when many European airports began to recognise the attraction of speciality retail outlets and the advantages of using familiar brand names. The specialist retail chains that had grown so quickly in the high streets started to appear at airports. Branding provided reassurance for the traveller, who was aware of the quality and price level of the goods within the branded outlet. More variety was also introduced into the F&B outlets by again bringing in famous brand names such as McDonald's and Burger King. The F&B area began to be split into a number of different, sometimes competing individual outlets. In most cases the large sit-down restaurant, which took up considerable valuable floor space, became a relic of the past.

However, the widespread adoption of branding at airports has meant there is now greater similarity between the shopping facilities at many airports, and less diversity. Brand fatigue can become a problem – particularly for the frequent traveller who can find that airport shopping can become rather dull and boring. Hence most airports are trying to blend famous brand outlets that provide consumer comfort together with local outlets that can give the airport some kind of identity and distinguish it from other airports. The character and culture of the city or country the airport serves can be represented by selling local merchandise or gourmet products such as cheese from Switzerland, chocolates from Belgium or Parma ham from Italy. A flavour of the local environment can also be provided by theming the commercial facilities. For instance, at Las Vegas airport a number of the outlets are themed after hotels and entertainments in the city. There are slot machines everywhere (even before arriving passengers reach the baggage reclaim) – 1,330 in total – and gaming accounts for around 15 per cent of concession revenue. At Orlando airport, there are shops representing the major theme parks in the area, and Memphis airport is themed around the blues, rock and roll and Elvis Presley. (There is even an Elvis-themed bar in Prestwick airport in Scotland, which is the only place in Great Britain that Elvis visited.) Vancouver airport is themed to represent the physical characteristics and cultural heritage of British Columbia, while Santiago airport in Chile tries to depict Chile's diverse geography from desert to Antarctic conditions. At Austin airport, there are live music performances to reflect the city's strong association with music culture, as there are at other airports such as New Orleans, Nashville and Seattle.

Fundamentally, the skill is in finding the correct balance between internationally recognised global brand retailers and local shops and F&B outlets that give the airport an individual identity. Brands also need to be appropriate for passenger spending capabilities – too expensive a brand may deter spending, but on the other hand too cheap a brand may mean suboptimal revenue is generated. In addition, even when global F&B brands are used, local tastes should be taken into account. Moreover, some airports have chosen to enforce and promote an airport brand rather than just the individual brands of the retailers. For example, at Amsterdam airport all the shops in the airside area are branded under the 'See Buy Fly' identity.

A survey of North American airports found some interesting results concerning branding (ACI North America, 2017). Relating to 2015, overall F&B was slightly more likely to be branded (internationally, regionally or locally) compared with news shops and speciality retailing. For F&B, it found 44 per cent of airports using national/international brands, 35 per cent using regional/local brands and the remaining 21 per cent having airport brands or no brands. Trends in branding are likely to continue to play a very significant role, and are further discussed below when looking to the future.

The development of airport terminals into shopping centres has not been universally popular. Certain passenger types, particularly business travellers who are seeking a quick transit through the terminal, favour a more streamlined airport service. Also, the airlines, while welcoming the fact that non-aeronautical income can reduce an airport's reliance on aeronautical charges (particularly if a single till is adopted), have periodically expressed concerns that the shopping function of the airport has interfered with the normal flows of passengers through the airports. Clear signage to gates, for example, is difficult to achieve if the airport is cluttered with retail and F&B signage and branding. There have been claims that passengers have delayed flights because they have been lost in the duty-free shops – so many airports have now placed flight information display systems (FIDS) in the commercial outlets as well. Digital passenger tracking may help here. Some airlines have also complained that airports have been giving too much attention to developing commercial facilities while ignoring basic operational requirements. A correct balance between commercial and operational space is needed so that the non-aeronautical revenue is optimised without compromising operational effectiveness – but this is no easy matter.

As well as adopting high street preferences for speciality shopping and branded products, airports have also applied other tried-and-tested retail practices. This has been helped by an increasing number of airports employing professional retail managers from the high street rather than from within the airport business itself, as historically used to be the case. Many airport operators have encouraged loyalty purchases at airports by introducing loyalty schemes. As with high street shopping, the schemes not only provide the airport operators and their retailers with a mechanism to encourage repeat buying and to encourage spend, but also enable airport operators to find out about their customers and their purchasing habits. This allows airport operators to communicate with scheme members when new products and services are being introduced, perhaps even providing customised offers. With these schemes, points are earned from travelling and spending at the airport, giving benefits including discounts on parking and the commercial facilities, and access to fast-track systems and airline frequent flyer mileage.

Examples of such loyalty programmes include Singapore Changi airport, which has Changi Rewards, Bristol airport, which has Bristol Airport Rewards, Dubuque airport, which has FlyDBQ Rewards Program, Venice airport, which has Club il Milione, Nice Côte d'Azur airport, which has Club Airport Premier and Wellington airport, which has Wellington Airport VIP. Also, in the United States there is the loyalty card 'Thanks Again' that can be used at over 100 airports and gives discounts on parking, shopping and eating as well as at local businesses and attractions. In addition, many airports have value and money-back guarantees that have been commonplace on the high street for many years. These are seen as particularly important because of the perceived expensive 'rip-off' reputation of many airports. For example, Singapore Changi airport has such guarantees, and in addition promises 15-minute meals in a number of participating airports, with a free meal if this does not arrive on time.

The airport's website and mobile apps can also be viewed as an important revenue-generating opportunity, as they can offer hyperlinks to the booking pages of airlines and the travel trade, and earn commission. Moreover, they offer many opportunities to stimulate passenger spending, which is further discussed below. They can also generate income from advertising, being just one of a wide range of advertising opportunities that airports can use to generate additional non-aeronautical revenue. Generally, airport advertising is often seen as attractive because of the high volume of passengers and the cosmopolitan and higher socio-economic group of many travellers. However, it is always important with airport advertising, as with the provision of all commercial facilities, to ensure it does not inhibit ease of movement through the airport or irritate the passengers. In practice, the amount of advertising varies quite significantly between airports, with the income depending on factors including the volume and characteristics of passengers and the design and layout of the airport. Advertising will typically be organised through advertising agencies such as JCDecaux.

Car parking facilities, particularly for North American and Australian airports, are an important source of commercial revenue. Generally, these can be split into different categories depending on their location, the duration of stay, and whether or not additional services are provided. There will be short-stay (or term) terminal car parks that are normally within walking distance of the terminal, and for that there will be a premium price, particularly for a very short time. Then there may be off-site long-stay, usually accessible only by shuttle bus. This will normally be the cheapest option for the passenger and the least profitable area for the airport operator, particularly if there is competition from other non-airport operator suppliers. The final category of car parking is the high-end product. This includes additional features, such as dedicated spaces close to the terminal, valet parking, or meet and greet services. There may also be a reservations system where travellers, by paying a premium, can reserve a convenient space, as at Denver airport (Petro, 2017). Amsterdam airport has its 'Excellence' parking product close to the terminal that offers a waiting area with Wi-Fi and other facilities, wider bays, bay sensors and easy payment options for pre-booking. Manchester airport offers premium 'meet & greet' and 'meet & greet plus' products but also a low-cost option ('jetparks') which is pre-book only and involves a longer transit time to the airport. At other airports, there may be other services on offer. For example, Frankfurt airport has introduced ladies-only parking with reserved rows and wider bays, colour-coded in pink to aid wayfinding, which has generated significant controversy. Loyalty schemes also exist.

The demand for car parking services will depend on factors including the passenger profile, the airport site and location, the public transport available, the amount of transfer traffic and the number of meeters and greeters – this is explored further in Chapter 10. While the traditional approach to car parking – paying a fixed price on the day of travel – is still popular, there is increasing use of online pre-booking with the use of dynamic pricing or revenue/yield management to manage demand and supply and maximise sales, just as with air tickets. Prices will vary according to the demand for space, the time of arrival and how far in advance a booking is made (Keefe, 2014). Pre-booking can provide the airport with valuable passenger profile information which can be used for other e-commerce and promotional activities. Processes associated with car parking are also being streamlined, for example with automatic number plate, and bay sensing to aid vehicle wayfinding and provide real-time occupancy data.

In addition to the concession and car parking income, the property income at airports can be significant. This can include very diverse revenue streams, for example those generated from the renting or leasing of terminal areas such as offices, business lounges, ticket desks and check-in desks, as well as off-airport space, including aircraft maintenance, hangars, training centres, cargo facilities and light industrial buildings. The income will vary according to the type of facility or property, its location and competing off-airport rents, and in recent years many airports have paid much more attention to maximising their income from these sources. However, this can be a complex aspect of airport management that may involve a number of different stakeholders from both the private and public sectors (Armstrong *et al.*, 2011). Property policies may link with broader strategies, for example with an airport's desire to develop as an airport city.

The commercial contract and tender process

There are various ways in which commercial facilities can be provided at airports that affects the amount of control and risk associated for the airport operator. Most airports chose to contract out these services to specialist retail and F&B companies. This lower risk option is usually chosen because the airport operator does not have specialist skills required or a detailed understanding of the market environment, and may not have the bulk buying power and well-established supply infrastructure that the specialist companies will have. There are a number of specialist traders that operate at airports, such as World Duty Free, Gebr Heinemann, Aelia, SSP Catering, Travelex and APCOA parking, as well as many other high street names that are keen to have a presence at airports.

When airport operators contract out their commercial facilities, they usually enter into a concession contract with the companies providing the services. This typically involves the concessionaire paying a percentage of sales to the airport operator, often in addition to agreeing a minimum annual guaranteed amount. The turnover fee may vary from as little as 5 per cent for some landside commercial activities to up to 50 per cent for facilities with higher profit margins – notably duty- and tax-free sales. Typically, the fees are around 30 per cent for duty free, 20 per cent for speciality retail, 17 per cent for F&B and 3 per cent for bureau de change (Pagliari, 2017). The fee may also increase at a faster rate than the level of turnover in the belief that concessionaires will be in a better position to pay higher fees once all basic fixed costs have been covered.

The airport operator will usually provide only the shell and utilities or the outlet and it will be up to the concessionaire to provide the capital investment for fitting out the facility. The concessionaire may offer its own brands, develop new ones for the specific airport or offer brands of others typically under some type of franchise agreement. A typical length for the concession will be around 5 to 10 years, although this can vary considerably and there may be options for renewal. For example, at Singapore Changi there is a duty-free contract for 6 years, an advertising contract for 7 years and some retail and F&B contracts for 3 years. At Copenhagen the duty-free contract is for 5 years and for 7 years for F&B; the equivalent figures at Rome are 14/6 years and Delhi 15/10 years. Overall, the average in North America in 2016 for all agreements was 9.5 years (ACI North America, 2017).

If the contract is too short there will be no time to develop the business, whereas if the contract is too long the airport may miss out on the increased revenues and opportunity to react to consumer trends that the signing of a new contract may bring, particularly with F&B where these trends move quite fast. There may be longer contracts, especially for F&B, to take account of the investment required, and traditionally there have always been a few shorter contracts as well for experimental or 'pop-up' facilities to test new products or locations. These are expected to become increasingly more popular in the future, which is discussed below.

Generally, concession contracts will be relatively low-risk for the airport operator, which will tend to have little responsibility over the commercial facilities and be assured of a certain amount of revenue. However, since this revenue stream will be linked to the concessionaire's sales rather than profit volumes, there is no guarantee that the concessionaire will aim to maximise its sales, as it may be more concerned with profit margins. An increasing number of such contracts also include service level agreements. These cover areas including staffing levels; staff training and other policies; marketing and after-sales service; store quality, maintenance and refurbishment schedules; and product innovation and pricing policies.

At many airports, concession contracts are automatically put out to tender when they come up for renewal. This is usually the most effective way of ensuring the best contractual arrangements. Having a tendering process will give existing retailers incentives to improve their performance if they want to win the contract again. It also gives the airport a chance to introduce new concepts in retail and F&B as fashions change, and perhaps the opportunity to generate more revenue if new concessionaires are prepared to pay a higher fee. In bidding for a concession contract, the specialist needs to be fully aware of the different operating environments that they face compared with high street shopping, particularly relating to staffing and operating hours, security and supply chain issues. Often, the tender will involve different stages, such as a prequalification and request for proposals, with bidders being shortlisted at each stage.

While selection criteria will vary from airport to airport, generally the evaluation of offers will consider both the financial terms (the concession fee paid) and more qualitative terms (experience, quality, vision, innovation). Publicly owned airports often have to use strict public sector procurement rules. Some airports may just choose the bid that will generate the highest revenue, but this may lead to overbidding, especially if there are new entrants that want new business. While in the short run this will benefit the airport operator with high levels of concession revenue, such a situation will not be sustainable in the longer term. The concessionaire will lose money and have to renegotiate conditions with the airport operator or be forced to abandon its airport operations completely. Sometimes this issue may be overcome by setting a maximum percentage fee. An example of an evaluation criterion used at Macau airport was provided by Moodie (2014). Out of a possible 1,000 points, 150 were to be given for experience and qualifications, 200 for customer service, 340 for financial information, 160 for marketing and operation plans, and the remaining 150 for design and proposed capital investment.

Rather than awarding multiple concessions to different operators, some airports, particularly smaller ones and those in the United States, may opt to offer their airports as a total retail or F&B package (or a few sub-category packages) to a master concessionaire, who in turn may seek specialist operators to run the individual outlets. In the United States, the type of agreement can typically get quite complex, typically with four alternative models (ACI North America, 2017):

1. Direct Leasing – Airport leases individual locations or small groups of locations (no more than three) directly to the operators.
2. Developer – Airport has agreement with a third party to develop/lease and manage the concessions without operating any directly. Developer invests in facilities directly.
3. Prime Operator – Airport leases packages of locations to two or more operators, each of which has multiple locations (more than three) within the airport.
4. Master Concessionaire – Airport leases all food service concessions to a single operator, who may or may not also operate retail. The Master Concessionaire may sublease some of the locations to other operators.

The choice of specific model will depend on a number of factors such as scale economies, financial return and the desired amount of competition. For example, direct leasing may create a competitive environment, whereas this will not be the case with the developed approach but the financial return to the airport may be higher. Examples of master concession agreements can be found at Los Angeles airport where in 2012 Westfield Concession Management was given the master concession of 17 years for all retail facilities. In Turkey, there is a single exclusive contract covering all airside retail space at the new Istanbul airport that will run from 2018 for 25 years. This has been awarded to the global retailer Unifree. It covers the world's largest airport shopping area of 53,000 m^2.

Rather than opting for a concession arrangement, alternatively the airport operator may choose to enter into a management contract that involves greater financial risk for that operator. These contracts have been used for car parking facilities at airports for many years, but are not a popular approach for other commercial activities. In this case the specialist operator will be paid a monthly fee in return for maintaining certain agreed standards, including accurate financial accounts, high quality of cleanliness and professional staff appearance. The ability to build in guaranteed service levels is important, especially with car parking where competition from off-airport parking may be present.

A third option is to have a joint venture arrangement where the airport operator enters into a partnership with the specialist retailer or some other organisation to provide the commercial facilities. The advantages of such an approach are that the airport and retailer develop a long-term relationship, and all the transaction costs and time associated with a concession contract can be avoided. In this case the risk, profits and CAPEX can be shared between the airport operator and specialist, and longer-term security for the specialist can be gained. Examples include the joint retail venture of AdP and Aelia (also Lyon airport and Aelia), TAV airports with Gebr Heinemann at Istanbul Ataturk airport, and Delhi airport's duty-free provision, which was a combined venture between the airport operator, the local operator India Duty-Free and ARI – although India Duty Free has now pulled out of this partnership. Two recent developments include the Schiphol Group selling a 60 per cent stake in Schiphol Airport Retail, which operates airside liquor, tobacco and confectionery business at the airport, to Gebr Heinemann in 2015. Then in 2017 Fraport and Gebr Heinemann also began a 50/50 joint venture covering all stores run by Gebr Heinemann at Frankfurt airport.

Elsewhere there are a few airport operators, for instance, Dublin airport, Malaysia airport and Hyderabad airport, which have chosen to provide some facilities themselves, including duty- and tax-free products, either directly or through a wholly owned subsidiary. Dubai and Doha airports also self-manage their retail and catering operations in-house (although some catering is outsourced). This was the model, too, at Abu Dhabi until 2008 when they opted instead for a concession approach. Likewise, duty-free was provided in-house at Helsinki airport until 2014. Overall, this type of practice is not that common for large airports, but it does offer opportunities for airport operators wishing to expand their involvement to other airports. DAA (through its subsidiary ARI) is the best example of this, where the operator has entered into a number of joint venture agreements in order to provide commercial facilities in areas including Asia and the Middle East (see Case Study 7.1). Moreover, a larger number of very small airports run their own facilities, which makes sense with small operations where it would be difficult to attract external specialists. Overall, car parking tends to be the only commercial activity that is provided by a substantial number of airport operators themselves, since it generally requires fewer specialist skills and also greater capital investment by the airport operator. For example, out of the 19 major airports in the UK, 15 operate all or some of their own car parks (LeighFisher, 2017).

Factors driving success

Choosing the right concessionaire or retailer and negotiating the most appropriate contractual agreement is crucial if an airport is going to fully exploit its commercial opportunities. However, there are many other factors that will also play a role, both internal and external (Martel, 2009). The airport operator may be able to influence some of these factors, but by no means all of them. Also, the nature of the airport traffic and its spending capability need to be taken into account. For instance, an airport handling predominantly domestic business travellers is likely to be in a less favourable position for generating commercial income than an airport with many long-haul leisure passengers. Therefore, understanding the mix of passengers and planning the facilities to match their needs and preferences as closely as possible is paramount to maximising the revenue-generating opportunities and return on investment. If an airline starts new services, or changes terminals, this may change the mix. Market research ideally needs to be undertaken, not only of passengers but also of staff, meeters, greeters and visitors, to enable their preferences and experiences to be examined. Focus group research may be particularly useful in identifying trends and future issues. Understanding why passengers do not shop is just as important as why they do. For example, Freathy and O'Connell (2012) found that the main reasons for not shopping at the airport were 'Did not need anything' (35.6 per cent), 'Airport too expensive' (10.5 per cent) and 'Preferred to have something to eat/drink (10 per cent). Rather similarly, DKMA (2014) found that 'Not interested in buying' (63 per cent), 'Too expensive' (10 per cent) and 'Didn't find what I wanted' (10 per cent) were the most important factors.

As an illustration of the impact of traffic mix, Figure 7.3 shows the comparative importance of concession and car parking revenues at the London airports of Heathrow, Gatwick and Stansted. Heathrow has a large share of scheduled long-haul traffic and consequently duty- and tax-free and speciality retail is a significant revenue source. By contrast, this is less important at Stansted, as the majority of traffic is carried on European LCCs. Here,

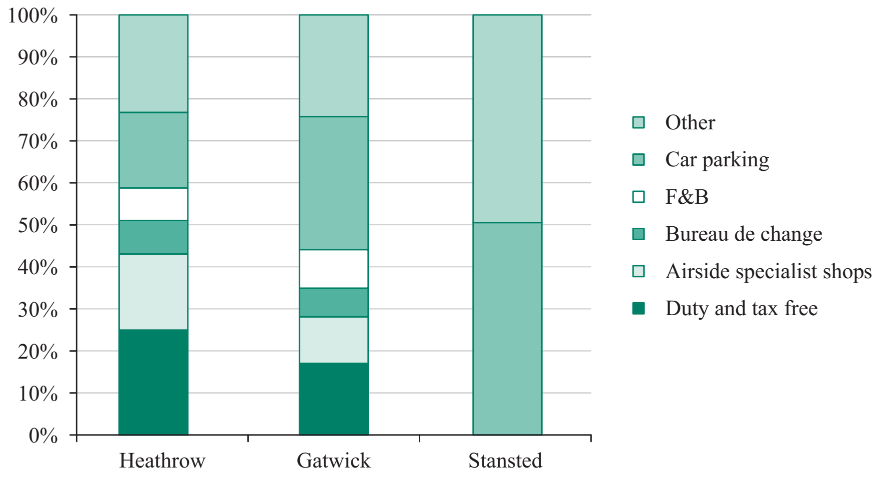

Figure 7.3

Concession and car parking revenue at London Heathrow, Gatwick and Stansted airports (%), 2016

Note: All concession revenue for Stansted is included under 'other'.

Source: Annual Reports

car parking makes up half the revenue, undoubtedly influenced by poorer public transport links, but also early and late flights of the airlines. Gatwick airport, which has a mix of LCCs and network carriers and some long-haul flights, lies in between Heathrow and Stansted in terms of mix of concession revenues.

Small airports with limited passenger traffic are at a distinct disadvantage since they will not have the critical mass, typically around five million passengers, necessary to diversify and support specialist retail and F&B outlets. Airports go through different evolutionary stages as regards their commercial income, depending on their size. Small airports can only really offer the basic facilities, including a duty-free shop, newsagent and F&B outlets, especially as the volume of traffic tends to be unevenly spread with just a few flights a day. Much of the traffic may be domestic with short dwell time. Focusing just on airside shopping will not be viable as often there will not be enough passengers to sustain such businesses. The airports are unlikely to be able to attract global specialists, using local companies and also perhaps making use of vending machines. The fees and rentals are likely to be lower than at large international airports. As the airport grows, more specialist shops can be added until finally the airport can be considered closer to a shopping centre.

Spending by all passengers will be influenced by the general economic climate. Factors to consider include growth in gross domestic product (GDP) and consumer expenditure, level of taxation, inflation rates and foreign currency fluctuations. The level of sales taxation will also play a role. In addition, purchasing patterns will be affected by delays at an airport. A delay of an hour or so for a departure slot may give passengers extra time to visit the shops or F&B outlets (although empirically Fuerst *et al.* (2011) found no significant relationship between the number of delayed flights and commercial revenues). On the other hand, congestion and lengthy operational delays within the terminal, including long queues for passport control, security or immigration, will have the reverse effect and reduce or even eliminate the dwell time that passengers have for browsing in the shops and having something to eat or drink.

This positive relationship between dwell time and passenger spending has been confirmed by a number of studies (e.g. Torres *et al.*, 2005; Geuens *et al.,* 2004; Castillo-Manzano, 2010). However, passengers will not increase their spending indefinitely with extra time and the industry often talks of the 'golden hour' for passenger spending. If time for spending increases beyond an hour, the benefit will be much more marginal if at all, as passengers will tend to have made all the purchases that they want to make and have eaten and drunk all they need. The dwell time is also affected by the check-in procedures and control and departure processes. Developments previously discussed such as self-service check-in and more stringent security rules will all have an effect on dwell time. Looking to the future the overall impact on dwell time will depend, to a certain degree, on how passengers respond to these developments and how prepared they are to shift their behaviour, for example related to the time they typically plan to spend at airports. Another impact of these developments is that they can potentially free up space for more commercial facilities, although the new space may not be located in the optimal position unless some major reconfiguration of all airport facilities is undertaken.

Overall, Figure 7.4 shows the average dwell time from the 2015 Airport Commercial Study (Moodie Research and the SAP Group, 2015). On average, domestic passengers spend 94

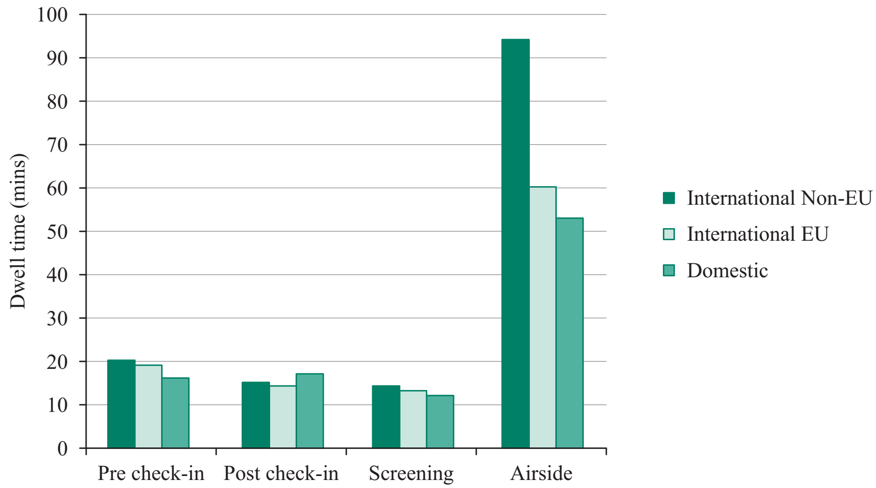

Figure 7.4
Dwell time (minutes) by journey stage, 2015
Source: Adapted from Moodie Research and the SAP Group (2015)

minutes with 55 per cent of this time airside. The remaining 45 per cent of time in the landside area is split relatively evenly between pre-check-in (e.g. seeing off friends and family), post check-in and security. By contrast, on average, intra-EU passengers spend 102 minutes in the terminal and non-EU passengers 139 minutes. Slightly more of the total time (58–67 per cent) is spent airside compared with domestic passengers, which partly helps explain why international passengers tend to spend more.

Then there is the competition for airport commercial facilities that can come from a variety of different sources. First, there are other airports. Notable examples of airports in a particularly competitive situation are those in the Gulf, including Dubai, Abu Dhabi and Doha, and some Asian airports serving destinations including Incheon, Singapore, Kuala Lumpur and Hong Kong. There is also competition from the in-flight sales of airlines. Some of the airlines allow pre-booking of goods in order to catch some business before the passengers can see what the airport competitor has on offer. In addition, competition can come from downtown tax-free outlets for international travellers, which are allowed in a number of countries, particularly in Asia. In Europe and North America, competition exists with discounted electrical and other high street businesses and from factory outlets. Online shopping, as discussed below, is a major competitor: customers are now far more likely to search online to see what bargains they can purchase rather than waiting until their next airport visit to shop. All this means the airports need to ensure they keep up to date with retail trends and fashions and that they constantly monitor competitor prices. A study of North American airports found that 34 per cent of airports stated they had pricing comparable to the high street, 58 per cent had a high street plus a percentage methodology, 4 per cent had prices comparable with other airports, and others (4 per cent) had no comparisons (ACI North America, 2017).

Just as in the high street, the outlet number, size and mix are very important. For example, too many outlets may reduce sales per outlet and create excess competition. The mix should be determined by the type of customer, the commercial viability of the outlets and the different space requirements needed. Again, using the example of Stansted and Heathrow, Stansted, which serves predominantly LCC demand, has much 'grab-and-go' F&B; whereas London Heathrow, which has a substantial amount of long-haul and transfer traffic, has many more designer retail stores and sit-down restaurants. Another key factor is the location, space and design of facilities. A large proportion of the airports in use today were designed without taking sufficient account of the commercial opportunities that airport terminals can offer. All too often, concession planners become involved at much too late a stage of the terminal design and development process. This has meant that commercial facilities very often are not ideally situated or have been added on later as an afterthought.

Successful concession planning, at least when passenger purchases are being considered, is all about providing facilities close to passenger flows and not in areas that are dead ends or are too far from passengers' view. A change in the flow line of passengers can have a dramatic impact on concessionaires' sales. The outlets should ideally be on the same floor levels as the departure gates, as having to go through the inconvenience of changing levels may deter some passengers from visiting the commercial facilities. Using the same logic, shops aimed at business travellers should be allocated near the business lounges. There is also a popular trend to have facilities that require passengers to walk through them to get to the departure lounge or gates. Ideally, these should be situated after security and with an orientation or re-composure zone in between where the retail is in sight. These walk-through shops can increase footfall at airports to 100 per cent, but such shops are difficult to introduce into a terminal unless new infrastructure is being provided. Other strategies can include using popular facilities, including duty-free shops, to attract passengers and act as an anchor for a concession hub. Mixing together F&B in a food hall, together with some speciality shops, can also often work well to create a marketplace environment. At all times, however, the commercial facilities must not hamper the passengers' ability to wayfind around the airport as this may well increase their anxiety. Likewise, when product promotions spill out of the retail units into other parts of the terminal they must not obscure passengers' lines of sight to the next essential airport process.

Particular problems can arise from terminals that are of a linear design, such as terminal 1 at Munich airport, because very often facilities have to be duplicated which can be costly until there is sufficient throughput of passengers to support all the facilities. This was the situation with the fourth terminal at London Heathrow when it first opened. At some airports, officially required separation of different passenger types may cause duplication of facilities, resulting in reduced custom for each outlet, for example, at some Canadian airports where there are three different passenger channels – domestic, United States and other international, which have to be separated from each other. In some cases where there is more than one terminal, passenger flows can be combined to go through a central security area that is situated near a commercial area. This means the airport can minimise the amount of duplication in its retail offer while at the same time giving a greater choice for passengers. Usually any way that involves consolidating space and passenger flows, for example with centralised security or by integrating different passenger flows, will be beneficial for commercial operations. It is worth noting that a few airports in Europe have recently decided to centralise their security, such as Amsterdam in 2015 and Vienna.

Passengers also need to feel relaxed when they shop, and tend to prefer to buy from outlets situated within the vicinity of the departure gates – once all essential processes including check-in and security screening have been completed. They will not want to walk long distances to be able to shop. Throughout their time at the airport, passengers' stress levels will fluctuate depending on where they are within all the airport processes, and this will have a direct impact on their spending patterns. Security is usually the most stressful experience where passengers will often have elevated levels of negative emotions. However, once this and all other processing activities are completed these negative emotions may give way to positive travel emotions of excitement and anticipation and a more self-indulgent mood which can be more conducive for shopping.

Passenger stress levels will vary according to other factors, for instance whether they are travelling alone or with their family. If they are travelling for leisure purposes, their excitement levels will often increase as they go through the airport, which should encourage spending in the airside area. However, boredom levels may also be important. As a result, factors that need to be taken into account to create the right atmosphere for shopping include the architectural aesthetics, the temperature, and other possible enhancements such as music and entertainment. The provision of personal shopping assistants is another factor to consider, as is the visibility of the commercial facilities.

Planning landside shopping is different from airside shopping, as convenient locations must be found not only for passengers, but also for staff, meeters, greeters, farewellers and local residents. If there is too much landside shopping, passengers may spend too much time in this area, which can reduce their purchases in the airside area where average spend tends to be higher. The split between airside and landside varies significantly, however, with Dubai airport, for instance, having very few landside facilities, while the split at airports such as Zurich and Amsterdam is much more balanced, as these airports have been very active in developing similar customer facilities at airport railway stations. At most airports, it is the sales in the airside area of the airport that still brings in the most revenue for the airport operator. For the terminal, Steer Davies Gleave (2017) stated that locating 85–90 per cent of retail airside is generally considered to be best industry practice. In the United States, 84 per cent of retail square footage is post security for large airports, 77 per cent for medium airports and 64 per cent for small airports (ACI North America, 2017). Some landside facilities, including post offices, travel agents or booking agencies, may not bring in huge amounts of revenue to the airport, but may be perceived as adding value to the airport product from the point of view of the passenger and other consumers.

A few airports have developed very successful arrival duty- and tax-free shops. This has tended to happen in developing countries where there are large numbers of returning expatriate workers. For example, in Colombo in Sri Lanka and Manila in the Philippines, a significant amount of the duty- and tax-free sales have tended to be on arrival, primarily due to spending by returning nationals from the Middle East. Oslo airport in Norway also has substantial sales from its arrivals shops because it is the only Scandinavian country still to sell duty- and tax-free goods within Europe as it is not a member of the EU. Arrivals shops overcome the security problems related to LAGs and can be considered to be more environmentally acceptable as, unlike goods from departure shops, they do not increase the overall weight on the aircraft and, consequently, cause fewer emissions. However, it is usually quite difficult to get passengers to shop on arrival because they are anxious to get through the airport as quickly as possible and to focus on the essential processes, including baggage reclaim. For this reason, airports such as Buenos Aires Ezeiza airport has TV screens in the arrivals shop that show when the baggage is ready to be collected.

F&B outlets can compete with passengers' dwell time in shops and so they need to be positioned near to the retail facilities, but must not interrupt the flow. This is particularly important as most shop purchases are made on impulse (Crawford and Melewar, 2003; Lin and Chen, 2013). Shops and F&B outlets have to be large enough not to give a congested and overcrowded image, but not so large that consumers may be deterred by an appearance of inactivity and empty space. In the airside area it is useful to have as many of the F&B facilities as possible situated by the outside wall to preserve views of the runway and keep the natural light. Average spend on F&B tends to be low and the spend per square metre is also less; more space is required for the kitchen, food storage and eating areas. Typically, the duty-free sales per square metre, in Europe for example, can be in the region of US$13,000–37,000 compared with values of US$6,000–10,000 for F&B (Moodie Research and the SAP Group, 2015). However, while F&B tends to account for a fairly small share of total airport commercial revenues and profit levels, more passengers tend to use F&B facilities than shops and so they can have a major impact on a passenger's image and perception of the airport. Thus if F&B is considered to offer poor value for money, the customer may assume the same is true for the shops.

Figure 7.5 shows that the average penetration rate for F&B is between 30 and 40 per cent compared with around 25 per cent for duty-free and only 5 per cent for bureau de change. In general, maximising income will involve assessing the passenger preferences, space requirements, spend levels, concession fees and penetration rates of the different facilities. For instance, regarding duty-free, the average spend and concession fee tends to be high and the penetration rates are significant, although such shops do tend to take up considerable space. By contrast, the space requirements and demand for both currency exchanges and car hire are less, but with average revenue tending to be high for exchanges and low for car hire.

Finally, the commercial performance of an airport will be influenced by a wide range of laws and regulations. These will include the duty- and tax-free limits set by governments and also any regulations related to legal contracts and the bidding process. There may also be local planning regulations, particularly if the airport is competing with nearby

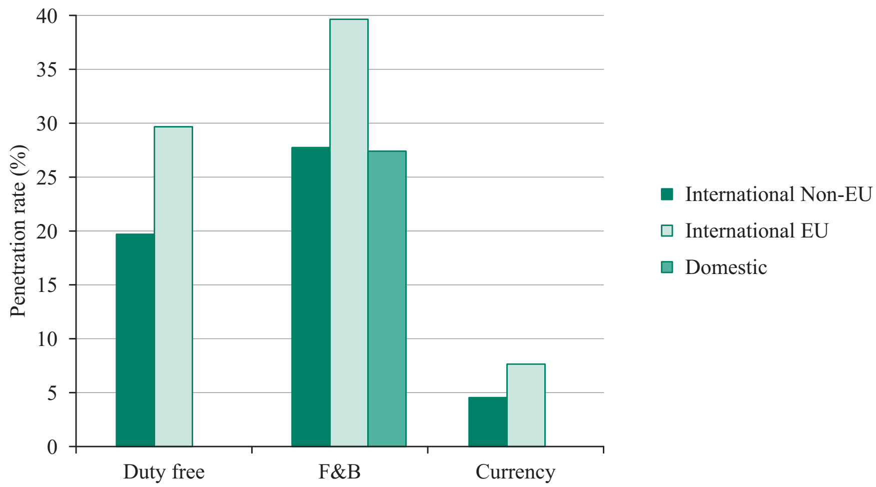

Figure 7.5
Penetration rate (%) by commercial category, 2015
Source: Moodie Research and the SAP Group (2015)

shopping centres. Then there are security rules, which have had a major influence on airport retail and F&B in recent years (see Chapter 5).

Therefore, overall there are a number of factors that influence commercial revenue generation. In a recent study by ACI (2016), the impact of some key drivers on non-aeronautical revenues was investigated. The research found that an increase of one per cent of passengers led to a 0.7–1 per cent increase in commercial revenue and an increase of 1 per cent in the commercial area space led to a 0.2 per cent growth in commercial revenue. However, arguably the most significant finding was that an increase of 1 per cent in passenger satisfaction mean (as defined in the ASQ survey) generated a growth of 1.5 per cent in commercial revenues, indicating that when passengers perceive an improvement in the quality of the service experience this results in a more than proportional growth of commercial revenues. The link between customer satisfaction and propensity to spend in retail is a well-studied relationship in general retail research but the ACI findings are one of the first to confirm this on a large scale at airports. DKMA (2014) also found in a survey of nearly 30,000 passengers that the most satisfied passengers, compared to the least satisfied, spent 10 per cent more time at the airport, were twice as likely to shop and spent 7 per cent more on retail, and 20 per cent more on duty-free.

Measuring non-aeronautical performance

Airports, with their concessionaire partners, have become increasingly active in monitoring their non-aeronautical performance. This is partly due to a drive for better performance monitoring of all aspects of the industry and also because retail experts, with experience of assessing retail performance at other locations, are now commonly employed at airports. Consumer satisfaction levels and perceptions of value for money are assessed by many airports through customer surveys (as described in Chapter 6).

In addition, airports use indicators including sales per passenger, passenger penetration levels and sales per square metre to analyse the economic performance of their commercial facilities. The latter measure has the advantage that it can be used to compare airport performance with other retail facilities at other sites, including shopping malls. However, making inter-airport comparisons is difficult because of the commercially sensitive nature of the information required and a lack of reliable industry-wide data. One of the most comprehensive benchmarking studies is the Airport Commercial Revenues Study which has been undertaken since 1998. The latest 2015 report included more than 100 airports. The study looked at performance indicators including sales per passenger and per square metre by different commercial activity, and other indicators including yield and penetration rates. In addition, it also had a number of management indicators examining how the airports manage and control the retail function, which considered factors including concession structures, dwell time and the marketing undertaken (Table 7.3).

Table 7.3 Key indicators used in the Airport Commercial Revenues Study

Activity	Indicator and measures
Duty-free and duty-paid	Sales per international departing passenger (IDP)/ departing passengers Sales per square metre Yields (airport income/sales)
F&B	International airside sales per departing passenger Domestic airside sales per departing passenger Sales per departing passenger Sales per square metre Airport income per departing passenger Airport income per square metre Yield
Currency exchange	Sales and airport income per IDP
Advertising	Income per departing passenger
Terminal space/property rental	Airport income per departing passenger
Car parking	Income per departing passenger
Car rental	Income per departing passenger
Dwell time	Time in minutes by airport processing stage

Activity	Indicator and measures
Penetration rate	Penetration rate by activity category
Retail marketing	Budget, airport and concessionaire contribution
Management	Reporting structure Number of staff Fastest-growing retail segment Level of private ownership
Shop fit-out cost	Costs paid by airport and concessionaire
Concession structure	In-house operations, single/multiple concessions, guarantees, revenue structure, approach, sales target, term, high street comparisons

In North America there is also an annual concessions benchmarking survey undertaken by ACI North America. This looks at measures including income per passenger and per square foot as well the types of concession agreement, length of contract, the staff involved and the branding used.

Current developments and future trends

Generating commercial revenues at airports over the past decade or so has become much more challenging. As discussed in Chapter 3, globally non-aeronautical revenues as a share of total revenues peaked at about 50 per cent in 2000 and has subsequently fallen to around 40–42 per cent. By way of illustration, the flattening out of commercial revenues, both in terms of airport non-aeronautical revenues per passenger and gross sales per passenger, can clearly be seen for Zurich airport (Table 7.4). Figure 7.6 further shows this relatively static trend, experienced by other neighbouring European airports. None of these airports have recorded significant increases in per-passenger revenues, even though the total revenues have increased due to the growth in passengers. Whilst there are unique factors influencing every individual airport's commercial performance, there are also some general factors which have had a key influence. These are discussed below.

EU duty- and tax-free shops

Duty- and tax-free shops in Europe have been in existence for many decades. The first duty- and tax-free airport outlet was opened in 1947 at Shannon airport in Ireland. In 1951, another shop was opened in Prestwick airport in Scotland. These shops were designed to be attractive to transatlantic passengers on refuelling stops (Freathy and O'Connell, 1998). The shops sold a small range of alcohol, tobacco and perfumes and a few other items. By the 1960s, other airports had opened similar shops and had started to expand the range of merchandise on offer. For example, in 1957 shops were opened in

Table 7.4 Commercial performance at Zurich airport, 2002–16

Year	Total terminal passengers (millions)	Non-aeronautical revenues per passenger (CHF)	Retail/F&B gross sales per departing passenger (CHF)
2002	17.8	14.5	33.0
2003	16.9	14.2	33.7
2004	17.2	15.0	35.4
2005	17.8	15.5	39.1
2006	19.1	14.8	40.6
2007	20.7	14.2	42.0
2008	22.1	13.9	43.5
2009	21.9	15.0	41.8
2010	22.9	13.8	42.1
2011	24.3	13.4	39.4
2012	24.8	13.2	41.7
2013	24.8	14.2	43.2
2014	25.5	14.7	42.5
2015	26.3	14.8	40.7
2016	27.7	14.2	39.4

Source: Annual reports

Amsterdam and Tel Aviv, in 1958 in Brussels and Miami, in 1959 in London Heathrow, Frankfurt and Dusseldorf, and in 1960 in Osaka and Oslo. This was primarily in response to the rapid increase in passenger traffic at that time and particularly the growth in package holidays and other forms of leisure travel. Amsterdam Schiphol airport was one of the first airports to offer tax-free electronics and photographic material. Then came a retail boom in duty- and tax-free shopping, with many airports substantially increasing the area dedicated to such shops and offering a much more diverse and varied product selection, ranging from the traditional alcohol, tobacco and perfume products to camcorders, watches and jewellery, sports clothing and other fashion accessories.

The 1990s were a period of uncertainty for most EU airports. It was originally intended that all EU duty- and tax-free sales would be abolished on 1 January 1993 as the single

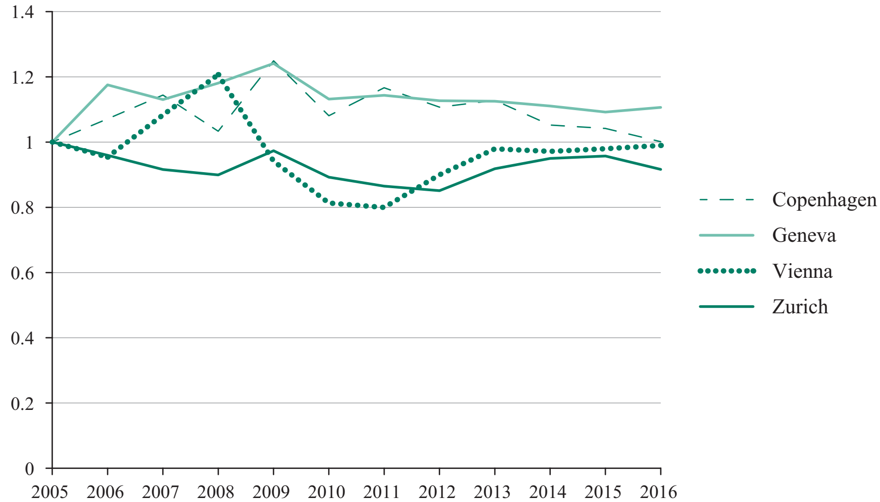

Figure 7.6

Non-aeronautical revenue per passenger at Copenhagen, Geneva, Vienna and Zurich, 2005–16

Note: The 2005 value has been indexed at 1 to aid comparisons.

Source: Annual reports

market was 'born'. The rationale was that it was illogical and incompatible to have such a system when the EU should be behaving as a single market with open borders. In addition, these shopping privileges were considered to distort competition between modes of transport with no access to these sales, including rail, and to be unfair trading in relation to downtown shopping. It was argued that EU consumers were subsidising not only duty- and tax-free outlets, but also air and ferry travellers. In response, the airports, charter airlines, ferry companies and associated manufacturing industries collectively argued that duty-free privileges did not distort or hamper the development of the single market and that abolition would result in millions of jobs being lost. It was claimed that the cost of travel would have to rise substantially to compensate for the loss of income, which would have a knock-on effect throughout entire national economies. Through active lobbying of government ministers, the proponents of the abolition managed to achieve a 6.5-year extension of these sales until 30 June 1999, when eventually these sales were abolished.

Many of the EU airports, in partnerships with their retail concessionaires, absorbed the value-added or sales tax themselves – effectively offering the merchandise still at 'tax-free' prices. A few airports sold a selection of liquor products at duty-free prices, but at most airports cheaper tobacco was no longer available to EU passengers. Different strategies were adopted by airports, including having dual pricing or different facilities for the different types of passenger. In 2004, 10 new European countries joined the EU which reduced the potential for duty- and tax-free sales to and from these countries, and this was followed by Bulgaria and Romania joining in 2007 and Croatia in 2013. This has undoubtedly had an impact on non-aeronautical revenues. For example, at 17 UK airports non-aeronautical revenue per passenger (in 2007 prices) decreased from £6.43 in 1998/99 to below £6 in

1999/2000 and then to £5.14 in 2006/07 (Graham, 2009). A key issue in the future will clearly be Brexit, which is discussed in Chapter 11. This could result in duty- and tax-free goods being available again on journeys between the UK and the EU.

Security and airline issues

There were a number of significant impacts on commercial revenue generation as a result of 9/11, particularly in the United States. This included the redesign of commercial facilities and car parks in order to conform with new security measures – particularly the banning of meeters and greeters who in many instances had previously been allowed right up to the gates.

The other security event that had a major impact on the commercial performance of airports was the introduction of the LAGs restrictions (see Chapter 5). The 100 ml rule for LAG in hand luggage was thought to have encouraged passengers to buy lower value and essential travel items airside that they previously would have bought landside or packed in their hand luggage. This may very well have reduced the money and dwell time that they had airside to make more high-value and impulsive purchases. Passengers were also confused as to what they could take on the aircraft. At the same time, more stringent and more time-consuming security measures at many airports caused congestion, taking up more space and reducing dwell time for shopping. The problems of different LAGs security rules in different regions or countries also led to a loss in sales and more confusion among passengers. When the rules were first introduced, many unsuspecting passengers from outside the EU had their LAGs purchases confiscated at EU airports if they were transferring onto a different flight. For example, in 2007 Frankfurt airport confiscated 2,500 liquids a day, and Amsterdam and Madrid airport removed around 1,000. Zurich estimated that it took away US$29,540 worth of alcohol and perfume from passengers daily, while at Heathrow this figure was around US$211,000 (Jane's Airport Review, 2007).

When screening of LAGs is finally introduced in the EU, the current problem which may have reduced passenger spend and damaged overall consumer confidence in airport shopping may be overcome. However, whilst the ban still remains, a few airports have adopted imaginative responses. For one day in July 2017, London City airport paired up with the manufacturers of the yeasty spread Marmite (which is one of the more commonly confiscated products) to offer new smaller jars at the security queues that can be taken onboard.

Airline developments will also continue to play a central role in the future. The ongoing pressure on airport charges is likely to mean that airport operators will remain committed to seeking new ways to increase their non-aeronautical revenues. However, this may become more challenging if airlines themselves continue to increase their focus on ancillary revenues. Also, there is the 'one-bag rule' policy introduced by a number of LCCs in Europe, which prohibits passengers from carrying retail and F&B purchases on board the aircraft unless they fit into the traveller's single cabin bag. This potentially can have a detrimental impact on commercial incomes, particularly at airports where this policy is strictly enforced. For the major LCC, Ryanair, these rules were relaxed for a while a couple of years ago but then certain restrictions and fees were reintroduced to speed up boarding and reduce delays. A few other airlines, such as Spirit Airlines in the United States, also charge for carry-on bags above a certain, relatively small, size.

New innovations

The poor economic climate associated with the global recession in the late 2000s undoubtedly dampened the demand for commercial facilities and reduced passenger spending. However, in many cases, as illustrated in Figure 7.6, spending per passenger in developed markets has not increased significantly in the last 10 years or so, even with a return to better economic conditions. It is generally thought that a key reason for this is the maturing of the market, with passengers needing something different at the airport to entice them to spend, and seeking more than just an ability to purchase well-known brands that they could buy elsewhere. Merely adding more space, which has been a popular option in the past, has become increasingly more difficult with growing congestion and also reaps only very marginal benefits if markets are already quite close to saturation. So instead many airports are now focusing more on creating a sense of excitement, authenticity or uniqueness with their commercial offering to produce an experience that can be integrated with other aspects of the modern-day passenger journey, which is discussed in Chapters 5 and 6.

Digital strategies and using the latest technology are being viewed as one key way to stimulate retail sales, since the majority of passengers are now very much engaged online with their smartphones, tablets and other devices (Griffiths, 2014). Digital engagement opportunities actually exist before the passenger's trip by aiding pre-planning and also by providing e- and m-commerce platforms for the internet and mobile apps to allow pre-ordering of products, especially car parking and foreign currency, but also other retail, to take place. A number of airports including London Heathrow are introducing pre-ordered F&B services. Discount vouchers can also be supplied during this pre-planning process, aided by frequent social media communication. This is especially important as passengers are much shrewder in digitally comparing prices than they used to be. Then during the actual airport journey, with the use of smartphones, airport apps and sensors (such as beacons – see Chapter 6) there are ample opportunities to provide personalised real-time information and offers with the content based on the specific location of the passenger. Finally, after the trip there are further opportunities for engagement to reinforce loyalty.

According to SITA, currently 27 per cent of global airports offer sales of airport services on their apps currently, but this is expected to rise to 84 per cent by 2019 (Airline Business, 2016). For North American airports specifically, 75 per cent have stated that they have a mobile-friendly website or app, with 72 per cent of the airports promoting concessions offerings through mobile devices (ACI North America, 2017). In Europe in 2014, 42 per cent of airports offered the purchasing of airport services and 19 per cent retail promotions. By the end of 2017 these shares were expected to increase to 57 and 81 per cent respectively (ACI Europe, 2015). So, in essence, this technology not only has the potential to provide passengers with the means to check in, pass through essential processes, navigate and board the aircraft, but also to keep passengers well informed about commercial facilities and promotions on offer.

A number of airports are offering collection on arrival for goods bought on departure and a few also provide a home delivery option to suit shifting consumer shopping behaviour. Indeed, these new e-commerce opportunities were a key factor influencing the recent joint venture agreed between Fraport and Gebr Heinemann, in order to provide a more flexible and closely aligned business model to address modern-day passenger preferences. Home delivery options for German inhabitants on EU flights purchasing and paying online were introduced in 2017. The service can be used by anyone possessing a valid ticket and orders can be placed up to 90 days before their flight. Also, passengers who do not wish to take advantage of the home delivery service can opt to collect their pre-ordered products at the airport. This reflects the general trend of multichannel or omni-channel shopping, using physical and electronic facilities, or having so-called ‘bricks and clicks’. Consumers frequently search online before buying in a store, and vice versa (Belardini, 2013). Hence it seems likely that more and more airports will move towards a situation where passengers will routinely take goods with them, order for home delivery or arrange collection, depending on their particular needs. Within this context, Sevcik (2014) argued that ‘showroomisation’ when the physical space serves more as a brand and product showcase than an actual POS, where consumers experience and test the product, could be a future trend at airports.

Whilst retail spend per passenger has been relatively flat at many airports of developed markets, F&B spending has in many cases continued to grow, prompting Groot and Scholvinck (2017: 10) to state that ‘eating is the new shopping’ at airports. For example, at Amsterdam airport airside retail spend per departing passenger dropped from €16.69 in 2012 to €13.65 in 2016, but for airside F&B it increased from €3.83 to €4.32. This is partly in reaction to the airline trend to serve less free F&B on board but also because the F&B offering is becoming more sophisticated and responsive to passenger needs. To achieve growth airports are looking at consumer trends and lifestyle choices in selecting the correct mix of types of F&B and in deciding which factors such as fast and convenient, local, fresh, authentic, healthy, globally-branded, exclusive or good value are most important. Some have followed general trends by introducing celebrity chef bars and restaurant products. Moreover, Assies (2014), amongst others, has argued that a growing number of consumers do not trust brands, leading to airports increasingly partnering with local brands to lend the airport experience a sense of community and place. She cited examples of Chicago O’Hare and Amsterdam airports, which have both opened restaurants that are sourced by local gardens.

Lifestyle trends are also being influential in encouraging more health/fitness treatments and personnel/pampering airport services, including manicures, pedicures, massages and yoga rooms. Then there are sporting activities; for example, Minneapolis airport offers a golf range in the terminal. Health factors, in combination with changing retail regulations in certain countries, have also caused a dramatic decrease in tobacco sales and in addition organisations such as the European Travel Retail Council and the Asia-Pacific Travel Retail Association now have codes of conduct to ensure retailers and producers do not encourage excessive consumption or misuse of alcohol.

Another related concept, currently quite popular at airports, is the pop-up outlet. As discussed above, this has always been used to trial new products, but as argued by Secvik (2014) it can increase excitement within the airport experience by introducing fresh ideas and by producing 'artificial scarcity', especially if linked to a special event. Pop-up concepts can also be ideal for local small retailers or F&B operators to sell their products without much investment and can be effective in creating a marketplace environment. A relevant example here is Vienna airport's seaside pop-up market in 2017. This included market stalls and specialist F&B such as fresh juices, superfood specialities, hot dogs and ice cream. There were beach chairs and a maritime design theme, including an anchor weighing 50 kg, and a photo wall for vacation memories.

CASE STUDY 7.1
DAA AND AER RIANTA INTERNATIONAL – AN INTERNATIONAL AIRPORT RETAILER

DAA (formerly known as Aer Rianta) is an interesting example, as it was one of the first airport companies to expand beyond national boundaries and become involved with the management and operations of commercial facilities at other international airports. DAA is the Irish state-owned airport company that had been responsible for managing the country's three major airports, Dublin, Shannon and Cork, since 1937 (until Shannon became a separate company in 2013). It has a long history with the provision of commercial facilities, as the world's first duty-free shop was opened at Shannon airport in 1947. It continues to operate its own duty-free shops at its own two airports.

In 1988, ARI was set up as a wholly owned subsidiary of Aer Rianta. With the population of Ireland being less than four million people, Aer Rianta recognised the limits of its own market and aimed to use ARI to promote commercial activities in locations outside Ireland. The first undertaking was a joint venture company, Aerofist, with Aeroflot Russia, the Moscow airport authority and ARI each having a one-third interest in the company. Aer Rianta had originally developed links with the Soviet Union in the early 1970s with an agreement whereby Aeroflot would trade airport charges for fuel at Shannon airport. In 1988, Aerofist opened the first duty-free shop at Moscow airport. It also began offering in-flight duty-free sales on international flights operated by Aeroflot out of Moscow. In the next few years, joint venture companies with ARI involvement were also set up to manage duty-free shops at St Petersburg and Kiev airports as well as downtown shops in Moscow and two shops, now closed, on the Russia–Finland border.

In 1991, ARI expanded its involvement into the Middle East area with the setting up of a joint venture company with local investors in Bahrain to be responsible for designing the duty-free shops, overseeing their fitting out and their day-to-day management. ARI further expanded operations in this region by getting involved in the management of the duty-free shops at Karachi airport in 1992 and at Kuwait airport in 1994. In 1997, other new duty-free shop contracts were awarded in Beirut, Qatar (in-flight F&B for Qatar airways), Damascus and Egypt. In Europe, ARI's first retail operation outside Ireland in Europe was at the terminals of the Channel tunnel. The organisation provided duty-free facilities from the tunnel opening in 1994 until the abolition of duty-free sales in 1999. In addition, ARI opened two shops in Cyprus in the late 1990s – one at Larnaca airport in 1997 and one in Paphos in 1998.

In 1998, ARI expanded into North America for the first time by acquiring the duty-free division of Canada's United Cigar Stores and the concession for duty-free shops at Montreal, Winnipeg, Edmonton and Ottawa airports. In 2002, ARI took over the duty-free concession at Halifax airport as well. In 2007, it expanded into the Caribbean with a contract at Bridgetown airport in Barbados. ARI has continued to expand and now has involvement at around 15 airports, employing in the region of 3,500 staff with turnover in excess of US$1 billion (Table 7.5). It has also maintained a 20 per share of ownership of Dusseldorf airport since 1997. Many of the duty-free outlets operate under the brand name 'The Loop Duty Free'. More recent developments include its involvement, starting in 2010, with DDFS (Delhi Duty Free Services), a joint venture with DIAL and IDFS (Indian Duty Free Services) – although IDFS has subsequently pulled out. This is now the single largest duty-free retailer in India. Then in 2015, ARI opened its first shops in New Zealand at Auckland airport and in 2017 it was awarded a contract at another Canadian airport, namely Quebec City. It will also provide duty-free shops in the new Midfield terminal at Abu Dhabi airport and at the new Muscat airport, which are due to open very shortly.

Table 7.5 Aer Rianta International's involvement in international retailing activities, 2017

Country	Location
Ireland	Dublin airport
	Cork airport
Cyprus	Larnaca airport
	Paphos airport
Bahrain	Mahama airport

Country	Location
Lebanon	Beirut airport
Oman	Muscat airport
UAE	Abu Dhabi airport
India	Delhi airport
New Zealand	Auckland airport
Canada	Montreal airports
	Winnipeg airport
	Halifax airport
	Quebec City airport
Barbados	Bridgetown airport

CASE STUDY 7.2
DUBAI AIRPORTS – NON-AERONAUTICAL STRATEGIES FOR A COMPETING AIRPORT

Many of the Gulf airports are in fierce competition for transfer traffic. They are very interesting airports as regards non-aeronautical strategies, as they probably have done more than any other airport in the world to attract passengers by promoting the duty-free facilities on offer. Dubai International airport is the world's largest airport in terms of international traffic, and ranked third in terms of total passengers in 2016 with just under 84 million passengers. This compares with 51 million passengers in 2011 and just 4.5 million in 1989. It works closely with the national airline, Emirates Airline, which is based at the airport. The airport serves Dubai, which has become the major trading and tourism base of the Gulf region as well as being used as a transfer stop for intercontinental services. The second newer Dubai World Central (Al Maktoum International) airport opened in 2010 for cargo operations and 2013 for passenger operations, handling 850,000 passengers in 2016. However, it is planned to ultimately have a capacity of 160 million passengers.

The airports are government-owned, as is the duty-free shop operator Dubai Duty Free (DDF), and DDF works very closely with the airport management. The first DDF shop was established in December 1983 and then, in 1987, arrival duty-free shopping was added. DDF recorded first-year sales of US$20 million but it is now one of the biggest travel retail operators in the world with sales turnover of US$1.85 billion in 2016 and with nearly 6,000 employees. It currently operates some 36,000 m^2 of retail space at Dubai International airport and 2,500 m^2 at Al Maktoum International. In addition to its retail operation, DDF operates a Leisure Division which includes The Irish Village, Century Village, Dubai Duty Free Tennis Stadium and The Jumeirah Creekside Hotel.

As with Emirates Airline, sponsorship and the support of international events has always been an integral part of DDF's marketing strategy. Key events include the Dubai Duty Free Tennis Championships, the Dubai Duty Free Irish Open and the Dubai Duty Free Irish Derby. In 2016 it also began partnering with Emirates Airlines' loyalty programme (Emirates Skywards) that enables the airlines passengers to spend their points in DDF shops. Similar to an increasing number of other airport retailers, it now has a dedicated 'Web Shop' for picking up items reserved on the DDF online service.

An interesting development occurred in November 1989 when DDF launched its 'Dubai Duty Free Finest Surprise' to mark the expansion of its shopping complex. This promotion offered a Rolls-Royce or Bentley Mulsanne car to the winner of a raffle, and has remained ever since with a continuous high-profile display of luxury cars in the airport concourse. The tickets, sold exclusively at the airport or online, were US$139 in 2017 and are limited to 1,300 per draw. In excess of 1,000 travellers have won luxury cars. Other competing airports in the Middle East, including Abu Dhabi and Bahrain, have undertaken similar promotions. There is also a motorbike promotion which was introduced in 2002 with a cheaper ticket of US$28. Also in 2000, a new duty-free area was opened at the airport, and to commemorate this and the millennium the airport launched another promotion, the 'Dubai Duty Free Finest Cyber Surprise'. This promotion offered US$1 million to winners of the 'Millennium Millionaire Draw'. Originally, this was planned as a one-off event, but it has now become an ongoing promotion with over 239 passengers having been made millionaires.

References

ACI (2016) *Does Passenger Satisfaction increase Airport Non-aeronautical Revenues?* Montreal: ACI.

ACI (2017) *Airport Economics 2017 Report*, Montreal: ACI.

ACI Europe (2015) *Digital Report 2014–2015*, Brussels: ACI Europe.

ACI North America (2017) *2016 ACI NA Concessions Benchmarking Survey Summary Results,* Washington, DC: ACI NA.

Agbebi, Y. (2005) 'How do traffic structure and leisure preferences drive airport retail and investment strategies?', *Hamburg Aviation Conference*, Hamburg, February.

Airline Business (2016) *IT Trends Airports*, December: 34–39.

Armstrong, Scout Marketing Group and Lynxs Group (2011) *ACRP Report 47: Guidebook for Developing and Leasing Airport Property,* Washington, DC: Transportation Research Board.

Assies, H. (2014) 'Local heroes on the move: How a growing number of local brands are gaining presence at airports', *Journal of Airport Management*, 8(4): 305–07.

Belardini, A. (2013) 'Growing retail revenues at airports', *Journal of Airport Management* 7(3): 222–30.

CAA (2015) *CAA Passenger Survey Report 2014: A Survey of Passengers at Birmingham, Doncaster, East Midlands, Gatwick, Heathrow, Leeds Bradford, Liverpool, London City, Luton, Manchester and Stansted*, London: Civil Aviation Authority.

Castillo-Manzano, J. (2010) 'Determinants of commercial revenues at airports: Lessons learned from Spanish regional airports', *Tourism Management*, 31(6): 788–96.

Chung, Y.-S. (2015) 'Hedonic and utilitarian shopping values in airport shopping behaviour', *Journal of Air Transport Management*, 49: 28–34.

Chung, Y.-S., Wu, C.-L. and Chiang, W.-E. (2013) 'Air passengers' shopping motivation and information seeking behaviour', *Journal of Air Transport Management*, 27: 25–28.

Crawford, G. and Melewar, T. (2003) 'The importance of impulse purchasing behaviour in the international airport environment', *Journal of Consumer Behaviour*, 3(1): 85–98.

DKMA (2014) Passenger Satisfaction: The Key to Growing Non-Aeronautical Revenue. Online. Available at http://www.dkma.com/en/images/downloads/commercial/Passenger%20satisfaction%20-%20the%20key%20to%20growing%20non-aeronautical%20revenue.pdf (accessed 4 July 2017).

Echevarne, R. (2008) 'The impact of attracting low cost carriers to airports', in Graham, A., Papatheodorou, A. and Forsyth, P. (eds), *Aviation and Tourism: Implications for Leisure Travel*, Farnham: Ashgate.

Fraport (2017) *Visual Fact Book 2016*, Frankfurt: Fraport.

Freathy, P. and O'Connell, F. (1998) *European Airport Retailing*. London: Macmillan.

Freathy, P, and O'Connell, F. (2012) 'Spending time, spending money: passenger segmentation in an international airport', *The International Review of Retail, Distribution and Consumer Research,* 22(4): 397–416.

Fuerst, F., Gross, S. and Klose, U. (2011) 'The sky the limit? The determinants and constraints of European airports commercial revenues', *Journal of Air Transport Management*, 17(5): 278–83.

Geuens, M., Vantomme, D. and Brengman, M. (2004) 'Developing a typology of airport shoppers', *Tourism Management*, 25(5): 615–22.

Gillen, D. and Lall, A. (2004) 'Competitive advantage of low-cost carriers: some implications for airports', *Journal of Air Transport Management*, 10(1): 41–50.

Graham, A. (2009) 'How important are commercial revenues to today's airports?', *Journal of Air Transport Management*, 15(3): 106–11.

Graham, A. and Dennis, N. (2007) 'Airport traffic and financial performance: A UK and Ireland case study', *Journal of Transport Geography*, 15(3): 161–71.

Griffiths, S. (2014) 'The future of airports: Capitalising on mobile devices to enhance the traveller experience and to maximise retail opportunities', *Journal of Airport Management*, 8(4): 312–17.

Groot, M. and Scholvinck, J. (2017) 'Trends in airport non-aviation business', *International Airport Business*, May: 9–12.

Halpern, N., Graham, A. and Davidson, R. (2011) 'Meeting facilities at airports', *Journal of Air Transport Management*, 18(1): 54–58.

Institute of Retail Studies (1997) *Airport Retail Economics,* Stirling: University of Stirling.

Jane's Airport Review (2007) 'Duty-free industry fears security restrictions pose risk to revenues', *Jane's Airport Review*, May: 4.

Keefe, J. (2014) 'What are the key considerations for an airport in implementing a direct channel for car park and ancillary pre-booking, and what are the potential resulting incremental revenue benefits?', *Journal of Airport Management,* 8(4): 327–33.

Lei, Z. and Papatheodorou, A. (2010) 'Measuring the effect of low-cost carriers on regional airports' commercial revenue', *Research in Transportation Economics*, 26(1): 37–43.

LeighFisher (2012) *ACRP Report 54: Resource Manual for Airport In-Terminal Concessions,* Washington, DC: Transportation Research Board.

LeighFisher (2017) *UK Airport Performance Indicators 2015/2016*, London: LeighFisher.

Lin, Y.-H. and Chen, C.-F. (2013) 'Passengers' shopping motivations and commercial activities at airports: the moderating effects of time pressure and impulse buying tendency', *Tourism Management*, 36: 426–34.

Madeira, C. (2011) 'Building retail practices for the New Lisbon airport', *Journal of Airport Management*, 6(1): 40–50.

Maiden, S. (2000) 'Getting to know the market at airports', *University of Westminster Marketing and Market Research Seminar*, London, December.

Martel, F. (2009) 'External factors and their impact on non-aeronautical revenues', *Journal of Airport Management*, 3(4): 337–44.

Martens, H. (2012) 'How to win back markets', *ACI Economics and Finance Conference*, London, March.

Moodie, M. (2014) Macau Airport Duty Free Concessions attract Packed Pre-bid Meeting, 30 April. Online. Available at https://www.moodiedavittreport.com/macau-airport-duty-free-concessions-attract-packed-pre-bid-meeting/ (accessed 5 July 2017).

Moodie Research and the SAP Group (2015) *The Airport Commercial Revenues Study 2015*, Brentford: Moodie Report.

Pagliari, R. (2017) 'Managing Airport Commercial Activities', *University of Westminster Finance and Strategy Course,* London, February.

Perng, S.-W., Chow, C.C. and Liao, W.-C. (2010) 'Analysis of shopping preference and satisfaction with airport retailing products', *Journal of Air Transport Management*, 16(5): 279–83.

Petro, A. (2017) 'Research airport parking: A creative parking product to enhance revenue and improve service', *Journal of Airport Management*, 11(2): 129–35.

Sevcik, T. (2014) 'The end of retail, the future of retail', *Journal of Airport Management*, 8(4): 308–11.

Steer Davies Gleave (2017) *Heathrow Airport – Review of Commercial Revenues*, London: SDG.

Torres, E., Dominguez, J., Valdes, L. and Aza, R. (2005) 'Passenger waiting time in an airport and expenditure carried out in the commercial area', *Journal of Air Transport Management*, 11(6): 363–67.

Unison Consulting (2016) *Final Report Los Angeles International Airport 2015 Air Passenger Survey Results and Findings*, Los Angeles: Unison Consulting.

8 Airport competition and the role of marketing

In the early stages of the development of the airport industry, it used to be commonly believed that most major airports were monopolies with significant market power, with their precise role being determined by the passenger demand in the catchment area. Airline choice was considered to be limited to particular airports because of government bilateral agreements. While this may still be true in a few limited markets, there are now many opportunities for airports to compete for passengers, freight and airlines. The modern-day airline industry, which has been transformed in many places from a regulated and public sector-controlled activity into a liberalised and commercially orientated business, has played a major role in this changing airport situation. Certain airline developments, including the formation of global alliances and the emergence of the low-cost sector, have been particularly important in creating new views on airport competition.

Airport competition is a complex area because there are many different aspects that need to be considered (Graham, 2006; Forsyth *et al.*, 2010). There is the competition between airports and competition within airport groups. Then there is the competition inside airports, including the competition for the provision of a certain service or competition between airport terminals. This chapter begins by discussing all of these. They have major consequences for many key areas of the airport business, including pricing and quality management, which are considered elsewhere in this book. However, one other very important issue related to competition that has yet to be covered is the role of marketing, which is investigated in the second part of this chapter.

Airport competition

Competition between airports

There are a number of main ways in which airports can compete. If airports are physically close, their catchment areas may overlap for certain types of traffic. For short-haul routes, passengers tend to choose the most convenient, nearest airport that has suitable services. For long-haul flights, passengers may be more willing to travel further distances to an airport that they regard as offering a more desirable or superior long-haul service. However, if airports are located on small islands or in remote regions, there will be very little competition.

There are many regional airport examples where catchment areas overlap and the airports compete. Typically, such airports will be publicly owned which can lead to overinvestment resulting in overcapacity, because the objectives for airport expansion can be political or driven by economic development reasons, rather than just steered by commercial or financial considerations. Japan is one such example where there are over 100 airports in total. If such regional airports are relatively free to compete, as they are for instance in Europe, this can produce a very challenging situation for the airport operators, as they struggle to cope with underutilised facilities, a small critical traffic mass for their non-aeronautical facilities and downward pressure on their aeronautical charges from their airline customers who can play one airport off with another.

In some major urban areas or cities there are also a number of situations when more than one airport serves the population. Notable examples are the European cities of London and Paris and the American cities of New York and Washington. Sometimes the airports may be under the same ownership, as with AdP, which owns Paris CDG, Orly and Le Bourget airports; and the Port Authority of New York and New Jersey, which owns JFK, La Guardia and Newark airports. Such common ownership arguably may reduce the amount of potential competition. Elsewhere, in London for instance, there are five airports that compete to a certain degree, namely Heathrow, Gatwick, Stansted, London City and Luton airports, although this has not always been the situation (see Case Study 8.1). In Washington, the Metropolitan Washington Airports Authority airports of Dulles and National compete to some extent with Baltimore airport, which is owned by the State of Maryland. The San Francisco bay area also has three airports that compete for domestic traffic. Other examples where neighbouring could potentially compete for traffic include Moscow (Domodedovo and Sheremetyevo) and Shanghai (Pudong and Hongqiao).

Often when there is more than one airport serving a major city or urban area, this is called a multi-airport system (MAS). Bonnefoy *et al.* (2008) identified 59 MASs worldwide, observing that the comparative number in each global region reflected the relative maturity of air transport. They listed 25 in Europe, 18 in North America and fewer in Asia-Pacific (8), Latin America (5) and Middle East (3) – although this may have changed slightly in recent years with the steady traffic growth in these latter three regions. The most frequent type of MAS is composed of a primary and a secondary airport (e.g. Chicago, Frankfurt and Melbourne) but there are also cases of two primary airports (e.g. Miami and Shanghai). The London and New York MASs were identified as some of the most complex.

In many cases where there are overlapping catchment areas, one airport tends to become the dominant player in a preferred location with the other airports playing a more secondary role. In the London area, for example, Heathrow airport is considered by many passengers, particularly those travelling on business, to be *the* 'London airport' in spite of a range of services being offered at the other London airports. The secondary airports tend to fulfil more specialised roles. They may act as overspill airports when the major airport has inadequate capacity, as has happened to a certain extent in London when airlines that cannot get into Heathrow go to Gatwick or Stansted instead. Alternatively, centrally located secondary airports may be able to attract a certain amount of domestic or short-haul traffic, particularly business-related traffic. These types of passenger favour the convenience and generally less congested environment that a city centre airport such as London City may offer.

Then there are the airports that market themselves as low-cost alternatives to the major airports – having been encouraged by the rapid development of European LCCs (Table 8.1). Particularly in the first few years of the twenty-first century, some of these alternative airports had a significant impact on the market share of the nearby major airports. For example, between 2002 and 2010 the total market share of Milan Linate and Malpensa airports with the alternative airport Bergamo reduced by 17 per cent. Likewise, at Stockholm's Arlanda and Bromma airports with the nearby alternatives Skavsta and Vasteras, the market share dropped by 22 per cent, and at Oslo Gardermoen with Sanderfjord and Moss as alternatives it fell by 8 per cent (Thelle *et al.*, 2012). In North America there are also a number of secondary airports primarily serving LCC traffic such as Providence and Manchester (Boston), Burbank and Ontario (Los Angeles), Sanford (Orlando), Atlantic City (Philadelphia) and Hamilton (Toronto). Elsewhere there are similar airports, including Avalon as an alternative for Melbourne and Clark for Manila, although this use of secondary airports is not so widespread in other areas.

In general, as discussed in Chapter 5, these alternative airports offer faster turnarounds, short walking distances from the terminal to the aircraft, and fewer delays, all vital elements of the low-cost model. They are also usually in a position to be more flexible on

Table 8.1 Examples of alternative secondary airports traditionally used by LCCs within Europe

Low-cost airports	Competing major airports	Under same ownership?
Beauvais	Paris – CDG and Orly	No
Bergamo	Milan – Linate and Malpensa	Yes
Charleroi	Brussels National	No
Girona and Reus	Barcelona	Yes
Hahn	Frankfurt	No
Prestwick	Glasgow International	No
Rome Ciampino	Rome Fiumicino	Yes
Sandefjord	Oslo Gardermoen	No
Skavsta	Stockholm Arlanda	No
Weeze	Dusseldorf	No

pricing and maybe to enter into long-term pricing agreements if desired by the low-cost carriers. In many cases, they are situated substantially further from the town or city they are serving compared with the competing airports. Sometimes, these airports may be owned by the same operator that has control of the competing airports; for example, AENA owns Barcelona, Girona and Reus; and Aeroporti di Roma owns both Fiumicino and Ciampino. Elsewhere, separate ownership patterns exist. Some low-cost airlines, including Ryanair, have even argued for competing terminals at airports run by different operators, especially at Dublin.

However, as also discussed in Chapter 5, a number of carriers such as Ryanair have been moving away from secondary airports and into the primary ones (Dobruszkes *et al.,* 2017). Ryanair moved into Barcelona airport in 2010, Brussels airport in 2014 and Frankfurt airport in 2017. This has been driven by a number of factors such as greater airport convenience for passengers (especially those for business), a pricing premium, a desire to compete with network carriers or feed or code-share, the use of larger aircraft and the maturing of demand. This has had a major impact on the competition between the primary and secondary airports, and indeed challenges the viability of some of the secondary airports.

Another different problem can arise when a new airport is built and is perceived as providing an inferior service to the old one, often by being in a less conveniently situated location. A notable, much quoted example is Montreal–Mirabel airport, which was built in the 1970s to provide extra capacity in addition to Dorval airport, but never managed to attract the volume of traffic that was forecast. Other examples include Tokyo: Haneda/Narita (1978), Osaka – Itami/Kansai (1994), Milan – Linate/Malpensa (1998), Seoul – Gimpo/Incheon (2001) and Bangkok – Don Mueang/Suvarnabhumi (2006). Sometimes the original airport just handles domestic/short-haul traffic or has become an LCC airport (e.g. in the United States with Chicago Midway, Dallas Love Field, and Houston Hobby airports, and Don Mueang in Bangkok). It will often be difficult to encourage the airlines to switch unless they are legally required to move, especially as convenient connectivity may also be lost if transfer passengers are forced to move from one airport to the other. As a result, the role of a number of the original airports that stayed open has now changed from being solely domestic airports, for instance Gimpo in Seoul and Haneda airports now serve some international routes as well. The alternative solution is to close down the original airport, with examples including Munich (1992), Denver (1995), Hong Kong (1998), Oslo (1998), Athens (2001) and Doha (2014). It is also planned with the new airport in Istanbul that Istanbul Ataturk will close. In these cases there will be no new opportunities for competition and in fact such development may hinder competition, for instance in Athens where it was agreed that no additional airport development within the same catchment area of the new airport was allowed.

Competition tends to be weakest at airports that have a high concentration of both short-haul and long-haul services. These airports appeal mostly to the traditional scheduled carriers who have networked services. In these cases it is difficult for other airports to provide effective competition. This is unless the airport is competing as a hub by providing good flight connectivity and efficient passenger transfers. Key prerequisites for a hub are a central geographical position and adequate runway/terminal capacity to enable a 'wave' system of arriving and departing flights to take place. Certain airports can compete as hubs for cargo operations, especially for express parcel services, and particularly if they are open all night and have a good weather record. Ultimately, all hub airports are, however, very dependent on the operating strategies of airlines. While many medium- and large-sized airports have aspirations to become a hub, in reality there is now less opportunity for this to happen as a result of the growing concentration within the airline industry through developments including global alliances, joint ventures and code-sharing. Within Europe, airports such as London Heathrow, Paris CDG, Frankfurt and Amsterdam have traditionally competed as transfer airports, but arguably this list of competitors should now be extended to include airports such as Istanbul Ataturk and those in the Middle East. In Asia, there are also a number of notable primary airport hubs such as Seoul Incheon, Hong Kong and Singapore, and there are major cargo hubs as well, such as Hong Kong.

Some of the smaller secondary hubs have actually experienced 'de-hubbing'. This may be due to a number of factors such as airline bankruptcy, downsizing, restructuring or consolidation. Examples within Europe include abandoning multiple hub policies (British Airways at Gatwick in 2000 and Birmingham in 2003; Iberia at Barcelona in 2003), airline bankruptcies (Swissair at Zurich in 2001; Sabena at Brussels in 2001; Malev at Budapest in 2012) and major airline company changes (Alitalia at Milan Malpensa in 2008; Olympic at Athens in 2009). Such airports have then faced significant challenges as to whether to focus purely on point-to-point traffic or provide feeder services to a hub, welcome new traffic such as LCCs or encourage other developments such as self-connection (see Chapter 5). However, in a study of 37 airports that had suffered de-hubbing, Redondi *et al.* (2012) found that these airports had recovered their original traffic after five years. When LCCs moved to the airport, the traffic recovered faster than the trend, a prime example being at Budapest after the failure of Malev (Bilotkach *et al.*, 2014).

In most cases, passengers will have a specific destination in mind when they travel and there will be just one airport providing access to a distinct destination, such as Alice Springs, Sharm El Sheihk or Las Vegas. However, in other cases, there may be more than one airport serving a major tourist attraction such as Barcelona (Barcelona, Girona or Reus) or Venice (Marco Polo or Treviso), resulting in much stronger competitive forces. Moreover, there is sometimes the case with intercontinental traffic when passengers might be more indifferent to their first destination. For example, Americans visiting Europe may not have a strong preference as to whether they start their European tour from Paris, London or Frankfurt. Airports serving these cities can therefore compete for this traffic. The same can be true with cargo traffic, as ultimately all that is important here is that this gets to the final destination. This is particularly relevant within Europe, where most long-haul freight is trucked to its final destination. A somewhat similar passenger example in North America is airports that compete as embarkation points for cruise holidays.

When an airport's relative competitiveness is being assessed, the substitution possibilities need to be considered. First, the prospect of new competing airports emerging has to be investigated. This is generally low because of the large investment that is needed for the new infrastructure and because of the long and complex planning and regulatory processes that frequently have to be followed in order for approval of any new development to be given. In many areas of the world it is increasingly difficult to find suitable locations for new competing sites, although in some regions, including Europe, the existence of a number of military airfields (e.g. Finningley – Doncaster, Hahn – Frankfurt, Bergamo – Milan, Weeze – Dusseldorf) have provided some opportunities for airport development in recent years. In addition, barriers to entry for new airports may also be high because of the existence of cost economies of scale, although, as discussed in Chapter 3, arguably these may disappear once the airport reaches a certain size.

At a broader level, the amount of substitution from other transport modes needs to be considered. High-speed rail is probably the greatest threat (Dobruszkes *et al.*, 2014; Castillo-Manzano *et al.*, 2015). For regional airports, the introduction of high-speed rail services can have a significant impact on air services to major airports. However, at major capacity-constrained airports, increased usage of high-speed rail for short-haul trips may free up capacity for other long-haul services – although this may have a detrimental impact on the airport's ability to act as a hub and attract transfer passengers. Improvements to the road and rail infrastructure to major airports may also reduce the necessity for feeder services from regional airports. So rail travel can potentially raise both competition and cooperation issues for airports (Albalate *et al.,* 2015).

The amount of substitution that exists depends on the type of traffic that is being served. For example, as discussed in Chapter 4, different types of airline have varying degrees of sensitivity to price. Airport charges can be substantially more important for short-haul operations as they are levied more frequently. For low-cost and charter operations they can be even more significant because these airlines will have minimised many of the other airline costs. In these cases, airport price competition can be very real, particularly if additional pricing incentives (discussed below) are offered. There are numerous examples of LCCs cutting services or abandoning airports entirely, giving high airport costs as the only reason, or one of the key reasons, for this action. Such 'route churn' depends on the specific LCC (De Wit and Zuidberg, 2016). A movement to primary airports as discussed above is another factor. Indeed, in a worldwide study of base abandonments by LCCs between 1997 and 2014, there were 109 cases (out of 813 airport-LCC pairs) where the LCCs had decreased their presence by at least 50 per cent in terms of offered seats, and in 28 cases the LCCs had completely abandoned the airports (Malighetti *et al.*, 2016). As regards passengers, those on leisure trips are the most likely to be willing to shift between origin airports because of airline price or product differences. Those on holiday may even have a choice of destination and hence a choice of airport, whereas those travelling for business or visiting friends and relatives (VFR) will probably be more limited in their ability or desire to shift destination airports.

When the Productivity Commission in Australia last reviewed the price-monitoring process, it considered these three substitution issues (airport, modal and destination). By way of illustration, these findings are summarised in Table 8.2, even though they are slightly dated now. The substitution possibilities generally seemed low, with the exception of Canberra airport because of surface transport competition, and Darwin which competes with other airports for holiday passengers. An additional element for the airport operator that is not covered here is the competition for commercial facilities. Some airports with a large share of transfer traffic, including Dubai and Singapore, may compete directly with their retail offering. While airports have the advantage of a captive and often fairly affluent passenger market, the substitution possibilities with high street and online shopping are quite considerable.

As discussed in Chapter 4, price regulation has traditionally been introduced when competition is not considered strong enough to deter airports from abusing their position of market power. This is most relevant for large city airports, as smaller regional airports, especially in high population-density countries, will tend to have overlapping catchment areas and be in a sufficiently competitive environment so as to not need regulatory intervention. One of the key issues, however, is determining that airports have SMP. It cannot simply be related to airport size, but also has to take account of competitive factors including market share, pricing, quality of service, capacity provision and substitutions possibilities.

Whilst this has been frequently discussed in theory, there has been very limited developed application using empirical evidence – two notable exceptions being Bilotkach and Mueller (2012) who considered the market power of Amsterdam, and Polk and Bilotkach (2013) who assessed the market power of hub airports. Moreover, there is no consensus of view concerning an appropriate detailed methodology for measuring this, which led Maertens (2012) to develop a common approach that he used on a wide range of European airports. Even in countries where more detailed market power analysis has been undertaken, such as in the UK, considerable areas of disagreement remain. For example, parallel analyses undertaken in 2007–08 by the CAA and Department for Transport resulted in the former concluding that Stansted did not possess significant market power and the latter reaching the opposite conclusion (see Case Study 8.1).

In spite of the degree of competition varying between different types of airports as a result of a complicated mix of factors related to issues such as market share, pricing, quality of service, capacity provision and substitution possibilities, there is a broad consensus that the competitive forces have increased, particular in areas such as Europe (Lieshout *et al.,* 2016). Indeed Thelle *et al.* (2012) found that in Europe airlines had become more footloose, being able and willing to switch away from airports if the conditions were not right. They found that many routes were opening and closing as the result of the high degree of switching taking place with the airlines. For example, in 2011 around 2,500 new routes were opened, whereas 2,000 were closed and every year around 20 per cent of the total routes were openings and 15 per cent were closures. The authors also found that passengers had more choice and there was more than one airport accessible for nearly two thirds of Europeans within a two-hour drive. The evidence suggested there was increasing choice for both local departing and transfer passengers. Similar arguments have been presented by Thelle and la Cour Sonne (2018).

However, a counter-study to the original report (which was prepared for ACI Europe) was published by IATA (2013) that argued that network airlines had limited switching ability

Table 8.2 Substitution possibilities at Australian airports

Airport	Main market segments (per cent)			Substitution possibilities		
	Holiday	VFR*	Business	Airport	Modal	Destination
Adelaide	23	27	44	Low with no nearby airports	Low for business travellers but some for VFR and holiday travel	Relatively low as mostly business and VFR traffic
Brisbane	22	28	44	Moderate with both the Gold Coast and Maroochydore airports nearby	Low for business travellers but some for VFR and holiday travel	Relatively low as mostly business and VFR traffic
Canberra	17	18	59	Low with no nearby airports	High as three-quarters of visitors to Canberra arrive by car and go by surface to Sydney then fly to a holiday destinations	Relatively low as mostly business and VFR traffic
Darwin	40	23	33	Various by market segment: low for visits to the 'top end' but higher for those visiting several areas within the Territory	Low for business travellers but significant for holiday travel	High as mostly holiday traffic can choose to go to other tourist destinations

Airport	Main market segments (per cent)			Substitution possibilities		
	Holiday	VFR*	Business	Airport	Modal	Destination
Melbourne	33	24	40	Generally low but Avalon airport used by LCCs for some of its flights	Low for business travellers but some for VFR and holiday travel	Relatively low as mostly business and VFR traffic
Perth	24	26	45	Low with no nearby airports	Low as Perth is relatively isolated	Relatively low as mostly business and VFR traffic
Sydney	26	25	45	Low with no nearby airports	Low for business travellers but some for VFR and holiday travel	Relatively low as mostly business and VFR traffic

*VFR, visiting friends and relatives.

Source: Adapted from Productivity Commission (2011) compared to point-to-point traffic, which it claimed had been overlooked in the previous research. In a further response by ACI Europe (2014a), it was contended that European airports would become increasingly reliant on O&D traffic for future growth. Moreover, IATA (2013) argued that passengers strongly prefer to use their closest airport rather than to exercise the choice available to them. It therefore reasoned that this limited the extent of airport competition for origin–destination passengers, although this point was refuted in the response of ACI Europe (2014a). Wiltshire (2018) from IATA reiterates some of the airlines' key concerns. In 2017, a further competition report was prepared for ACI Europe (Oxera, 2017). It concluded that the competitive landscape of the European aviation market was evolving rapidly, and competition between airports was widespread and increasing. In essence, this lively debate between these two leading industry bodies indicates the complex nature of airport competition and the existence of quite divergent views in some areas.

CASE STUDY 8.1
THE UK SITUATION

The UK is an interesting case to consider as regards airport competition. BAA was privatised as a single entity in 1987, but this remained a controversial issue. At the time of the privatisation of BAA, the arguments in favour of the retention of this single airport group, as opposed to separation, included the existence of very limited competitive pressures because of product diversity at the airports and the dominance of Heathrow; the small effect of airport charges on airline costs; economies of scale in airport operations; less uncertainty and a higher share price; and less risk of under-investment with an overall investment strategy. It was claimed that group ownership was needed to enforce the government's traffic distribution rules which redirected traffic from congested Heathrow to elsewhere, and to fund investment at Stansted airport. Opponents, however, argued that Gatwick and Stansted could compete for charter traffic, that the former was developing into a credible alternative airport to Heathrow, and that the group sale would give BAA much less incentive to provide any extra capacity than would have been the case with individual airport sales.

Since the privatisation of BAA, the UK airline regulatory environment has become progressively more liberal, providing more opportunities for airport competition. Consequently, there were various governmental reviews investigating whether BAA should be split up, but these generally concluded that the additional benefits of competition would be more than offset by the disbenefits of loss of economies of scale and fragmentation of financial strength together with the dispersion of expertise (Toms, 2004). Interestingly, however, this UK policy did not seem entirely consistent, as a few years after BAA privatisation, Belfast International airport wanted to buy the neighbouring Belfast City airport but was prohibited from doing so by the government as it was seen as anti-competitive. Then, in 2005, the owners of Bristol airport (Ferrovial/

Macquarie) were selected as preferred bidders for nearby Exeter airport, but pulled out when it was announced that there would be a detailed investigation to ensure this situation did not have a negative impact on competition in the region.

In 2006, the UK airports market was investigated again, this time by the Office of Fair Trading (OFT). By then BAA was just under new ownership and was coming under increasing criticism from both airlines and passengers regarding its responsiveness to customer needs. As a result the OFT inquiry concluded that the BAA group should be referred to the Competition Commission for more detailed investigation, as the OFT identified joint ownership as a factor that could be preventing, restricting or distorting competition. The Competition Commission reached its decision in 2009 (Competition Commission, 2009; Bush, 2009). Its main conclusion was that common ownership of airports in south-east England and lowland Scotland did give rise to adverse effects on competition in connection with the supply of airport services by BAA. However, it did also identify a number of other features that affect the competition, including Heathrow airport's position as the only significant hub airport in the south-east of the UK; aspects of the planning system and other areas of government policy; and the economic regulatory system for airports. It therefore concluded that Gatwick and Stansted airports should be sold to different airport operators as well as either Edinburgh or Glasgow. In 2009, BAA completed the sale of Gatwick airport that it had begun before the final outcome of the Competition Commission's inquiry was known. BAA subsequently undertook a number of appeals, but none overturned the Competition Commission's decision. As a result Edinburgh airport was sold in 2012 and the sale of Stansted airport was completed in 2013. Evidence shows an increase in competition (Competition and Markets Authority, 2016).

There have also been some interesting developments in terms of market power. In 2008, Stansted and Manchester were investigated by the government's Department for Transport with a view to possibly having the price control economic regulation for these two airports removed, having been suggested by the CAA after their own market power analysis. The criteria that were used in the UK for price-regulated airports was that they must possess SMP, that EU and domestic law would provide an insufficient tool to remedy any abuse, and that the incremental net benefits of regulation could be shown to outweigh its costs. In the Manchester case the department decided that the airport did not hold a position of SMP since local airports, including Liverpool airport, provided a meaningful substitute; there was spare capacity at Manchester and competing airports; the market share of Manchester was declining; high service quality was provided at Manchester; the airport and the airlines effectively and constructively engaged with one another; and finally pricing and quality of service decisions appeared to have been determined more by competitive forces than by the price cap (Department for Transport, 2008a). For Stansted the department concluded that the airport already had SMP by virtue of BAA's common ownership and that it was likely to acquire more market power in the future (Department for Transport, 2008b). As a result, the government decided to remove the price control for Manchester, but not for Stansted.

For the new economic regulatory system based on licences, which was introduced in 2014, there is a similar three-part market power test (CAA, 2014a: 17):

- Test A: the relevant operator has, or is likely to acquire, SMP in a market, either alone or taken with such other persons as the CAA considers appropriate;
- Test B: that competition law does not provide sufficient protection against the risk that the relevant operator may engage in conduct that amounts to an abuse of that SMP;
- Test C: that, for users of air transport services, the benefits of regulating the relevant operator by means of a licence are likely to outweigh the adverse effects.

The CAA's view was that competition at Heathrow airport was quite limited with the degree of market power being the strongest of all the three airports, Heathrow, Gatwick and Stansted. A key feature of the CAA's argument was that the scope for competition, particularly at Heathrow and Gatwick, was limited by capacity shortages. The CAA concluded that Gatwick had market power but less than at Heathrow. They argued that the diversity of airline requirements (low cost, full cost and charter) meant that it was difficult to make a 'one-size-fits-all' decision and that there could be particular benefits from the airport and airlines working more closely together which is why they supported a lighter-touch monitoring regulatory mechanism. For Stansted the CAA reached the conclusion (as regards the passenger market) that the airport did not have SMP and so from April 2014 the airport has not been economically regulated (CAA, 2014c). This decision was based with knowledge of the existence of spare capacity except at peak time, and evidence suggesting that the two main airlines (Ryanair and easyJet) had countervailing buyer power (CAA, 2014a, 2014b, 2014c).

Competition within airport groups

When airports are operated as a system or a group rather than individually, there is an important issue as to whether this inhibits competition (Forsyth, 2006). As discussed in Chapter 2, particularly when privatisation of groups takes place, decisions have to be made as to whether the group should be privatised in its entirety or split up. Arguments for keeping the group include the ability to share resources and expertise, reduce costs due to scale effects and adopt a strategic and coordinated approach to airport development. Financial cross-subsidisation can occur between airports which may help the airport operator but may not be popular with all users. On the other hand, it can be argued that not only does group ownership restrict competition but it may also hinder local management innovation.

In practice, experience varies. In Australia the government decided on individual privatisations for the major international airports and limitations on cross-ownership; in Argentina the airports were privatised as a group; and in Mexico the airports were divided into four different groups with a mixture of small and large airports in each group. Meanwhile, with the Brazilian airport privatisations, during the first round of biddings in 2012, no company could be awarded more than one concession. Moreover, the bidding rules of the second round (in 2013) stated that organisations responsible for operating one of the airports granted in the first round could not hold more than a 15 per cent stake in a consortium bidding for an airport in the second round. These restrictions were designed to foster more intense competition among different airports (Neto *et al.*, 2016). While issues related to competition and airport groups especially tend to be raised when airport privatisation is taking place, clearly it is an ongoing issue that is relevant to both public and private airports alike. An interesting example of this as regards a public sector group is DAA (Case Study 8.3).

Competing facilities and terminals

As discussed in Chapter 3, many airport services, including ATC, security, ground handling and the provision of commercial facilities, can be provided either by the airport operator or by a third party. The way in which they are offered, and whether there are competing services, can have a major impact on an airport's competitive situation in both price and service quality terms. Competing services tend to be the most established in the commercial areas, including airport retail outlets, F&B, hotels and car parks. A major airport service for airlines is ground handling, and the issue of competition with the provision of handling services has always been controversial, as traditionally it has been quite common for the national airline or airport operator to have a monopoly or near-monopoly in providing these services. This resulted in the introduction in 1996 of the ground handling directive in Europe (see Chapter 4), but elsewhere the extent to which ground handling services are offered on a competitive basis varies from country to country.

Potentially, the greatest competition within airports could be achieved by having competing terminals under different ownership offering competition in terms of price and service quality. Varying quality standards and facilities could be offered to different services, including low-cost, short-haul, long-haul or business – although the more specialised the terminal, the less scope for competition with other terminals. However, strategic planning could be much more difficult with the lack of a single ownership, and economies of scale could be lost. In addition, coordinating the essential passenger processes could be more challenging – in particular, ensuring that there are clearly defined and allocated accountabilities for the delivery of security in the different terminals. Fundamentally, competing terminals might not always bring about the best use of capacity, which for many of today's airports is a crucial consideration as they have limited space to expand. There could also potentially be an anti-competitive issue if the airlines control the competing terminal and limit access to rival airlines.

There is only limited and insufficient industry evidence to conclude whether it is possible to have successfully competing airport terminals. In 1986, terminal 3 at Toronto airport was handed over to a private consortium to provide new investment. However, in 1996 it was bought back under the responsibility of the Greater Toronto Airport Authority to allow for the development of the airport master plan. Elsewhere, at Birmingham airport, the Eurohub terminal was at one stage operated separately, but has now been brought back under single management at the airport. In Brussels there were not competing terminals but the management of the airside and the terminal was split. However, in 1998 this dividing of management was reversed with the establishment of the Brussels International Airport Company. These cases suggest that the experience of competing terminals or split management was not too favourable. On the other hand, in the United States, and particularly at JFK airport in New York, there are permanent examples of different terminals being operated by airlines. Likewise in Australia, some of the domestic terminals have been run directly by the airlines. However, in these cases the situation is really more to do with allowing the airlines to operate their own facilities rather than aiming to provide greater competition. The country where competing terminals have probably been given the most consideration is Ireland, and this is discussed in greater detail below. Experience here has shown that attempts to introduce competition can also significantly lengthen the process of planning and constructing additional capacity.

During some of the regulatory reviews in the UK, the introduction of competing terminals has also been discussed. In 2003, the CAA concluded that the benefits of regulatory intervention to stimulate intra-airport competition were most likely to be outweighed by the operational and regulatory disbenefits. For the 2008–13 review, the issue was again considered and while some stakeholders, including the airlines at Stansted, very much favoured competition between terminals, there was no overall consensus of views and consequently this idea was again not developed any further (CAA, 2008). Subsequently this issue was explored again in the government review of airport economic regulation (Department for Transport, 2009). Some airlines, including easyJet, were in favour of moves towards terminal competition, and British Airways agreed that the option should be kept open. Others, including the airports, opposed the idea and overall there has been no further movement towards the introduction of competing terminals.

The birth of airport marketing

Having debated the extent of competition that exists at airports, this chapter now focuses on airport marketing. It needs to be acknowledged that airport marketing as a concept did not really exist at most airports until the 1980s. Prior to this, the role of the airport as a public service meant that very often airport management would merely respond to airline requests for new slots by providing published charging and use-of-facility information rather than initiating talks to attract new services. In most cases, the airports considered it was solely the role of the airline to identify opportunities for new or expanded services. It was up to the airport to provide an efficient and safe airport with good facilities for aircraft and travellers. Promoting the air services at the airport was also not considered to be a responsibility of the airport, the view being that this should be undertaken by the airlines and travel agents selling the products. It was rare to find airport marketing managers, and generally the resources allocated to marketing activities were very small. Airport promotion tended to be very basic, typically consisting of the production of a timetable and publicity leaflets, and reactive responses to press enquiries about the airport. In essence, even if there was some potential for competition between airports even at this early stage of the evolution of the airport industry, there were very few airports that recognised and exploited this.

This passive approach has long since gone at most airports. Airports have become much more proactive in their outlook and have developed a wide range of increasingly sophisticated techniques for meeting the demands of their complex mix of customers, including passengers, airlines, freight forwarders, tour operators and so on. Within any commercially run business, marketing is considered to be a core activity and one that is a vital ingredient for success. The airport sector is no longer an exception, and in most cases marketing is now seen as an integral part of the airport business.

Deregulation of air transport markets has made the airport business much more competitive. Airlines in Europe, for example, are much freer to operate out of any airport they choose without being constrained by bilateral restrictions. They are thus much more susceptible to aggressive marketing by airports. Many airports have actively sought to attract the new LCCs through a range of marketing techniques. The increase in demand for air transport due to deregulation and other more general factors, including economic growth, has meant there have been enhanced opportunities for more airports to share in this expansion of the market. This has provided airports with greater incentive to develop innovative and aggressive market strategies so that they can reap some of the benefits from this growth. A number of airports are close to capacity and unable to offer attractive slots for new services, which means there may be attractive prospects for other airports to promote themselves as alternative uncongested airports.

The travelling public have also become more demanding and more sophisticated in their travel-making decisions and their expectations of the airport product. Airports have had to develop more sophisticated marketing strategies and tactics to meet the needs of travellers and adopt contemporary approaches, including relationship marketing, e-marketing and social media marketing. In addition, deregulation, privatisation and globalisation trends within the airline industry have increased the commercial pressures being faced by airlines which, in turn, has encouraged airports to recognise the need for a professional marketing-oriented approach when dealing with their airline customers.

By the late 1990s, the majority of airports were devoting considerable resources to marketing activities. It is difficult accurately to quantify this increased emphasis on the role of marketing, but some indication of this trend can be gleaned from an analysis of staff employed in the marketing area. For UK regional airports the number of passengers per marketing staff decreased significantly between 1991 and 1997. For instance, the number of marketing staff at Manchester airport increased from 16 to 27, and at Birmingham airport from 10 to 24. This meant that the number of passengers per marketing staff decreased from 631,000 to 562,000 at Manchester and from 325,000 to 227,000 at Birmingham (Humphreys, 1999). Thelle *et al.* (2012) gave further examples. Marketing staff at Copenhagen airport increased from two full-time employees in 2000 to four in 2005 and eight in 2012, while expenditure on sales, marketing and administration at Zurich airport increased from CHF17.6 million in 1999 to CHF39.1 million in 2011. Along with increased industry activity in this area, there has also been a growing interest in airport marketing as an area of academic study. Kramer *et al.* (2010) provided a marketing guidebook for small airports; Jarach (2005) examined the new management vision of airport marketing; and Halpern and Graham (2013) applied principles of marketing within the airport industry by integrating key elements of marketing theory with airport marketing in practice.

If marketing is defined in its broadest sense of satisfying customer needs, there are various other activities (discussed in other chapters) that can also be considered as airport marketing. These activities include quality assessment and improvement, and environmental neighbourhood communication initiatives. In addition, the development of non-aeronautical activities can be treated as a marketing role. However, this chapter offers a narrower consideration of satisfying customer needs by assessing how general marketing concepts and techniques can be applied to the airport industry.

Marketing concepts

The market for airport services

The focal point of any marketing system is always the consumer of the services. For the airport product, demand comes from a variety of markets each with their own specific requirements. From a marketing perspective, it is useful to divide this demand into two: the trade, including airlines, who buy the airport facilities direct; and the general public or travellers who merely consume or utilise the airport product. The marketing techniques used for these two types are very different. Most airports would probably now agree that both airlines and passengers are key customers, whereas the traditional view, still held by some airlines, is to think of passengers as their customers and themselves as customers of the airports (Paternoster, 2012). Airlines are key drivers of the overall air travel business – unless they provide a suitable product, passengers and freight shippers will not be able to use a certain airport. Freathy and O'Connell (2000) discussed how airlines could be considered as primary customers with passengers as secondary customers, but argued that in practice this distinction is difficult to maintain because the boundaries of responsibility between airport operators and airlines are often obfuscated in the mind of the passenger.

As discussed in Chapter 7, passengers enable airports to generate significant amounts of non-aeronautical revenues which, in turn, can be used for airport operations and development. Therefore, one view is to consider modern airports as so-called two-sided businesses or markets, which offer services to both passengers and airlines (see Chapter 4). Such businesses provide platforms for two distinct customers who both gain from being networked through the platform. The positive interdependence means that airport operators will be incentivised to compete for airline traffic and passengers, as these will influence both their aeronautical and non-aeronautical revenues. If passengers stay away, this will affect the airlines, which might have to leave the airport; if airlines reduce or withdraw these services, this will reduce passenger numbers and consequently non-aeronautical sales.

In addition to passengers and airlines, a broader assessment of the airport market can include other segments, including local residents and businesses, whose needs must be met. Concessionaires, tenants and other organisations, including handling agents, can also be considered customers of the airport. Hermann and Hazel (2012) divided airport customers into five groups: airlines, passengers, non-travellers (employees, visitors and retail customers, meeters and greeters and neighbours), tenants/service providers (retail, car park, ground handling, advertisers), and potential development partners (real estate developers, hospitality, transportation service providers, government). Table 8.3 shows a simpler classification that defines customers as trade, end users and 'other'. Each of these needs to be further subdivided into much smaller discrete segments so they can be targeted appropriately and so that the airport's marketing efforts can be the most effective.

A common way to segment trade customers is by product type. For example, with passenger travel this would include a full-cost traditional service, a low-cost service, regional airlines and a charter service. Airline alliances could well be given special consideration. In the cargo area, the market may be segmented into integrators, cargo airlines, passenger airlines and other freight companies. In addition, at some airports GA may be an important market. This can cover many activities, including flight training, police aviation, air ambulance, aerial firefighting, surveying and crop-spraying, as well as private flying and leisure pursuits, including skydiving, aerobatics and gliding. Another significant area may be private business or corporate aviation. Other trade customers include tour operators who traditionally have sold charter airline seats as part of a package tour. Hence the tour operator may make the decision as to which airports should be served, while the charter airline will pay for, and consume, the airport product. In this respect tour operators can be considered as separate customers from charter airlines, although this is a grey area, with many charter airlines and tour operators belonging to large integrated travel companies. Travel agents indirectly sell certain parts of the airport's product by selling airline seats and so can be considered both as customers and distribution intermediaries. For cargo traffic there are other intermediaries, including freight forwarders or global logistics suppliers, who provide the interface between the freight shipper and airline. They will often make decisions regarding which airport to use to transport the cargo.

The end users – the passengers and owners of cargo that is being transported – are another group of customers. Passengers are clearly of central importance to airports not only because they consume the product that the airline provides, but also because they are direct customers for airport commercial facilities. In contrast to passengers, the end user in the cargo market rarely comes into contact with the airport itself. Instead, freight shippers tend only to deal with the forwarder or integrator away from the airport. There are many ways in which passengers can be segmented at airports. The easiest and most basic way is to use the airline types or models (e.g. alliance, LCC). Passengers can also be segmented according to the type of airline service. For instance, domestic and international passengers have needs for different facilities (including customs and immigration) and may have access to additional commercial facilities (including duty-free and tax-free retailing). A distinction can be made as to whether they are terminal or transfer passengers. There are other variables related to travel characteristics that can be used, including

Table 8.3 The airport's customers

Trade	End users	Others
Airlines	Passengers	Tenants and concessionaires
General aviation	Freight shippers	Handling agents
Tour operators		Visitors
Travel agents		Employees
Freight forwarders		Local residents
		Local businesses

group size, length of stay and seasonality. One of the most popular variables is trip purpose. At the most basic level, passengers can be grouped by business and leisure and then each of these categories can be further subdivided. Business passengers can be grouped according to whether they are travelling for internal business, meetings with external customers, conferences, trade fairs or exhibitions. Leisure passengers may be going on short breaks, long holidays, package tours, VFR, or travelling to study. Linked to this, there can be segmentation by travel class (including premium or economy).

Airports may also use general demographic and geographical variables, including nationality, income, age, gender, life stage, education and occupation, to segment demand. Sometimes they may use psychographic and behaviouristic market segmentation in order to match more closely the needs of each market segment. As discussed in Chapter 6, an increasing number of airports are now segmenting their passenger market by travel needs and requirements, in order to more fully understand the passenger experience.

The 'other' customer category includes all individuals who will use some features of the airport product, but will not be direct customers of the airlines. This includes employees at the airport who work for the airport operator, airlines, ground handlers, commercial concessionaires and other organisations. These individuals may use airport commercial facilities primarily because of their convenience and other facilities, including car parking. In addition, there will be the accompanying visitors known as 'farewellers and weepers', 'well-wishers' and 'meeters and greeters'. These visitors may use the retail and F&B facilities in the terminal and the car parks. The size of this market will depend on the purpose of trip and length of haul of the associated passengers, and will be influenced by other factors, including culture and nationality. International and long-haul flights for passengers who are travelling for leisure purposes generally attract the most accompanying visitors. There will also be visitors who are not directly related to air transport activity. For instance, there may be aviation enthusiasts who visit the airport to view aircraft, buy specialist merchandise and perhaps have a tour of the airport. Local residents may also visit the airport to use the retail and F&B facilities, or businessmen and women may use conference and meeting facilities. This customer category includes concessionaires who typically provide the terminal commercial facilities, including shops and F&B. Other organisations, including handling agents, can also be considered as customers of the airport.

Some of these different customer groups will inevitably be interdependent – hence the view held by some of the airport as a two-sided business. If the number of airlines serving the airport decreases, this is likely to reduce the volume of passengers, employees and accompanying visitors and could ultimately, if the decline is sufficiently large, make the airport less attractive to other customers, including the providers of commercial facilities. It is also certainly true that the different customer groups, especially the airlines and passengers, will view airports from different perspectives. In most cases, given the competitive nature of the airline industry, the interests of airlines will align quite closely with the interests of passengers. However, this may not always be the case, for instance with airlines giving too much attention to higher-yielding premium passengers, or not supporting expansion plans that might benefit passengers but increase airline competition. Cambridge Economic Policy Associates (2010) argued that the circumstances in which there may be a misalignment of interests between airport passengers include when airlines have market power; when developments that may increase the degree of competition are being contemplated; and when airports are subject to economic regulation.

For each type of customer, choosing an airport is the result of an amalgam of many decision processes (Table 8.4). This is a complex issue very much influenced by the unique characteristics of the airports and airlines (Parrella, 2013). However, for passenger airlines (and tour operators if relevant), one of the most important factors is the size and nature of the catchment area, especially if point-to-point services are the main focus. Depending on the type of route being considered, key factors are the business and tourist appeal of the catchment area for incoming passengers and the characteristics and purchasing power of those residing in the catchment area. The opportunities for carrying cargo (preferably in both directions) on passenger flights may need to be assessed. If an airline wants to develop or maintain a hub and draw on traffic beyond the immediate catchment area, it will also look for a central geographical location in relation to the markets it wants to serve.

The airport product has to be able to meet the needs of the airline. There must be sufficient capacity and slots to enable the airline to operate the services that it wants now and in the future, and other airfield physical capabilities, including runway length, need to be appropriate. The infrastructure also needs to fit the requirements of the specific airline, including fast turnarounds for LCCs or reliable transfer facilities for network carriers. After the existence of high demand, the next factors are quick and efficient turnaround facilities and convenient slot times. Corporate aviation operators will look for a swift, efficient and personalised service for their company executives. There are also commercial factors to consider, including the presence of other airlines and the amount of competition that exists at the airport, the fit with the rest of the airline's network and the potential for its passengers to feed into other services, or for other services to provide feed for them. Just as important will be the total visiting costs of operating from the airport. Undoubtedly, the level of aeronautical charges and other marketing support

Table 8.4 Factors affecting the choice of airports

Passengers	Airlines
Destinations of flights	Catchment area and potential demand
Flight fare	Slot availability
Flight availability and timings	Capacity for growth
Frequency of service	Competition
Image and reliability of airline	Network compatibility
Airline alliance policy and frequent-flyer programme	Airport fees and availability of discounts
Surface access to airport cost	Other airport costs (e.g. fuel, handling)
Ease of access to airport	Marketing support
Car parking cost	Range and quality of facilities
Range and quality of shops, F&B and other commercial facilities	Ease of transfer connections
Image of airport and ease of use	Maintenance facilities
	Environmental restrictions

that the airport offers is very important. In addition, airline choice will be influenced by other costs, including for handling and refuelling, over which the airport operator will generally have less control. If the airline is planning a significant presence at the airport, or wants to develop the airport as a base, this will involve recruiting local staff and so the cost of labour may be important. By way of illustration, Table 8.5 presents the findings of Dziedzic and Warnock-Smith (2016) who recently updated some research on LCC choice, where they ranked the most important factors that influenced the LCC choice of airport. Unsurprisingly, costs, demand and efficient operations were the most important factors, but potential to attract business passengers was ranked at number 6, demonstrating how these carriers no longer just focus on leisure demand.

With regard to cargo operations, airports need to have strong demand for such services or be centrally located to operate as a cargo hub. Visiting costs can again be very important, as cargo traffic can be highly price-sensitive and easily shifted from one airport to another by freight forwarders, as long as they can meet the delivery requirements of the shippers. More specific factors will be the ability of the airport to operate at night, to have quick customs clearance times, to have a good weather record and convenient road access so

Table 8.5 Factors affecting LCC choice of airport

Ranking	Factor
1	Airport costs/availability of discounts
2	Demand for LCC services/catchment area
3	Quick and efficient airport operations
4	Proximity to the primary city
5	Free airport capacity/slot availability
6	Airport potential to attract business passengers
7	Airline competition
7	Airport competition
9	Airport potential to attract leisure passengers
10	Availability of LCC dedicated facilities
10	Good non-aeronautical revenues
10	Positive experience of LCCs
11	Airport ground accessibility

Source: Adapted from Dziedzic and Warnock-Smith (2016)

that cargo can be efficiently trucked to its final destination. All-cargo flights often use large aircraft that need specialist loading and transfer equipment. In addition, certain types of cargo, including livestock, dangerous or perishable goods, may require specialist handling and storage facilities that may not be available at all airports. For integrated carriers, factors including the weather record to ensure high reliability and space to build dedicated facilities that are needed for such operations may be vital. Gardiner *et al*. (2005) undertook a rare survey of non-integrated carriers, which were asked to rank the most significant factors that influenced their choice of airport. Night operations were the most important, followed by costs, the airport's reputation and local demand.

For passengers, clearly the nature of air services on offer (in terms of fares, destinations, schedules and so on) – in effect the airline product – will be the key influencing factor as no one will choose to fly from an airport unless it offers the required travel opportunities. Hence what seems like airport competition is in effect competition between airlines. For example, two airports may be described as being in strong competition with each other, but this may be because they are served by airlines that themselves are in fierce competition. From a passenger viewpoint, airport competition will be closely linked to the amount of airline competition that exists (Morrell, 2010).

Factors including the distance, cost and ease of surface access to a certain airport, as well as cost and convenience of car parking at the airport, can also be very important to passengers. The quality of the airport product can have an impact, but usually only after these other factors have been taken into account. For business passengers, facilities including fast-track processes and airline lounges may affect choice, while for customers with special needs, for example disabled passengers, the quality of the provision of wheelchairs, lifts and general assistance may be important. Then there are other factors that are more difficult to explain and quantify. For example, in many European countries there will be a preference for the established capital city airport even if there are alternative airports that offer a comparable service. This is especially the case among the business community. In some instances, this may be because of better flight availability and frequency at the main airport, but not always. It may be because of ignorance about the other airports or because of some other factor, including the traveller's choice of a certain airline in order to add to their frequent flyer points. Passenger choice may also be influenced by personal preferences for a certain airport because of factors related to the airport product and the overall experience. For example, in a qualitative study of UK passengers, Sykes and Desai (2009) found that passengers preferred smaller airports because they were less formal, offered better customer care, were less congested and allowed passengers to feel more in control. Familiarity and reliability were also considered to be important factors, especially for business travellers. Passenger choice may also be influenced by the involvement of third parties or intermediaries, including travel agents or corporate travel offices, during their decision process.

Figure 8.1 shows passenger choice factors for four London airports, Heathrow, Gatwick, Stansted and Luton, in 2011, which is the latest year for which such detailed data are available. Routes and frequency factors were much more important at Heathrow airport than the other airports, reflecting its role as the UK's main hub airport with a higher share of business passengers. By contrast, cost was much more important at Stansted and Luton airports, which are predominantly served by LCCs. The route network was the second and first choice factors for UK and foreign business and VFR passengers, respectively, but not so important for leisure passengers; by contrast, cost was not among the top five choice factors for UK business passengers and only positioned fourth for foreign business travellers (Table 8.6). These results were confirmed by Accent (2011), which found that in the UK, availability of flight was identified as a reason for choice of airport by 63 per cent of business passengers compared with 55 per cent of leisure passengers, while only 23 per cent of business passengers mentioned the cost of the flight in contrast to 35 per cent of leisure travellers. Only 8–10 per cent of both groups identified airport facilities as being a significant factor. Similarly, a survey of the three Washington, DC airports (Baltimore Washington International, Dulles International and Reagan National) also demonstrated the importance of accessibility, especially for the centrally located Reagan National airport, with 33 per cent of passengers citing 'closest airport' as a reason for their choice (Table 8.7). The cost of air travel at Baltimore airport, which offers an alternative to Washington and has the LCC Southwest as one of its main airlines, was given as a reason

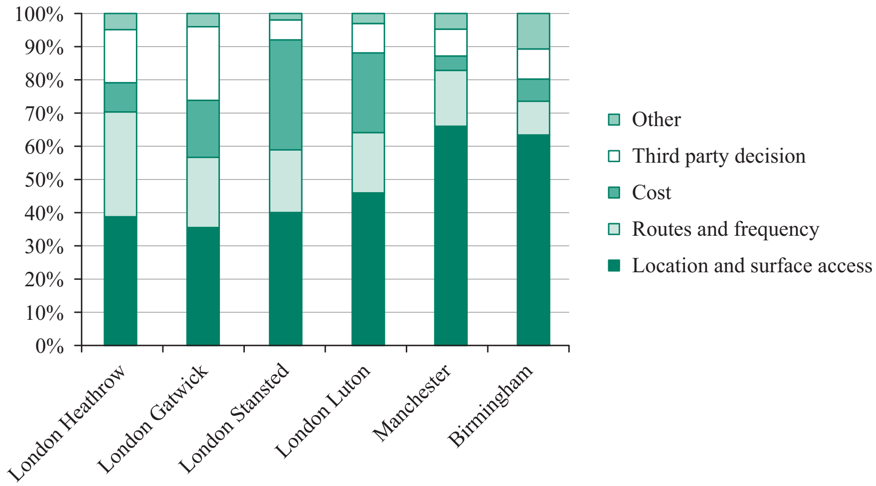

Figure 8.1

Reasons for passenger airport choice at UK airports, 2011

Source: Adapted from CAA (2011)

Table 8.6 Main reasons for airport choices at London Heathrow, Gatwick, Stansted and Luton airports by purpose of travel, 2011

UK residents	Reason for choice (per cent)	Foreign	Reason for choice (per cent)
Business			
Nearest to home	33	Nearest to business	38
Route network	20	Third-party decision	20
Third-party decision	14	Route network	16
Nearest to business	11	Cost	8
Timing of flights	10	Timing of flights	7
Leisure			
Nearest to home	31	Cost	36
Third-party decision	27	Third-party decision	17

UK residents	Reason for choice (per cent)	Foreign	Reason for choice (per cent)
Route network	18	Nearest to leisure	17
Cost	15	Route network	15
Timing of flights	4	Nearest to home	7
Visiting friends and relatives			
Nearest to home	36	Cost	28
Route network	25	Nearest to leisure	26
Cost	20	Route network	20
Nearest to leisure	5	Nearest to home	10
Timing of flights	4	Third-party decision	5

Source: Adapted from CAA (2011)

Table 8.7 Reasons for passenger airport choice at Washington, DC airports, 2015

	Baltimore	Washington National	Washington Dulles
Accessibility			
Closest airport	28	33	25
Better public transport	3	10	2
Better access roads & parking	18	12	14
Quality of air services			
More convenient flight times	17	18	19
Only airport with direct times	7	7	12
Less expensive airfares	17	12	14

	Baltimore	Washington National	Washington Dulles
Frequent flyer with specific airline	6	5	7
Only airport serving market	1	2	5
Other			
Other	1	2	1
Total	100	100	100

Source: Adapted from Mohammed and Roisman (2017)

by 17 per cent of passengers compared with 14 per cent at Dulles and only 12 per cent at Reagan National (Mohammed and Roisman, 2017).

Within this context, there has been some interesting research that uses discrete choice models to understand individual passenger behaviour and the choices that passengers make in terms of choosing airlines, airports and surface access. Many of the initial discrete choice studies relied on revealed preference data, but increasingly stated preference data has become more popular as it enables more data to be used and is more effective in identifying the significant effects of some of the crucial factors, particularly air fares (Hess *et al.,* 2007). Examples include Pels *et al.* (2001) and Başar and Bhat (2004) who developed discrete choice models based on the MAS in the San Francisco Bay Area. Another similar case is the research of Hess and Polak (2006) which looked at the combined choice of airport, airline and access-mode in the Greater London area.

The airport product

The airport product consists of a supply of services, both tangible and intangible, to meet the needs of different market segments. Urfer and Weinert (2011) classify the tangible features as being the airside infrastructure (runways, taxiways, navigational aids), landside infrastructure (terminals, parking facilities, ground transport interchanges), airport support infrastructure (aircraft maintenance, in-flight catering services, police and security facilities) and support areas, including industrial areas and duty-free zones. The intangible components are defined as the organisational, structural and operational aspects, including state support, administration (airport management, airport planning, ATC, operations (ATC, airport safety and security), airport maintenance and external factors, including regulations and the environment.

Marketing theory often divides the product into core, actual or physical, and augmented elements to relate the product to customer needs and expectations. The core product is the essential benefit that the consumer is seeking, while the actual product delivers the benefit. Product features, quality level, brand name, design and packaging will all make up the physical product. The augmented product is then additional consumer services and benefits that will be built around the core and actual products, and will distinguish the product from others. Much of the competition will typically take place at the augmented level (Kotler *et al.,* 2017). Sometimes the physical product is referred to as the 'generic' product, with the 'wide' product representing the augmented elements (Jarach, 2005).

Each market segment will perceive these product levels very differently. For the airline, the core is the ability to land and take off an aircraft, while for the passenger it will be the ability to board or disembark an aircraft. For freight forwarders it will be the ability to load and unload the freight on the aircraft. In order to provide the core product for the airline, the actual product will need to consist of the runway, the terminal building, the freight warehouses, the equipment and so on – and the expertise to provide all these facilities efficiently and safely. For the passenger, the actual product will include check-in desks, baggage handling and other features, including immigration control which will enable the passenger to fulfil his/her need to board or disembark the aircraft. The actual product will also include adequate transport services to and from airport and the provision of outlets selling essential travel goods, as well as other facilities including information desks and toilets. At the augmented level the airport may, for example, offer marketing support or pricing incentives to the airlines or may formalise some agreement about the exact service levels to be expected. For the passenger, the range and diversity of shops, F&B and other commercial facilities as well as other features, including ease of transfer between different aircraft, could all be considered part of the augmented product.

It is difficult to apply this marketing concept to the airport sector because of the composite nature of the airport product. From a passenger viewpoint, the airport product includes the airline product as well as the product of the concessionaire, handling agent and so on. Another way of looking at the airport product is by considering its 'raw' and 'refined' features. The raw product consists of both physical tangible elements (including the runway, buildings, apron, lighting, navigation aids, fuel, fire and rescue) and intangible service elements provided by the airport operator's own staff and those of the customs, immigration and security agencies. To produce the refined product involves adding the services provided by concessionaires and other tenants and the air travel elements, both tangible and intangible, provided by the airlines.

Chapter 5 provides a number of examples of how airport operators are increasingly differentiating their product to appeal to different market segments. Related to such product differentiation is the idea of an airport brand. In marketing theory a brand is represented by a name, logos, design, signing, merchandising and advertising, which all give the product an identity. These tangible and intangible features of the identity differentiate the product from its competitors. Within this context Karamanos (2014) suggested that a successful brand is dependent on a number of different features which he identified as value, relevance, technology, reputation, difference, and personality. Table 8.8 presents some examples of airports which he considered to be successful examples of airports with each characteristic.

Table 8.8 Characteristics of successful airport brands

Characteristic	Airport example
Value of the products/services	Dubai, Amsterdam
Relevance to passenger experience	Singapore
Technology (e.g. social media)	Heathrow, Dublin, Los Angeles, Gatwick
Reputation (e.g. environmental responsibility)	Swedavia
Meaningfully different	London City
Distinctive personality	Singapore, Munich
Global brand with local touches	Copenhagen, Zurich, Hong Kong

Source: Adapted from Karamanos (2014)

Moreover, it is certainly true that within the airport industry there are widespread attempts to create a corporate identity with the use of catchy publicity slogans and eye-catching logos and designs on promotional information and within the terminal itself. For airport operators that own more than one airport, use of similar signposting, colour schemes and interior design may also be used for all their airports. However, whether such branding actually gives an airport any competitive edge is open to debate, especially as there will usually be other brands of retailers, airlines and alliance groups displayed within the terminal. The brand effects may also be diluted by advertising on blank wall space, which airport operators encourage to boost their commercial revenues. So the airport operator needs to ensure there are not too many brands that may confuse passengers and have a negative impact on the passenger experience.

Airport operators often give considerable attention to the name of the airport. Many regional airports like to be called 'international' airports to demonstrate that they serve international as well as domestic destinations – even if in some cases there may be only one international route. On the other hand, as airports become more developed and well known for their range of services, they might choose to drop the international part of their name, as Birmingham airport did in 2010. Other airports will include the name of the nearest large city or town, even if it may not be particularly close and there may be more conveniently located airports. This may result in many airports seemingly serving one city. A prime example is London, which appears to be served by eight airports: London Heathrow, London Gatwick, London Stansted, London City, London Luton, London Southend, London Biggin Hill, London Oxford and London Ashford. This is also typically the case with secondary airports that serve LCCs. Examples include Stockholm Skavsta airport which is 100 km from Stockholm; Frankfurt Hahn airport which is 120 km from Frankfurt; Chicago Rockford which is 145 km from Chicago; and Brussels South Charleroi airport (BSCA) which is 46 km south of Brussels. Including the nearby city name may well make the airport easier to market and will give routes served by it better placing in the airline computer reservation systems and internet searches. However, it can also be misleading to passengers and disliked by rival airports. A relevant case here was in 2003 when the German court blocked Weeze airport from using the name Dusseldorf which is more than 70 km away – although this name is still used by some of the airlines when they are selling their services.

Giving an airport a name that is based on geographical characteristics, natural or man-made attractions or aspects of historical importance may raise the visibility and profile of the airport. These may be natural (e.g. Lakselv Banak North Cape airport and Annecy Haute-Savoie airport Mont Blanc) or man-made (e.g. Bardufoss Snowman International airport). The name EuroAirport for Basel-Mulhouse airport was devised to reflect its central European location and bi-national ownership characteristics. Knock airport in Ireland was rebranded as Ireland West Airport Knock in 2005 to emphasise its importance as an access point to the West of Ireland. Other airports use famous people associated with the location, which may include members of the royal family (King Abdulaziz International airport), politicians (John F. Kennedy international airport, Indira Gandi Delhi airport), composers, entertainers and musicians (Warsaw Chopin airport) or artists (Leonardo da Vinci-Fiumicino airport). In the UK there are also now 'John Lennon' Liverpool airport, 'Robin Hood' Doncaster airport and 'George Best' Belfast City airport. However, there has been some debate as to whether the name 'Robin Hood' is appropriate for Doncaster Sheffield airport, given that this legendary figure is more strongly linked with Nottingham; and likewise whether the naming of the George Best airport is the most appropriate, given that he was closely associated with Manchester United football team.

There can be a problem if the name is too distinctive and encourages certain traffic types. For example, Rovaniemi airport in Finland became known as Santa Claus airport in order to contribute to the Santa-based tourism in Finnish Lapland, initially after BA took a Concorde flight of 100 passengers there in 1994. However, this type of traffic is very seasonal and is dominated by charters, so this name may discourage other airlines that might provide a more regular service. Another example of an airport that has had a particular problem with its name and geographical position is the airport in the UK that up until 2003 was called East Midlands airport. In 2003, it decided to change its name to Nottingham East Midlands to make its location seem more specific. However, there are two other towns, Leicester and Derby, that are nearer to the airport than Nottingham and the new name was therefore not popular there. Eventually, in 2006 the airport was given another new name, East Midlands airport – Nottingham, Leicester and Derby.

A comprehensive study of 1,562 world airports gives some insight into the typical use of names (Halpern and Regmi, 2011) (Figure 8.2). Unsurprisingly, nearly 80 per cent include a place name, and just over 40 per cent include an indication of the services (e.g. international, regional). Using famous people or attractions is less popular.

This study also found that one-tenth of airports used slogans, and this was most common in North America. Typically, these may relate to the connectivity that the airport

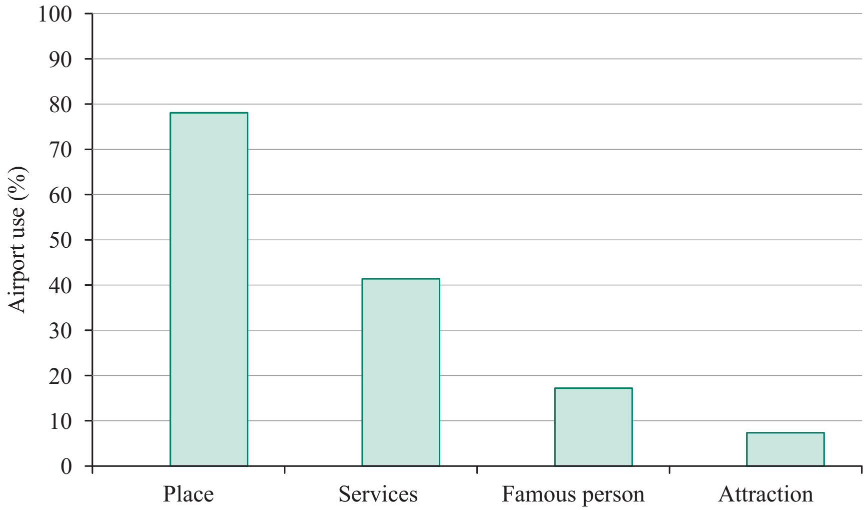

Figure 8.2
Use of different types of airport names
Source: Adapted from Halpern and Regmi (2011)

provides, including Dallas/Fort Worth International airport 'The world connected', Munich airport 'Service non-stop', Budapest airport 'Where everything takes off', Brussels airport 'Welcome to Europe', Macau International airport 'Gateway to China', Aéroports de Montréal 'Where Montreal meets the world', Cheddi Jagan International airport 'The gateway to South America', and Miami airport 'Gateway to Miami, to Florida and to the Americas'. They may also relate to the travel and passenger experience, including Helsinki-Vantaa airport 'For smooth travelling', Singapore Changi airport 'The feeling is first class', and Moscow Domodedovo airport 'Happy Landings'. At some other airports they may link to the destination such as Ivalo airport 'Airport for wilderness and trekking', Sunshine Coast airport 'A destination beyond expectations', and Prague airport 'Prague loves you'. Airports may adopt a new slogan when there is a significant change to their product, for example London Gatwick airport used 'Your London Airport Gatwick' to differentiate itself from London Heathrow airport when it came under new ownership, and Kuala Lumpur airport used to slogan 'KLIA Next Gen Hub' to prepare for new facilities, particular the new KLIA2 terminal.

Airport marketing techniques

Successful airport marketing involves focusing on understanding and responding to the needs of the various customer segments. Every airport is unique and needs to be marketed in its own specific way. At small airports, all marketing tasks may be undertaken by a couple of staff, whereas at larger airports there may be separate departments for coping with different customers, including the passengers and airlines, and different teams looking at different marketing activities, including market research, sales and public relations. Once an airport gets to a certain size, the marketing focus is likely to change. Small airports may concentrate on growing specific services that appear to offer opportunities for the airport. Larger airports, that already have a reasonably developed route network, may be more concerned with putting forward a good positive image for the airport and building on a corporate identity. The marketing of airports aiming to be hub or feeder points is totally different from marketing an airport that relies on point-to-point services including charter or low-cost services. Airports with considerable spare capacity will adopt different strategies from congested airports. Smaller airports competing with major capital city airports will probably find that they are always faced with an uphill struggle; nevertheless a considerable amount of proactive and aggressive marketing may achieve results.

Airlines

At the most basic level, airports promote themselves to airlines by producing general publicity information, by placing advertisements in trade journals, and by being represented at exhibitions, travel trade seminars and workshops, roadshows and other similar events. The aim here is to increase awareness among the airlines. It must be borne in mind, however, that this activity will usually only reach a general audience, will rarely mention current or potential demand and may be very costly. Developing regular contact with key airlines through visits by airport sales staff and other promotional activities may also be effective.

However, very often airports deal with potential airline customers in a much more direct and personal way as well. This hard or personal-selling approach, called route or air service development, was developed in the 1980s owing to the realisation that airports were actually in a good position to identify new route opportunities for airlines. This was a task previously left solely to the airlines. The airport operators analysed passenger and catchment area data which gave them adequate information to suggest new route opportunities to potential operators. Many of the airports had the advantage that they already kept at least some of these data for their own passenger marketing and forecasting. They also benefited from certain cost economies by being able to consider all different markets and routes simultaneously. For a small airline interested in operating just one or two new routes, the cost of undertaking such research could well have been too prohibitive.

So the airports started to take a leading role in initiating interest from airlines with this more direct route development approach. From their databases, they would provide airlines with information about potential routes and the size of the market, and perhaps other factors including the likely requirements for frequency and aircraft size and route cost and yield considerations. By the 1990s, airline presentations from the marketing departments of airports to route planners in airlines had become commonplace. Typically, the presentation would give a detailed analysis of the new route or routes and usually an approximate financial evaluation. This would be supplemented by information about the catchment area in terms of the characteristics of residents and its tourist and business appeal for incoming passengers. Information would also be given about the airport's facilities and accessibility by transport links.

Times have now moved on in the air transport industry, and both airports and airlines have developed more sophisticated marketing techniques. The airline presentation can still be an important element of an airport's marketing, but it has to be highly focused. The emphasis must be very much on the potential demand at the airport (including an assessment of any newly stimulated traffic and the impact on existing routes) and the LOS needed in terms of frequency and capacity, with the quality of facilities taking second place. Emphasis on architectural excellence and best quality facilities could even have a negative impact, with airlines being concerned that the cost of such infrastructure may be passed on to them. The airlines themselves have become awash with route studies from numerous airports and so have become much more skilled in using this information to back up and verify their own research.

An interesting development regarding airline marketing has been the route development forums that provide networking opportunities for airline route planners and airport operators through one-to-one meetings. The airport operator will typically use its market research to demonstrate opportunities for new routes or expansion of services, and will sell the virtues of its catchment areas and facilities and services. In turn the airlines will explain their expansion strategies to the airports. The first forum was 'Routes' in 1995, which is now an annual global event that has been joined by region-specific meetings including Routes Americas, Routes Asia, and Europe. There are other similar events, for example, in North America there is 'JumpStart' and in Europe there is 'Connect'. In line with previous events, the 2017 Global Routes event was expected to attract 3,000 delegates (including 300 airlines,700 airports and 130 tourism authorities) from 110 countries who will have had more than 13,000 meetings over the 4 days. Meetings can be pre-scheduled and there are on-site request meetings available as well. Airports and tourism authorities will be able to request up to eight city pair meetings – work collaboratively to identify new business opportunities, exchange data and contracts and plan joint strategies. Airports pay different fees for meetings dependent on their size, whilst airlines are not required to pay a registration fee.

More recently there has been the opportunity to explore route development opportunities online. For example, in 2008 the anna.aero website, previously dedicated to airline network news and analysis, launched the Route Shop. With this, airports can provide details about unserved routes and other information, including the catchment area, marketing support, airport infrastructure and services, and freight opportunities. In September 2017 there were 3,301 unserved routes and over 300 airports. Prices varied from €999 for a 'lite' service to €2,999 for a full service. Around the same time, the organisation involved with the Routes events launched the online Route Exchange. Airlines are invited to submit a request for proposal (RFP) that will include their requirements for a new route related to target markets, data needs and desirable support. Airports can access this and respond directly with a confidential proposal to the specific airline. The airports can also provide full details of their profiles which are available on the website. As of the end of September 2017, Route Exchange had 346 listed airlines, 164 listed airports, 14 listed destinations and 12 listed suppliers.

One of the most important aspects of the route development process will be pricing incentives which the airport operator will offer to encourage the airline to serve the airport (Fichert and Klophaus, 2011; Jones *et al.*, 2013; Ryerson, 2017). In Europe Malina *et al.* (2012) found that about a third of all airports offer these. Usually, they involve reduced fees over a certain period (Table 8.9). These can be particularly important, and may be crucial particularly for LCCs. Such discounts will usually diminish as traffic grows and the service becomes sustainable. One of the most popular methods is to waive or reduce the landing fee in the first few years of operation so that the airline only pays for the passengers it carries. If demand at the start of a service is initially low, the airline will pay very little. This means the airport will share more of the risk when the airline is developing the route. There may also be discounts on passenger and parking charges. Alternatively, the three charges may be replaced with a set charge per passenger, which again is a more risky option for the airport as it has the effect of relating the charge solely to passenger numbers, which drive airline revenues. As well as these new route incentives to encourage greater connectivity for the airport, there may be incentives to persuade airlines to offer more capacity, or to increase frequencies, or to operate non-stop services. Incentives may be offered to support airlines to use the airport as a base. Not all these incentive schemes are published, but Table 8.10 contains a sample of those that are, to give an indication of the range of incentives on offer. Here some airports consider new routes or greater volume/frequency in general, while others give different priority to certain services (e.g. strategic routes, long-haul routes, summer/winter routes).

Table 8.9 Types of airport charges discounts

Discount	Objective
Landing charge discount on flights to new destinations	Encourages new routes
Landing charge discount on all additional flights or larger aircraft	Encourages new frequencies or additional capacity
Landing charge discount for replacing one-stop service by non-stop	Encourages new direct routes
Landing charge discount for positioning flights	Encourages airlines to base aircraft at the airport
Transfer passenger discount	Encourages growth of transfer passengers
Passenger charge discount	Encourages new routes and more frequencies/ capacity
Passenger and landing charge discounts for off-peak/daytime flights	Encourages new routes and frequencies/ capacity while avoiding congestion and night noise
Aircraft parking charges discount	Encourages new routes and more frequencies/ capacities and basing of aircraft

Source: Adapted from STRAIR (2005)

Table 8.10 Examples of airport discount schemes, 2017

Budapest	*New destinations:* Landing charge short-haul year 1–5, 100–10 per cent, long-haul 100–25 per cent Passenger charge long-haul year 1, 50 per cent *New winter destination:* passenger charge year 1, 50 per cent *New thin route:* passenger charge year 1–3, 50 per cent *Route recovery*: landing charge year 1–2, 100–50 per cent *Frequency increase:* landing charge year 1, 100 per cent
Copenhagen	*New routes:* Take-off charge (low or high seat capacity) Low year 1, 80 per cent High year 1–5, 100–20 per cent Passenger charge (low – EU, high – Non-EU) Low year 1–5, 80–10 per cent High year 1–5, 90–20 per cent
Geneva	*New route landing charges:* Period 1 (80 per cent), 2 (60 per cent), 3 (40 per cent) 4 (20 per cent) Period is a year for long-haul and 6 months for short-haul
Malta	*New route passenger charge:* Summer year 1–3, 30–10 Winter year 1–3, 40–20 *Strategic new route passenger charge:* Summer year 1–3, 40–20 Winter year 1–3, 60–40
Kansai	*International new route:* Landing charge mid-/long-haul year 1–3, 100–40 per cent Landing charge short-haul year 1–3, 90–40 per cent Landing charge transfer 100 per cent (short leg flight) *International growth:* Landing charge mid-/long-haul year 1–3, 90–40 per cent Landing charge short-haul year 1–3, 80–30 per cent Cargo landing charge 1–3 80–30 per cent
Seoul Incheon	*New route:* Landing charge year 1–3, 100–50 per cent *Increased frequency:* Landing charge year 1–3, 50 per cent *Night flight (23:00–05:00):* Landing charge year 1–3, 25 per cent

Source: Compiled by author from various sources

As well as offering reductions on charges, airports very often provide financial help for marketing or will pool resources so that joint advertising and promotional campaigns may be run to promote the new services. For example, all Swedavia airports offer support for airlines and tour operators that start a new route with at least 20 departures or expand their service on an existing route by at least 20 departures during a 12-month period. Costs may also be shared for exhibitions and trade fairs. Very often stakeholders, including local governments, regional agencies and tourism boards, can become involved at this stage, which is quite common in the United States (see Chapter 9). In addition, non-financial incentives can be offered, including information provision, for example regarding the regulatory situation and market characteristics or useful contacts lists for local travel agent, tour operation, ground handling, recruitment agencies and media sectors. Airports may give advice on scheduling decisions, particularly if an airline is to benefit from connecting traffic from other airlines. The airport may also promise to help lobby government to remove environmental or traffic rights regulatory obstacles. Finally, another way an airport can put together an attractive deal for an airline, and be cost-effective in its marketing, is by pairing up and cooperating with the airport at the other end of a route that has been identified as having potential. Extending this idea further may lead to airport sister agreements, discussed in Chapter 2.

A relevant development here has been the emergence of negotiated long-term contracts with airlines. This may be the result of a light-handed regulatory system (see Chapter 4) but certainly not always. These contracts agree the level of airport charges and other conditions, such as service targets, in return for an airline-guaranteed number of aircraft or traffic volume operating out of the airport. As such, these ensure that the airport can plan for the long term without the fear of the airline disappearing, whilst the airline benefits from knowing that its long-term costs will be fixed. Table 8.11 shows that in Europe in 2014, 7 per cent of airports just offered such contract but a much higher proportion, namely 35 per cent, offered both discount incentives and contracts. Only 16 per cent did not offer either. The key drivers of these discounts were the encouragement of new routes, new services and overall airline traffic growth.

The most common airlines to benefit from a total package of measures are the LCCs. Airports are willing to enter into such agreements due to the additional commercial revenues that hopefully the extra passengers will bring and the impact such services will have on raising the profile of the airport and encouraging other new carriers. For a number of regional airports, this may also be a way of filling airport capacity that was underutilised. If the airport is under regional public ownership, the new services may be supported because of the potential broader economic benefit they could bring to the whole region – for example in terms of encouraging tourism and inward investment. However, this raises the issue of whether state aid should be used in this way to support certain airlines. In Europe there are now specific guidelines on this, following on initially from experience of Ryanair at BSCA (Case Study 8.2). These revised guidelines were introduced in 2014. It was generally agreed that the previous rules had been complex and cumbersome and so the new guidelines are simpler. They state that airlines will be able to receive aid covering 50 per cent of airport charges for new destinations during a three-year period. The aid can only be used for routes within the Common European Aviation Area and for airports of less than three million annual passengers, or five million passengers in exceptional

Table 8.11 Airport charges discounts at European airports, 2014

Feature	Airport responses (per cent)
Availability of discounts	
Formal open-to-all incentive schemes	42
Specific commercial contracts	7
Formal incentive schemes and contracts	35
No incentive schemes	16
Drivers of discount	
New routes	63
New services	28
Achieving overall airline traffic growth	33
Achieving overall airport traffic growth	22
Achieving overall airline traffic stability	7
Providing discounted fares to passengers	4
Achieving overall airline limited traffic decline	2
Achieving overall airport limited traffic decline	2

Source: Adapted from ACI Europe (2015a)

circumstances. Aid for airports larger than five million passengers is not allowed. However, there are more flexible arrangements possible if the airports are located in a remote area, for example an island or sparsely populated area, where aid can be given irrespective of the size of airport and destination of the route (EC, 2014).

In other parts of the world, airport incentives may also be subject to government regulation. For example, in the United States, a subsidy (which is defined as a direct payment of airport revenue to an airline or to any provider of goods or services to that airline, in exchange for additional service by the airline) is not permitted. However, an incentive (defined as any fee reduction, fee waiver, or use of airport revenue for acceptable promotional costs, where the purpose is to encourage the airline to increase service at the airport) is allowed. Moreover, the airport revenue incentives are allowed to be used to enhance airline services at an airport and create an opportunity to increase traffic but not to contribute to a destination marketing programme that promotes a region, attraction or business with the focus being on increasing regional revenue, not just that related to the airport's services or facilities (FAA, 2010). As a result, two of the most common incentives in the United States are fee waivers for airport charges and terminal rents, as well as marketing assistance for new flights. A common feature in the United States is to use so-called ‘co-op’ marketing funds, travel banks and revenue guarantees which are discussed in Chapter 9.

Providing financial help for marketing as well as discounting charges is actually common in many world regions. An example is provided in Table 8.12 for Nice airport. Different marketing support is available for different categories of routes and frequencies for three years. There is also an additional 30 per cent support for winter routes. The support is paid in the form of a media plan and can cover activities such as a press conference, inaugural flight promotion, purchase of advertising and promotional events.

Marketing support at Nice airport is also available for capacity increases. For example, for up to 10 per cent new seats there is marketing support of €0.25 per seat in the summer, and €0.50 per seat in the winter, for services which previously offered less than 20,000 seats per year. If the service offered 20,000 -199,999 seats this support is doubled, and if the service offered more than 200,000 seats per year, this support is three times as large. Moreover, if the increase in seats is greater than 10 per cent, more support is available. For example, for services of less than 20,000 seats per year this increases to €0.50 per seat in the summer and €1.00 per seat in the winter if there is 10-20 per cent more seats. If there are more than 20 per cent new seats, the equivalent support is €1.00 per seat in the summer and €1.50 per seat in the winter. Larger support is available for services with a greater number of annual seats. As with the support for new services, this is paid through a media plan. For example, the route shop website for Nice airport states that the airport can offer a choice of leading radio stations for the airline to advertise with, covering a daily audience of 200,000 listeners. In addition, for direct marketing the airport has 4,000 business contacts and 1,800 email details of key influencers such as travel agents who are regularly contacted.

Table 8.12 Marketing support at Nice airport for new routes, 2017

Annual frequencies	Maximum marketing support (€000s)		
	Year 1	Year 2	Year 3
Short-haul			
25–99	25	15	5
100–199	50	30	10
200+	100	60	20
Long-haul			
16–30	50	30	20
31–99	100	60	40
>100	150	90	60

Source: Adapted from Nice Cote d’Azur airport (2017)

Overall, with a survey of 124 airports worldwide, Halpern and Graham (2015) identified the most popular marketing activities used in airport development. The top five were: attending networking events such as Routes; presenting to airlines in their office; using strategic marketing principles; offering pricing flexibility; and developing joint advertising or promotional campaigns (Table 8.13). The survey also found that larger airports were significantly more active than smaller airports in route development, private airports were more active than public airports, and that airports in Europe were more active than airports in other world regions (Halpern and Graham, 2016).

Table 8.13 Marketing activities used in airport route development

Ranking of use	Activity
1	Attend route development networking events
2	Meet airlines in their offices and present to them
3	Use strategic marketing partnerships
4	Offer flexibility on pricing
5	Develop joint advertising or promotional campaigns
6	Target a specific airline with a bespoke report
7	Invite target airlines to visit the airport
8	Modify facilities or services to meet airline needs
9	Send marketing materials to airlines by e-mail
10	Improve processes for providing assistance to airlines
11	Promote a recognised airport brand
12	Collaborate with other airports
13	Present itself on route development websites
14	Hire a consultant to conduct activities
15	Provide information on the airport website
16	Lobby for the removal of obstacles for further development
17	Send marketing materials to airlines by post/fax
18	Communicate with airlines via social media

Source: Adapted from Halpern and Graham (2015)

CASE STUDY 8.2
THE BRUSSELS SOUTH CHARLEROI AIRPORT (BSCA) CASE

Charleroi airport is a regional airport formerly owned by the Walloon government which is 46 km south of Brussels. Between 1990 and 1996, its passenger levels fluctuated around 50,000. Then, in 1997, Ryanair began to operate two flights a day to Dublin and the airport passenger numbers increased dramatically to over 200,000. Ryanair's passenger numbers increased from 86,000 in 1997 to 178,000 in 2000, but the airport still remained very much a small regional airport. The most significant change came in 2001 when Ryanair decided to make Charleroi its first continental base and began operating 10 routes with 19 daily frequencies. This changed its status from that of a regional airport serving passengers on charter airlines originating from the Walloon region to a larger secondary airport with a much greater traffic base in the whole of Belgium and also cross-border regions in France and Germany. It was at this time that the name was changed from Charleroi airport to Brussels South Charleroi airport (BSCA). Total airport traffic grew from 236,000 in 2000, to 773,000 in 2001, and 1,272,000 in 2002.

The airport offered Ryanair a very favourable deal because it felt the presence of Ryanair could substantially grow its non-aeronautical revenues and attract other airlines to the airport. For example, it transformed the coach shuttle from the airport to Brussels city from a loss-making into a profitable activity and generated a substantial amount of revenue from car parking since it introduced parking charges in 1999. It also expanded the duty-free and catering outlets to cope with the additional passengers and increase the overall non-aeronautical revenues.

Ryanair paid very low landing and handling charges starting at €1 per passenger, which was planned to go up to €1.13 in 2006 and €1.30 in 2010. In addition, BSCA contributed towards other expenses incurred by Ryanair which, together with the low charges, resulted in a net substantial benefit to Ryanair – estimated to be in excess of €3 million. The expenses covered by BSCA included marketing support (€2 per passenger), incentive payments for each route started (€160,000 per route) and Ryanair's one-off costs for local crew hiring and training (€768,000). Some other costs related to hotels (€250,000 per year), offices (€250,000 per year) and hangar space (€250,000) were also covered. For this support from BSCA, Ryanair agreed to base two to four aircraft at the airport and to operate at least three departing flights for each aircraft over a period of 15 years – if not it would have to repay the incentives (Aviation Strategy, 2001).

However, in 2001 a complaint was lodged with the EC concerning these incentives and whether they were anti-competitive, and an investigation was undertaken concerning the state aid that had been given by the Walloon region to Ryanair. Two issues were considered. First, according to Article 87 of the Treaty of Rome and European transport policy, aid is allowed if it encourages the development and use of under-utilised secondary airport infrastructure. On the other hand, state aid is not allowed when it can be proved that a private airport operator would not behave in the same manner – the so-called private market investor principle. A decision was reached in 2004 when it was decided that Ryanair could keep some of the aid, but the remaining amount had to be paid back (EC, 2004). The EC determined that no private operator in the same circumstances as BSCA would have granted the same advantages to the airline, hence the private market investor principle had not been followed. However, the EC took the view that some aspects of the aid could be compatible with European transport policy. Thus the EC allowed Ryanair to keep some of the aid intended for the launch of new air routes (including marketing and publicity) and other one-off incentives, including recruitment payments. However, other aid that took no account of the actual costs of launching such routes was not allowed, nor were the fee discounts because they had not been allocated in a non-discriminatory and fully transparent manner and were planned for a very long period of operation. Ryanair launched an appeal against this judgment.

Following on from this case, and to clarify the application of state aid principles to airports, the EC issued guidelines on financing of airports and start-up aid to airlines departing from regional airports in 2005. However, these were not actually law, but only guidelines of the EC's interpretation of how the law should be applied. Since the issuance of the guideline the EC investigated a number of airports and their incentive schemes for airlines. Moreover, in 2008 Ryanair successfully won its appeal against the original decision in 2004 that some of the aid was illegal. These developments led to revised guidelines on start-up aid to airlines being introduced in 2014.

Meanwhile at BSCA, Ryanair continued to develop its services (although also pulling out on a few routes), as did some other LCCs, with the airport traffic totalling over two million in 2004 and five million in 2010, and six million in 2012. Over seven million were handled in 2016. In January 2017, a second terminal (terminal 2) was opened ultimately to enable the airport to accommodate 10 million passengers a year. However, a very significant development was the decision of Ryanair in 2014 to open 10 routes at the main Brussels National airport, as well as its 57 routes from BSCA. This was one of the examples of Ryanair offering services at primary airports; further shifts have occurred since at other European airports. However, even though the majority of these routes at Brussels were already served from BSCA, none of the routes were dropped, although there were significant frequency reductions. BSCA's traffic dropped for the first time in 2014 to 6,440,000 compared to 6,786,000 in 2013, but grew again in 2015 to 6,956,000. By 2017 there were 17 new routes offered at Brussels National and 26 new routes at BSCA since 2010. The perceived advantages of operating out of Brussels National airport, in terms of traffic mix, location and so on, must have outweighed the fact that the airport is much more expensive. At BSCA there is just a simple charge per passenger on landing, whereas the cost at Brussels is much higher, resulting in an estimated airport charge per aircraft rotation of €194.65 per plane/€1.15 per passenger compared to €4,962.37 per plane/€29.19 per passenger at National (Dobruszkes *et al.*, 2017).

Travel trade

Airports also need to promote themselves to the travel trade, including travel agents, tour operators and freight forwarders. Again this can be done by producing general publicity electronically and paper information, by placing advertisements in trade journals and by going to trade exhibitions such as ITB Berlin and the World Travel Market in London. In spite of the increased use of the internet and other direct-booking methods, travel agents can still be highly influential in some cases when passengers go through the process of selecting and assessing possible travel options. Some of the general sales promotions directed at the airlines may be targeted at the travel agency sector as well and may help to give exposure to the airport and the services that it offers. Regular electronic mailshots to agents may enhance that awareness. This is particularly important when new routes are being launched and there is first departure promotional activity.

In many cases, however, this is not enough. A number of airports, particularly the regional and smaller ones, have found that it is particularly important to spend some time and effort in developing close, personalised links with travel agents serving the direct catchment area. This usually involves regularly sending out a sales representative who can talk to the agents about new developments at the airport and explore the agents' knowledge and views of the services on offer. This one-to-one contact can be supplemented with frequent, personalised e-mails giving details of promotions, new facilities, up-to-date timetables and other information. Very often, airports will also organise competitions, airport tours and other social events to encourage greater interest in the airport and to forge closer links with the agency sector. Familiarisation trips and launch parties for new routes for key business and travel trade representatives are particularly important. There are stories of regional airports discovering that their neighbouring travel agents are unaware of some of the services they offer, with agents advising passengers to travel instead via a larger airport further away. In the past, Cardiff airport in the United Kingdom overcame this problem by buying a chain of 22 local travel agents in an attempt to promote flights from its airport. Norwich airport, also in the UK, went one stage further by not only opening its own travel agencies, but also operating its own charter flights to some of the main leisure destinations in Europe.

Passengers and the local community

Generally, a much more soft-sell approach is adopted for passengers. Advertising is used to create awareness and communicate messages to a mass audience. It is undertaken by producing general publicity information (internet and mobile sites, information leaflets, stickers and T-shirts) and advertising in a range of media (print, radio, television, outdoor and electronic media). Travel brochures and adverts, produced jointly with tour operators or airlines, can be circulated or offered online. Sponsorship and fundraising events may also be used as a means of advertising, although this perhaps could be considered more as public relations than actual advertising. Likewise, airports may organise open days, air shows and exhibitions.

The choice of media will depend on the relative costs, the target audience and the message the airport operator wants to put across. A basic message or idea can be successfully communicated through a simple advert, whereas more detailed information, for example timetable or flight materials, needs to be presented in more detailed written form. Airports adopt various approaches to woo passenger to their airports. Most commonly, airports try to increase the consumer's awareness of flights and closeness of the airport by listing the destinations on offer or by focusing on the convenience of the public transport links. More specific messages may relate to a certain service or facility at the airport, particularly airport shopping, or a certain market segment, including business travellers. Advertising can be particularly important when a new route is launched. In general, the ultimate aim of advertising activities is to sell a product, but the airport has a rather unique relationship with its passengers as it is not selling a product directly to them. The passenger will not go to the airport unless the required airline service is there, and so this more limited role of advertising needs to be recognised. For this reason, there may be joint airline–airport adverts but mass market advertising aimed at passengers focusing just on the airport product is not very common. Rare cases include Heathrow airport, which previously ran an advertising campaign using various media including outdoor billboards and those on the London underground, with messages including 'Can't stop thinking about your holiday? Neither can we'; 'Everyone gets a smoother take-off at Heathrow'; and 'How the Great British getaway will getaway this Easter'. Then in Christmas 2016, it ran a campaign called 'Coming home: the greatest gift of all' which included billboard and TV adverts featuring two ageing teddy bears. Halpern (2016) also mentioned how Manchester airport used its Fly Manchester Campaign in 2013 to promote Manchester airport in north-west England as an alternative to London airports for long-haul flights to/from the UK. The airport used digital communications such as the airport's website and social media accounts, as well as more traditional communications like advertising on the exterior of buses and outdoor displays. However, it is generally more common to find more examples of promotional activities aimed at passengers undertaken primarily to increase non-aeronautical revenues at airports rather than directly influencing their choice of airport.

Some airports have developed loyalty schemes for their passengers – a very common marketing practice in the service industries. These can be viewed as part of the airport's customer relationship management which also covers other areas, including enhancing passenger travel and communications (Halpern and Graham, 2013), considered in Chapters 5 and 6. Loyalty schemes typically give rewards or points that can then be used in the future to gain discounts or other benefits. For airports they can provide greater insight into the needs of their customers, reduce marketing costs by being more focused on familiar customers, and incentivise customers to buy more products. Regular e-newspaper, mobile messages or social media communication can be sent to those passengers who are involved with the schemes. However, compared with other industries such as supermarkets, hotels or even airlines with their frequent points, the impact of these is likely to be less significant at airports, again because of the more limited impact that the actual airport product (as opposed to the airline product) can have on passenger choice. There are generally two types of schemes: paid membership schemes based on frequent flyer programmes that focus on helping passengers travel through the airport more comfortably and swiftly (Chapter 5), and free schemes that tend to concentrate on incentivising passengers to spend more in the commercial areas (Chapter 7).

All airports have a need for public relations activities – airports have major impacts on the local community not only by providing local flights for residents, but also by generating jobs and other economic benefits. On the other hand, the environmental impacts including noise and pollution are of major concern. Generally, the aviation industry still holds a fascination and wonder for some and a fear for others. For all these reasons, airports tend to receive extensive coverage, both favourable and otherwise, in the press. It is worthwhile for airports to put considerable effort into trying to capitalise on the general interest people have in airports and to create a degree of goodwill between airports and the community, particularly should anything go wrong, when crisis management techniques will be needed. Developing good links with local, regional, national and in some cases foreign media is crucial, and hosting events for journalists and travel writers can increase interest in the airport and stimulate press coverage. Arranging school visits and other trips will also be an essential public relations activity.

Special events at the airport are also used. These have various purposes, as explained, such as enhancing public awareness of the airport; stimulating interest in and growth of the airport and aviation; fostering community support; providing community benefits; and possibly generating revenue for the airport or community/charitable organisation. Aeronautical special events can include air shows, fly-ins, and airport open houses where aircraft are on display), whilst non-aeronautical events can cover many different areas such as car shows, sponsored runs, and concerts and other performances (Prather, 2013).

Market research and route development

A fundamental element of marketing is market research so that organisations can have a thorough understanding of the characteristics and needs of their market. Most research will cover two areas: market characteristics in terms of market size, share, segmentation and trends; and the more subjective area of passenger satisfaction. Chapter 6 considers passenger satisfaction, so the emphasis of the discussion here is very much on the first area. In practice, many small airports will not have the resources to undertake all the market research that is needed, so strategic partnerships with tourism and regional development agencies may be vital so that resources can be pooled.

There are a number of different data sources that airport operators can consult to gain knowledge about their market (Table 8.14). Passenger volume data are easily available from the airport itself, and in addition many airports undertake periodic surveys of their passengers to find out details including O&D, age, sex, socio-economic group, flying frequency and so on (these surveys may be tied in with the quality surveys described in Chapter 6 so that correlations between passenger profiles and levels of satisfaction can be made). In some countries, surveys may be undertaken by the national civil aviation authorities or government transport departments instead of, or in addition to, those carried out by the airport operators. For example, in the United Kingdom the CAA regularly surveys passengers at all main airports. This has the advantage of producing survey data that are directly comparable for different airports. Information about the characteristics of existing travellers may also be obtained from tourism statistics that may be available from local or national government agencies or from the United Nations World Tourism

Organization (UNWTO). While these can give an indication of the volume of tourists and current trends, they may have limited use if they are not available by mode of transport and if they are not available for outbound as well as inbound flows. More in-depth information about current services and particularly any underserved destinations can be also gleaned from other organisations including travel agents, local businesses and freight forwarders.

Table 8.14 Types of data used for route development research

Data	Typical sources	Information obtained
Airport traffic data	Airport or government departments	Passenger, freight and aircraft volumes
Airport passenger survey data	Airport or government departments	Passenger characteristics such as O&D, purpose and frequency of travel, socio-economic group
Tourism data	UNWTO, tourist boards or government departments	Tourist numbers, tourist/trip characteristics, events/place of interest
Airline booking and sales data	Computer reservation system market information data tapes and billing and settlement plan data	Travel details such as passenger O&D, connecting airports, routing patterns
Airline schedule data	Official airline guide, airlines	Current routes, frequencies/ schedules and seat capacity data
Economic and social data	Government departments	Employment sectors, main exports/imports, population and economic growth trends

Most of the market analysis undertaken is based on revealed preference techniques, that is by assessing the passenger's current behaviour to determine future travel patterns. The alternative is to use stated preference techniques, where passengers are asked to state their preference between a number of different scenarios. These techniques have been used to look at airport choice and also transport modal choice for surface access (as discussed earlier). For instance, passengers might be asked how they would trade off higher journey costs to an airport against journey time. Such information can give airports invaluable insight into how passengers rate the factors that influence passenger choice.

An important area of airport market research is associated with the marketing of new services. For this, the airport operator will typically go through an air service or route development process that will have different data and research requirements at each stage

(Martin, 2008; ASM, 2016). The overall task is to identify potentially viable routes that are not currently being served and ultimately to produce route-by-route forecasts and a feasibility assessment. Halpern and Graham (2013) define the seven stages of the route development process:

- Define catchment area
- Undertake market assessment and leakage analysis
- Identify unserved or underserved routes
- Produce growth forecast for potential routes
- Choose possible airlines to operate the routes
- Undertake a financial viability assessment of the route
- Present the business case to the airline

The first stage of this route development process involves defining the catchment area of the airport. This relates to the geographical reach of the airport services to the surrounding population and economy that they serve, and so is the area to which most inbound passengers are travelling, or from which most outbound passengers have originated. The most basic approach to defining a catchment area is by using a certain drive-time period criteria – typically one or two hours. This area can be called the primary catchment area, where most travellers are likely to consider the airport their first choice based on proximity. Isochrones of longer times may represent weaker secondary or even tertiary catchment areas, where the airport will not necessarily be the first choice. For example, Toronto, Copenhagen, Prague and Cancun airports all use 30-, 60- and 120-minute drive-time definitions. More complex definitions may make distinctions between drive time and public transport time. With such definitions, improvements in the road infrastructure or the quality of public transport may change the catchment area. Alternatively, a distance criterion may be used, for instance 100 km for Dubrovnik airport, 250 km for Rome Fiumicino airport, and 10, 40 and 50 miles for Dublin airport.

Whilst using an isochrone is a common and relatively straightforward approach to adopt, it is worth noting that it has been criticised, for example by Lieshout (2012), because it rather ignores the driving forces behind passenger airport choice. Ideally airport operators need to take into account the willingness of passengers to travel certain times or distances to or from the airport and the nature and purpose of their journey. For instance, more time-sensitive business passengers will tend to demand shorter travel times than leisure passengers, while long-haul (or perhaps international) travellers are likely to be less concerned with this element of travel time compared with short-haul (or perhaps domestic) travellers, as it accounts for a smaller share of their overall journey time.

Once the catchment area has been defined using whatever approach is considered appropriate, the level of air travel demand needs to be estimated. This will depend on factors such as the economic, business and tourist activity within the area, the demographic characteristics of the residents, and past immigration patterns. However, this level of demand will be only a hypothetical maximum measure of the traffic-generating power of the area, as it will fail to take account of nearby competitor airports and the impact such airports will have on potential traffic volumes. In reality, many airports have overlapping catchment areas and so potential passengers within these areas will make their choice of airport dependent on a number of factors, including fare levels, service levels (frequency, or whether the service is nonstop or connecting), preferred airlines, parking and so on. For short-haul travel to popular destinations, there may be significant competition from other airports and so catchment areas will probably overlap considerably, whereas this may not be the case for less popular or longer-distance destinations. Overlap typically occurs with regional airports or when there is more than one airport serving a major city. The larger the overlap of the two catchment areas, the higher the likelihood that the two airports will compete directly for the same passengers. In fact the notion of catchment areas for large capital city airports is not generally so applicable, as in many cases these airports may offer the only link to the destination under question in the whole country.

When traffic is lost or diverted away from its 'natural' catchment area to another airport, due to factors including insufficient airline capacity or frequencies, higher air fares, or a lack of non-stop services at the airport in question, this is defined as traffic leakage. Reverse leakage is the opposite situation, when passengers will use a given airport even though they have not been directly associated with its catchment area. A number of LCCs have been particularly successful in attracting passengers from outside catchment areas and causing leakages because of the lower prices that they offer. This has been especially the case with leisure passengers because of the lower value of their own time. For example, Dennis (2007) described how Stansted originally operated as a regional airport for East Anglia, but has now been transformed into a major airport serving the London area. Another example cited is Charleroi, where only 16 per cent of Ryanair passengers resident at the Charleroi end of services come from the natural catchment area of the airport. However, Dennis also observes how demand levels can contract as the provision of low-cost services increases – giving the example of the low-cost services to Barcelona from East Midlands that began in 2002, but two years later had competing services from the nearby airports of Leeds/Bradford, Birmingham and Manchester. Pantazis and Liefner (2006) also observed how LCCs have caused reverse leakage at Hanover airport.

The airport operator needs to estimate these leakages when going through the route-development process. However, the problem with most sources of traffic data is that they do not normally show the true origin and/or destination of a passenger, as they will not take into account leakage when passengers have travelled out of their way to another airport to reach the same destination. While the data will include passengers who are connecting at both ends, they will not count passengers who have flown indirectly between the two points. This leakage problem may be partly overcome by using airport survey data for neighbouring airports. However, these data exist only for some countries, such as the UK, and additionally will not help identify indirect passengers. For these reasons, booking data are often used. There are two major sources: market information data tapes that come from the global distribution systems (including Sabre and Amadeus) used by high street and online travel agents; and billing and settlement plan data from IATA and its accredited travel agents.

However, there are a number of shortcomings with these data. They do not cover tickets sold through direct distribution channels including airline call centres and internet sites, and so do not provide complete coverage – particularly with the trend towards more direct selling. LCCs will be especially unrepresented and also charter activity is not covered. Therefore the total market size may have to be estimated, typically by using schedule data but most of the major databases, such as Sabre's Airport Data Intelligence or IATA's PaxIS will provide these estimates. Also, with the booking data it is assumed the place of issuing the ticket represents the passenger's residency, but now in many cases travel agencies process bookings through a centralised office that will invalidate this assumption. Also, the cost of obtaining such information may be beyond the reach of the marketing department budgets of many small airports.

Once the airport operator has assessed the market within its catchment area and the associated leakages, it can determine the adequacy of air services at the airport and identify routes that are not served satisfactorily. By weighing up the factors that passengers take into account when considering different flight and airport options, including air fares, frequencies and schedules and accessibility of the airport (in terms of cost and time), the airport operator can estimate the likely market share of new services to and from the airport. There is a statistical tool called the quality service index (QSI) that airports may use, which estimates passenger behaviour by quantifying the relative attractiveness of different flight options. It has traditionally been used by airlines when assessing their networks, but a number of airports have chosen to develop their own QSI models. The future demand for the route can then be estimated, typically by taking into account key drivers of demand including income, population, propensity to travel and journey purpose. The airport operator subsequently can identify which airline would be most suitable to operate the route, and perhaps undertake a financial and operational feasibility assessment of the route that can be discussed with the airline, either at a formal presentation or through physical or electronic route development networks. However, ASM (2016) recommended against a full financial assessment, suggesting instead a presentation of revenue projections, arguing that airlines will know their cost base better than the airport. It also advised against focusing too much on the airport and its plans for development, reasoning that it is the market that drives the airline choice and in addition development plans may be costly. It is the promotion of the destination rather than the airport that is more important and hence this is why ASM contended that route development is the responsibility not just of airlines and airports, but also tourism authorities, calling the relationship between these three the route development golden triangle.

Typically at a 5–30 million passenger airport, market research will be one of three functions, the other two being sales and account management, and the marketing management, with all three departments reporting to a Head of Route Development. The overall route development team is likely to contain around 5–15 employees. The sales team will be experts in negotiation and bringing in new airlines, whilst the marketing team will aim to build awareness and passenger numbers. Alternatively, responsibility can be divided up geographically to enable a greater understanding of specific markets, which is often undertaken at large airports (ASM, 2016). Through time route development teams have become much more professional with more experienced personnel (Leigh, 2015).

Digital marketing

As in most other industries, the development of new technologies and in particular digital forms of communication such as via the internet, mobile and social media has had a very significant impact on airport marketing (Halpern, 2016). As discussed in previous chapters, the growing digital connectivity of passengers has provided opportunities to engage with passengers before, during and after their trips. This has the potential to enhance their experience and increase their non-aeronautical spend. At the most basic level most airports now have their own website, and an increasing number have developed their own mobile website or apps designed to run on smartphones and tablets, as well as communicating intensively with social media.

Initially, as airports started to develop their websites, most of the information was aimed at passengers, and while airport websites now have additional roles, this continues to be an important feature. This includes airport location details, car parking and local transport information, with perhaps opportunities for pre-booking car parking space or buying public transport tickets online. Real-time flight information, flight delay details and check-in requirements are usually provided. There will also often be a list of the commercial facilities, including shops and F&B, perhaps with pre-ordering possibilities (see Chapter 7). Tourist and other information and travel tips about the airport's catchment area might be included. There may also be links to airlines and other products including car hire, hotels and tourist boards. There may even be the possibility to book flights directly, with the website acting as a distribution channel itself.

However, information provision for passengers is just one role of the airport website. It also provides aviation information for trade customers such as airlines, GA, freight forwarders and tour operators. This will include technical and facilities information, traffic data, airport charges, details of incentive schemes and marketing support, and perhaps market research information related to the catchment area and potential demand which can be used to investigate route development opportunities. Details about customs requirements and handling and warehousing facilities available to cargo customers can also be provided. Moreover, airports are increasingly turning their attention to the non-aviation business opportunities that the airport website may offer. This includes selling advertising space, hiring out meetings facilities, providing details of property and real estate services, and listing other commercial and consultancy services the airport may offer.

The final main role of the airport website is in using it as a platform for corporate communications to inform and develop good relations with a number of different stakeholders including local residents, local businesses, shareholders, employees and the media. Local residents may be able to find out about achievements in environmental protection or social responsibility areas. Shareholders can track the performance of their shares and have instant access to the airports' financial reports. Employees may be able to explore career and training opportunities.

Halpern and Regmi (2013) undertook a survey of European airports to assess the content of their websites and found that most of these focus on the passenger. In general, while passenger information and corporate communications were provided by all airports, non-aviation business areas were only covered by 46 per cent of airports. In addition, 60 per cent of airports provided technical information for airlines and only 41 per cent gave details about airport charges. However, it is important to note that this data are rather dated now, given the rapid speed of technology changes, but no up-to-date picture was available. Many airports have developed their websites for mobile use as well, which are designed for easier navigation for smaller screens. Martin-Domingo and Martin (2015) observed that the time of adoption of such mobile websites and their degree of maturity has had a significant impact on the level of innovation that has occurred.

Unlike a mobile website that is accessed through a web browser, a mobile app is a dedicated application designed for a smartphone or tablet. It provides the airport with a greater control over the passenger experience with developing a more personal relationship, but requires passengers to download and store the app. It can offer services such as navigation (e.g. interactive map wayfinding), notification of flight status (e.g. check-in, boarding, disruption), notification about airport status (e.g. security wait times, local traffic), personalised information services (e.g. loyalty programmes), customer relationship management (e.g. complaints, compliments), passenger surveys and focus groups, and access to lounges, transit and other secure areas. Figure 8.3 shows that in a survey of around 230 global airports in 2017, the majority of airports are offering, or plan to offer in the next three years, all these services with navigation, flight/airport status and customer relationship management being the most popular. Table 8.15 provides a more detailed breakdown of services provided on airport apps ranked by passenger access, although it is less up to date. Again, services such as flight status and wayfinding were popular. As discussed in previous chapters, the use of such apps can potentially improve satisfaction and enhance the passenger experience (Inversini, 2017; Florido-Benítez *et al.*, 2016), especially with the use of sensors and beacons to allow more personalised services. In addition, wearable technology, such as glasses and watches, is likely to play a significant role in the future, as is already the case at airports such as Dubai, Milan Malpensa/Linate, Amsterdam and Dallas Fort Worth, which have a smartwatch app.

An increasing number of airports communicate with social media. If used effectively this allows the airport to interact with users rather than just providing information or selling services (Nigam *et al.*, 2011). Opportunities exist in a number of areas, including contingencies and reputation management; passenger flow/customer service communications; passenger engagement; retail enablement; customer loyalty; destination marketing and business intelligence (ACI Europe, 2014b). Hence in recent years airports, like most other organisations, are increasingly using social media to market to their customers. Halpern (2012) investigated the use of social media at 1,559 airports worldwide, considering four main categories. These were social networking sites including Facebook and Google+, blogs (e.g. airport's own blog or Twitter), professional business networking sites (e.g. LinkedIn, XING) and content communities where multimedia information is shared (e.g. YouTube, Flickr).

In a 2012 study by ACI Europe, five main uses of social media were identified: corporate communications as a tool to raise awareness; crisis communications to communicate

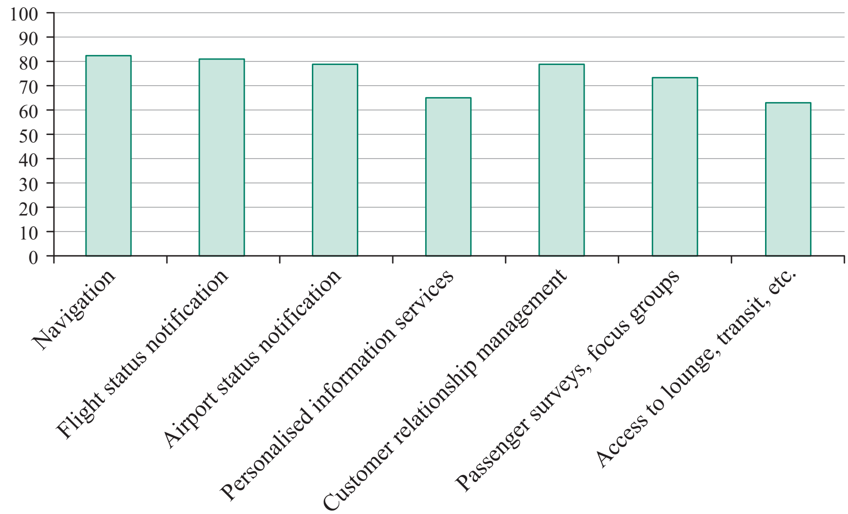

Figure 8.3

Airport use or planned (in the next three years) passenger mobile services, 2017 (%)

Source: Adapted from SITA (2017)

Table 8.15 Services available on airport apps

Ranking of passenger access	Service
1	Live arrivals/departure information
2	Wi-Fi information
3	Shop and F&B information
4	Wayfinding
5	Parking information
6	Public transport schedules
7	PRM information
8	Lost and found
9	Pre-book/purchasing of car parking
10	Ability to personalise
11	Passenger rights information
12	Information for families

Ranking of passenger access	Service
13	Social media links
14	Security regulations
15	Currency converter
16	Live security queueing time
17	Live request/enquiry

Source: Adapted from ACI Europe (2015b)

quickly and directly during times of crisis; commercial promotion to sell products and services; informal engagement to build relationships with customers; and customer service to act as a virtual customer service desk. In an update to the study in 2015 (ACI Europe, 2015b), three additional activities were identified, namely crowdsourcing, media relations and political campaigning. Table 8.16 summarises these. The study found that 289 European airports were present on Facebook (representing 86 per cent of European passenger traffic) and there were 292 official airport Twitter accounts (representing 87 per cent of traffic). Thirty-eight airports used Instagram, 141 used YouTube, 77 used Google+, 12 used Pinterest, and 18 used LinkedIn, but considerably more airports are likely to be using social media communications now.

Wattanacharoensil and Schuckert (2015) found extensive use of Facebook for five roles, which they defined as promotion, providing information, product distribution, research and surveys, and airport management, when they researched 10 major airports in Asia, Europe and Canada. However, they emphasised the need for an effective social media strategy, which was lacking with some of the airports, and indeed this was also a point argued by Malinowski (2016).

Numerous examples of different and imaginative social media initiatives exist. VanAuken (2014–15) discussed how a very important way that airports can use social media is to promote airline services in both informing their communities about the new services and in providing accessible links to the airline's website to make it easy to book flights. At her airport (Akron-Canton), when Southwest started services, their new service campaign included an inaugural 'flight countdown', an online contest (with 7,200 entries) 'Party with Southwest & Win', and a 'Super Social Super Fan party on the tarmac' (covering real-time filming, tweeting and Facebooking of the new flight, a social sharing photo-booth and a muffin top pie eating content with videos and photos posted on the social networks. Perry *et al*. (2014) provided many more examples in the United States. Another campaign to promote a non-stop service from Eugene, Oregon to Palm Springs, California was run by Eugene airport. Part of the campaign included placing 2,000 golf balls, including the winning orange ball, on tees in four separate locations in Eugene and

Table 8.16 The uses of social media at airports

Use	Examples
Corporate communications	Annual reports, infographics, CEO speeches
Crisis communications	Weather status, disruption in processes, airport closure
Commercial promotions	Special events, product promotions
Relationship building	Competitions, campaigns, reports on minor events
Customer service	Q&A, lost and found, wayfinding
Crowdsourcing	Researching new route development plans and new retail brands
Media relations	Direct messaging with journalists
Political campaigning	Raising awareness of key issues, reaching out to residents/public

Source: Adapted from ACI Europe (2015b)

neighbouring areas. After the golf balls were placed, four clues were posted on Facebook between 8:00 a.m. and 10:30 a.m., with an announcement of the winner posted by 1:00 p.m. Likewise, with a new flight between Boston Logan and Paris, passengers were asked to submit a short video of what it meant to be an American in Paris and the winning video won a free trip. Similarly, Los Angeles airport had a major social media campaign to inform communities of the new Tom Bradley International terminal that included frequent posts with construction photos, a 3D tour of the completed terminal, and invitations to the opening, with a contest for 'out-of-the box' ribbon cutting ideas to create a spectacular, cost-effective grand opening.

Outside the airport, if there is a major event occurring, the airport can run parallel marketing campaigns. For example, in Ireland in 2013 there was a year-long national tourism initiative called 'The Gathering' to celebrate Irish culture. To coincide with this, DAA launched 'The Big Welcome' competition, which offered winners the opportunity to fly friends or family home to Ireland and stay in a unique Irish heritage property. A YouTube video was used to announce the five winners.

Hernandez (2015) emphasised how important it was to engage the community with positive and happy posts. At her airport (Grand Rapids), she explained how this had been achieved with events, such as handing out flowers on Mother's Day, goodie bags for returning military members, and free photos with Santa, which were cheap to organise but had a wide appeal on social media. Another way of generating interest is Charleston

Yeager airport's initiative – frequently posting pictures of unique aircraft spotted at the airport. They have also posted a sighting of the Despicable Me blimp.

Crowdsourcing is an interesting technique to use. The Finnish airport authority Finnavia has used this in co-operation with Finnair for passengers to report new innovations with an initiative called Quality Hunters. Likewise, Copenhagen has had a crowdsourcing platform called CPH Ideas, where passengers and others can put forward their ideas, users can then vote on these, and the ones with the most votes may be incorporated into future developments at Copenhagen. Similar examples include Boston Logan, which invited the community to vote for a colour scheme for a new terminal connector. To engage passengers, Tucson airport ran the 'Name Me' campaign, which involved choosing a name for an animated character (Les Stress) at the airport.

CASE STUDY 8.3
COMPETITION AND MARKETING ISSUES AT THE IRISH AIRPORTS

There have been a number of interesting competition and marketing issues at the Irish airports that make it a valid case study. In 1937, the Irish state-owned company Aer Rianta was established as a holding company for the national carrier Aer Lingus. It also took control of Dublin airport, with this becoming a statutory responsibility in 1950. Then in 1969 it also took over the management of Cork and Shannon airports, and in 1988 ARI was established to pursue international projects (see Chapter 6). The three airports handle over 95 per cent of all air traffic to, from and within the Irish Republic, and Dublin airport accounts for around 80 per cent of all the traffic of the three airports. Traffic rose rapidly in the late 1990s, very much helped by the economic boom that was occurring at the time (McLay and Reynolds-Feighan, 2006).

During these early years, Aer Rianta had one of the most complex published discount schemes in existence at the time. The airport operator gave discounts on new routes and growth on existing routes, which reduced over time. In the initial years, airlines could be paying as little as 10 per cent of the standard landing and passenger charge. Various airlines, especially Ryanair, benefited significantly from this scheme – particularly because of the short-haul nature of their services and the price sensitivity of its leisure passengers. However, Aer Rianta terminated their discount scheme at the end of 1999, largely in preparation for the demise of EU duty- and tax-free sales. This was greeted with considerable opposition from the airlines, particularly Ryanair, which announced it would abandon any new route development from Dublin. As a consequence the Commission for Aviation Regulation was established in 2001 and the level of fees at Dublin are now controlled with an RPI-*X* single-till approach. However, the level of fees has continued to be a very controversial area, with both the airport operator and the airlines at various times being critical of the Regulator's decisions. After 9/11, new discount schemes were introduced to stimulate new routes, and they are still in existence today.

For a number of years there has also been the issue of the second terminal at Dublin. Before this was built, Ryanair argued that it should have the right to run its own separate terminal rather than to put up with what it claimed to be the costly and inefficient operation of Aer Rianta, which had led to the unjustified high charges. Partly as a result of this pressure and because of the need for extra capacity due to the high growth rates, in 2002 the Irish government asked for expressions of interest from organisations that might wish to develop an independent/competing terminal at Dublin airport. Thirteen companies responded, including international airport groups and airlines. The government appointed an independent panel to scrutinise these proposals and advise on the feasibility of the concept, and in 2003 this panel decided in favour of an independent terminal. It concluded that this could bring effective competition at Dublin through increased capacity and quality of service (Department of Transport, 2003).

This was followed by the Irish government approving the building of a new terminal in 2005 which would be commissioned by the DAA and would have a tender process to select an operator for the new terminal. So although the principle of the second terminal being operated on a competitive process was accepted, the recommendation of the panel of 2003 to also have this terminal designed, built and owned separately was not adopted. While DAA welcomed this decision, Ryanair opposed it, claiming this would mean the terminal would be too costly and badly designed. There were a number of appeals, but eventually the terminal was opened in 2010.

Another key issue has been the group state ownership. While privatisation has been discussed at various times, this option has not become a reality although the operator has become much more commercial in its outlook (Cahill *et al.*, 2017). However, a less radical move was introduced by the State Airports Act of 2004 which created the DAA to replace Aer Rianta and also established new authorities for Shannon and Cork. The split was welcomed by a number of the airlines, but was heavily criticised by management and the trade unions who feared it would weaken the company and lead to job losses in Cork and Shannon. These two airports formed separate boards of directors, but it was not until the end of 2012, after a considerable amount of debate, that Shannon airport was separated from DAA and made a separate state entity (Shannon Airport Authority). Traffic at Shannon airport had fallen from 3.6 million in 2007 to 1.6 million in 2011. Cork airport remains under the direct control of DAA. All airports suffered considerably during the global economic recession of the late 2000s but traffic has since recovered. Shannon airport handled 1.7 million passengers in 2016 and Dublin recorded a record 27.9 million passengers. A second runway is planned with the support of Ryanair, although in 2017 the construction was delayed because of legal and planning issues.

As regards the current discount schemes, it is interesting to compare Cork and Shannon airport (Table 8.17). At both airports there are annual discounts for new long-haul and short-haul routes, but whereas Cork airport offers a discount on all charges, instead Shannon airport now has an all-inclusive charge by passenger. Additional marketing support is also offered at Cork depending on certain criteria shown in Table 8.18 for short-haul routes. Using these criteria a new route can be categorised as one of three bands (1, 2 and 3) with different marketing support available. Shannon airport has a similar approach although the marketing support is available for two years rather than one.

Table 8.17 Airport charges incentives and marketing support at Cork and Shannon airports, 2017

	Cork	Shannon
New routes short-haul	All charges discount Year 1: 100% Year 2: 80% Year 3: 60% Year 4: 40% Year 5: 20%	All-inclusive charge per passenger Year 1: €0 Year 2: €0 Year 3: €1 Year 4: €1.50 Year 5: €2
New routes long-haul	Charges discount Year 1: 100% Year 2: 90% Year 3: 75% Year 4: 50% Year 5: 25%	All-inclusive charge per passenger Year 1: €0 Year 2: €1.20 (Apr–Oct), €0.30 (Nov–Mar) Year 3: €3 (Apr–Oct), €0.75 (Nov–Mar) Year 4: €6 (Apr–Oct), €1.50 (Nov–Mar) Year 5: €9 (Apr–Oct), €0.2.25 (Nov–Mar)
Marketing support short-haul	Year 1: Band 1 <€34,999; band 2< €59,999; band 3 €150,000 and over	Year 1: Band 1 <€50,000; band 2< €100,000; band 3 €150,000 and over Year 2: Band 1 <€30,000; band 2< €60,000; band 3 €100,000 and over
Marketing support long-haul	Year 1: Band 1 <€199,000; band 2< €299,999; band 3 €300,000 and over Year 2: Band 1 <€49,999; band 2< €149,999; band 3 €150,000 and over	Year 1: Band 1 <€200,000; band 2< €300,000; band 3 €300,000 and over Year 2: Band 1 <€50,000; band 2< €150,000; band 3 €150,000 and over

Source: Compiled by author from various sources

Table 8.18 Cork airport marketing support development criteria (short-haul operations), 2017

Weighting	Criterion
1	Network development potential (new, key developing market or existing market)
2	Route detail (EU or non-EU)
3	Capacity origin (new or redeployment)
4	Country (served or not)
4	Commercial revenue potential (high or medium)
4	Aircraft capacity (>170, 101–169, 50–100, 0–49 seats)
4	Tourism potential (high, medium, low)
4	Availability of new route (annual, seasonal)
5	Route (new or existing)
6	Operator commitment to Cork (high, medium, low, predatory route, entry)

Source: Adapted from DAA (2016)

References

Accent (2011) *2131 Consumer Research*, London: Accent.
ACI Europe (2014a) *Competition in the European Aviation Sector*, Brussels: ACI-Europe.
ACI Europe (2014b) *Guidelines for Passenger Services at European Airports*, Brussels: ACI Europe.
ACI Europe (2015a) *Airport Charges Survey 2014*, Brussels: ACI Europe.
ACI Europe (2015b) *Digital Report 2014–2015*, Brussels: ACI Europe.
Albalate, D., Bel, G. and Fageda, X. (2015) 'Competition and cooperation between high-speed rail and air transportation services in Europe', *Journal of Transport Geography*, 42: 166–74.
ASM (2016) *The Fundamentals of Route Development*, Manchester: ASM.
Aviation Strategy (2001) 'Ryanair, just too good a negotiator', *Aviation Strategy*, July–August: 3.
Başar, G. and Bhat, C. (2004) 'A parameterized consideration set model for airport choice: An application to the San Francisco Bay area', *Transportation Research Part B: Methodological*, 38(10): 889–904.
Bilotkach, V. and Mueller, J. (2012), 'Supply side substitutability and potential market power of airports: Case of Amsterdam Schiphol', *Utilities Policy*, 5–12.

Bilotkach, V., Mueller, J. and Németh, A. (2014) 'Estimating the consumer welfare effects of de-hubbing: The case of Malév Hungarian Airlines', *Transportation Research Part E: Logistics and Transportation Review*, 66: 51–65.

Bonnefoy, P., de Neufville, R. and Hansman, J. (2008) 'Evolution and development of multi-airport systems: A worldwide perspective', *Journal of Transport Engineering*, 136(11): 1021–29.

Bush, H. (2009) 'The development of competition in the UK airport market', *Journal of Airport Management*, 4(2): 114–24.

CAA (2008) *Economic Regulation of Heathrow and Gatwick Airports*, London: Civil Aviation Authority.

CAA (2011) *Guidance on the Assessment of Airport Market Power*, London: Civil Aviation Authority.

CAA (2014a), *Market Power Determination in relation to Heathrow Airport – Statement of Reasons* CAP 1133, London: CAA.

CAA (2014b), *Market Power Determination in relation to Gatwick Airport – Statement of Reasons,* CAP 1134, London: CAA.

CAA (2014c), *Market Power Determination for Passenger Airlines in relation to Stansted Airport – Statement of Reasons,* CAP 1135, London: CAA.

Cahill, C., Palcic, D. and Reeves, E. (2017) 'Commercialisation and airport performance: The case of Ireland's DAA', *Journal of Air Transport Management*, 59: 155–63.

Cambridge Economic Policy Associates (2010) *The Extent to which Airlines' Interests are Aligned with those of Passengers*, Cambridge: CERA.

Castillo-Manzano, J.I., Pozo-Barajas, R. and Trapero, J.R. (2015) 'Measuring the substitution effects between high speed rail and air transport in Spain', *Journal of Transport Geography*, 43: 59–65.

Competition and Markets Authority (2016) *BAA Airports: Evaluation of the Competition Commission's 2009 Market Investigation Remedies,* London: Competition and Markets Authority.

Competition Commission (2009) *BAA Airports Market Investigation*, London: Competition Commission.

DAA (2016) *Cork Airport Route Support Scheme (RSS) Short Haul Operations: Valid from 1st January 2017*, Dublin: DAA.

Dennis, N. (2007) 'Stimulation or saturation? Perspectives on the European low cost airline market and prospects for growth', *Transportation Research Record: Journal of the Transportation Research Board*, 2007: 52–59.

Department of Transport (2003) *Dublin airport – Review of expressions of interest for an independent terminal – Panel report to Minister for Transport*, Dublin: Department of Transport.

Department for Transport (2008a) *Decision on the Regulatory Status of Manchester Airport*, London: Department for Transport.

Department for Transport (2008b) *Decision on the Regulatory Status of Stansted Airport*, London: Department for Transport.

Department for Transport (2009) *Reforming the Framework for the Economic Regulation of Airports Decision Document*, London: Department for Transport.

De Wit, J.G. and Zuidberg, J. (2016) 'Route churn: an analysis of low-cost carrier route continuity in Europe', *Journal of Transport Geography*, 50: 57–67.

Dobruszkes, F., Dehon, C. and Givoni, M. (2014) 'Does European high-speed rail affect the current level of air services? An EU-wide analysis', *Transportation Research Part A: Policy and Practice*, 69: 461–75.

Dobruszkes, F., Givoni, M. and Vowles, T. (2017) 'Hello major airports, goodbye regional airports? Recent changes in European and US low-cost airline airport choice', *Journal of Air Transport Management*, 59: 50–62.

Dziedzic, M. and Warnock-Smith, D. (2016) 'The role of secondary airports for today's low-cost carrier business models: The European case', *Research in Transportation Business & Management*, 21: 19–32.

EC (2004) *Commission's Decision of 12 February 2004 concerning Advantages Granted by the Walloon Region and Brussels South Charleroi Airport to the Airline Ryanair in Connection with its Establishment at Charleroi*, OJ L 137, 30 April.

EC (2014) *Communication from the Commission: Guidelines on State aid to Airports and Airlines*, Official Journal C99, 4 April.

FAA (2010) *Air Carrier Incentive Program Guidebook: A Reference for Airport Sponsors*, Washington, DC: FAA.

Fichert, F. and Klophaus, R. (2011) 'Incentive schemes on airport charges – theoretical analysis and empirical evidence from German airports', *Research in Transportation Business and Management,* 1(1): 71–77.

Florido-Benítez, L., Alcázar Martínez, B. and Gonzalez Robles, E.M. (2016) 'Analysis of the impact of mobile marketing on passenger experience and satisfaction at an airport', *International Journal of Innovation, Management and Technology*, 7(1): 8–15.

Forsyth, P. (2006) 'Airport competition: regulatory issues and policy implications', in Lee, D. (ed.), *Competition Policy and Anti-Trust*, Oxford: Elsevier.

Forsyth, P., Gillen, D., Mueller, J. and Niemeier, H.-M. (eds) (2010) *Airport Competition*, Farnham: Ashgate.

Freathy, P. and O'Connell, F. (2000) 'Market segmentation in the European airport sector', *Marketing Intelligence and Planning*, 18(3): 102–11.

Gardiner, J., Ison, S. and Humphreys, I. (2005) 'Factors influencing cargo airlines' choice of airport: an international survey', *Journal of Air Transport Management*, 11(6): 393–99.

Graham, A. (2006) 'Competition in airports', in Papatheodorou, A. (ed.), *Corporate Rivalry and Market Power: Competition Issues in the Tourism Industry*, London: I.B. Tauris.

Halpern, N. (2012) 'Use of social media by airports', *Journal of Airline and Airport Management,* 2(2): 66–84.

Halpern, N. (2016) 'Air transport marketing', in Ison, S. and Budd, L. (eds), *Air Transport Management: An International Perspective*, Abingdon: Routledge.

Halpern, N. and Graham, A. (2013) *Airport Marketing*, Oxford: Routledge.

Halpern, N. and Graham, A. (2015) 'Airport route development: A survey of current practice', *Tourism Management*, 46: 213–21.

Halpern, N. and Graham, A. (2016) 'Factors affecting airport route development activity and performance', *Journal of Air Transport Management*, 56: 69–78.

Halpern, N. and Regmi, U. (2011) 'What's in a name? Analysis of airport brand names and slogans', *Journal of Airport Management*, 6(1): 63–79.

Halpern, N. and Regmi (2013) 'Content analysis of European airport websites', *Journal of Air Transport Management*, 26: 8–13.

Hermann, N. and Hazel, B. (2012) *The Future of Airports: Part 1 – Five Trends That Should Be on Every Airport's Radars*, New York: Oliver Wyman.

Hernandez, T.M. (2015) 'Enhancing the travel experience and delivering great customer service at Gerald R. Ford International Airport', *Journal of Airport Management*, 9(1): 30–35.

Hess, S., Adler, T. and Polak, J.W. (2007) 'Modelling airport and airline choice behaviour with the use of stated preference survey data', *Transportation Research Part E: Logistics and Transportation Review*, 43(3): 221–33.

Hess, S. and Polak, J.W. (2006) 'Exploring the potential for cross-nesting structures in airport-choice analysis: A case-study of the Greater London area', *Transportation Research Part E: Logistics and Transportation Review*, 42(2): 63–81.

Humphreys, I. (1999) 'Privatisation and commercialisation: changes in UK airport ownership patterns', *Journal of Transport Geography*, 7(2): 121–34.

IATA (2013) *Airport Competition*, IATA Economics Briefing No 11, Geneva: IATA.

Inversini, A. (2017) 'Managing passengers' experience through mobile moments', *Journal of Air Transport Management*, 62: 78–81.

Jarach, D. (2005) *Airport Marketing: Strategies to Cope with the New Millennium Environment*, Farnham: Ashgate.

Jones, O., Budd, L. and Pitfield, D. (2013) 'Aeronautical charging policy incentive schemes for airlines at European airports', *Journal of Air Transport Management*, 33: 43–59.

Karamanos, G. (2014) 'Adding Value', *Airport World*, 13 March. Online. Available at http://www.airport-world.com/features/marketing-communications/3756-adding-value.html (accessed 20 June 2017).

Kotler, P., Armstrong, G. and Harris, L. (2017) *Principles of Marketing*, 7th European edn, New York: Pearson.

Kramer, L., Fowler, P., Hazel, R., Ureksoy, M. and Harig, G. (2010) *ACRP Report 28: Marketing Guidebook for Small Airports,* Washington, DC: Transportation Research Board.

Leigh, R. (2015) 'Key tips for airport route development'*, Aviation Economics*, 8 April. Online. Available at http://www.aviationeconomics.com/NewsItem.aspx?title=Key-tips-for-airport-route-development (accessed 30 June 2017).

Lieshout, R. (2012) 'Measuring the size of an airport's catchment area', *Journal of Transport Geography*, 25: 27–34.

Lieshout, R., Malighetti, P., Redondi, R. and Burghouwt, G. (2016) 'The competitive landscape of air transport in Europe', *Journal of Transport Geography*, 50: 68–82.

Malighetti, P., Paleari, S. and Redondi, R. (2016) 'Base abandonments by low-cost carriers', *Journal of Air Transport Management*, 55: 234–44.

Maertens, S. (2012) 'Estimating the market power of airports in their catchment areas – a European-wide approach', *Journal of Transport Geography*, 22: 10–18.

Malina, R., Albers, S. and Kroll, N. (2012) 'Airport incentive programmes: a European perspective', *Transport Reviews*, 32(4): 435–53.

Malinowski, H. (2016) 'The profession of being social: Developing an effective and purposeful social media strategy for an airport', *Journal of Airport Management*, 10(3): 245–52.

Martin, S.C. (2008) *ACRP Report 18: Passenger Air Service Development Techniques,* Washington DC: Transportation Research Board.

Martin-Domingo, L. and Martin, J.C. (2016) 'Airport mobile internet an innovation', *Journal of Air Transport Management*, 55: 102–12.

Martin-Domingo, L. and Martin, J. C. (2015) 'Airport surface access and mobile apps', *Journal of Airline and Airport Management*, 5(1): 1-17.

McLay, P. and Reynolds-Feighan, A. (2006) 'Competition between airport terminals: the issues facing Dublin airport', *Transportation Research Part A*, 40(2): 181–203.

Mohammed, A. and Roisman, R. (2017) *2015 Washington-Baltimore Regional Air Passenger Survey*, Washington DC: The National Capital Region Transportation Planning Board.

Morrell, P. (2010) 'Airport competition and network access: a European Analysis', in Forsyth, P., Gillen, D., Mueller, J. and Niemeier, H.-M. (eds), *Airport Competition*, Farnham: Ashgate.

Neto, C.M.D.S.P., Casagrande, P.L., Lancieri, F.M. and Moraes, J.N.P. (2016) 'Pro-competition rules in airport privatization: International experience and the Brazilian case', *Journal of Air Transport Management*, 54: 9–16.

Nice Cote d'Azur airport (2017) *Airport Public Services Charges: Applicable from 1 January 2017*, Nice: Nice Cote d'Azur airport.

Nigam, S., Cook, R. and Stark, C. (2011) 'Putting the joy back into the airport experience: can social networking platforms make a genuine contribution to increasing commercial revenues and engaging customers?', *Journal of Airport Management,* 6(1): 7–11.

Oxera (2017) *The Continuing Development of Airport Competition in Europe*, London: Oxera.

Pantazis, N. and Liefner, I. (2006) 'The impact of low-cost carriers on catchment areas of established international airports: the case of Hanover airport, Germany', *Journal of Transport Geography*, 14(4): 265–72.

Parrella, B. (2013) *ACRP Synthesis 98 Understanding Airline and Passenger Choice in Multi-Airport Regions,* Washington DC: Transportation Research Board.

Paternoster, J. (2012) 'Great Expectations', *Airport World*, 10 October. Online. Available at http://www.airport-world.com/item/1916-great-expectations (accessed 20 June 2017).

Pels, E., Nijkamp, P. and Rietveld, P. (2001) 'Airport and airline choice in a multiple airport region: an empirical analysis for the San Francisco Bay Area', *Regional Studies*, 35(1): 1–9.

Perry, J., Oana, D. and Amit, L. (2014) *ACRP Synthesis 56 Understanding the Value of Social Media at Airports for Customer Engagement,* Washington DC: Transportation Research Board.

Polk, A. and Bilotkach, V. (2013) 'The assessment of market power of hub airports', *Transport Policy*, 29: 29–37.

Prather, C.D. (2013) *ACRP Synthesis 41 Conducting Aeronautical Special Events at Airports,* Washington DC: Transportation Research Board.

Productivity Commission (2011) *Economic Regulation of Airport Services*, Canberra: PC.

Redondi, R., Malighetti, P. and Paleari, S. (2012) 'De-hubbing of airports and their recovery patterns', *Journal of Air Transport Management*, 18(1): 1–4.

Ryerson, M.S. (2017) 'Incentivize it and they will come? How some of the busiest U.S. airports are building air service with incentive programs', *Journal of American Planning Association*, 82(4): 303–15.

SITA (2017) *2017 Air Transport IT Trends Insights*, Geneva: SITA.

STRAIR (2005) *Air Service Development for Regional Development Agencies*, Brussels: STRAIR.

Sykes, W. and Desai, P. (2009) *Understanding Airport Passenger Experience*, London: Independent Social Research.

Thelle, M.H., Pedersen, T.T. and Harhoff, F. (2012) *Airport Competition in Europe*, Copenhagen: Copenhagen Economics.

Thelle, M.H. and la Cour Sonne, M. (2018) 'Airport competition in Europe', *Journal of Air Transport Management*, 67: 232-40.

Toms, M. (2004) 'UK regulation from the perspective of BAA plc', in Forsyth, P., Gillen, D., Knorr, A., Mayer, O., Niemeier, H. and Starkie D. (eds), *The Economic Regulation of Airports,* Farnham: Ashgate.

Urfer, B. and Weinert, R. (2011) 'Managing airport infrastructure', in Wittmer, A., Bieger, T. and Muller, R. (eds), *Aviation Systems: Management of the Integrated Aviation Value Chain,* Heidelberg: Springer.

VanAuken, K. (2014–15) 'Using social media to improve customer engagement and promote products and services', *Journal of Airport Management*, 9(2): 109–17.

Wattanacharoensil, W. and Schuckert, M. (2015) 'How global airports engage social media users: A study of Facebook use and its role in stakeholder communication', *Journal of Travel and Tourism Marketing*, 32: 656–76.

Wiltshire, J. (2018) 'Airport competition: Reality or myth?', *Journal of Air Transport Management*, 67, 241-8.

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9 The economic and social impact of airports

The wider picture

The focus of this book shifts in the next two chapters from the internal environment within which the airport operates to considering the wider consequences of the airport business. This chapter looks at the economic and social impact of airports, while Chapter 10 discusses the environmental effects. A key issue for any airport operator is how to optimise the economic potential of an airport while providing acceptable environmental protection. This may be a particular problem when the economic impacts of airport development may be perceived as being the most relevant within a regional or national context, whereas the negative environmental impacts may be hardest felt by the local community.

Many airports undertake an economic impact analysis (EIA) and they do this for a number of reasons. The overriding rationale tends to be to assess the overall economic significance of an airport, with such studies often being used in a public relations role to inform policymakers, airport users and the general public as to the economic value of airports. In addition, impact information may be used for lobbying purposes, to gain regulatory approval, for example for more direct services, or to justify subsidies for new services. EIA has also been used to support debates about strategic economic investment and to make the economic case for investment in new airport facilities or off-site infrastructure, including roads or rail links. The results of a survey in the United States found that the four most common reasons were: to measure the significance of the airport to the local economy; to justify airport investment/expansion; to measure the significance of the airport to specific industries; and to formulate economic development/planning initiatives (Hoyle, Tanner & Associates and RKG Associates, 2008). However, it is important to note that there are occasions when EIA has been inappropriately used, particularly to measure net economic benefits rather than impacts, as is discussed later in this chapter.

There are basically two types of economic impact at airports: first, the income, output, employment, capital investment and tax revenues that airport operations can bring by virtue of the fact that they are significant generators of economic activity; and second, the wider catalytic or spin-off benefits, including inward investment or the development of tourism, that can occur as a result of the presence of the airport. These can contribute to the economic development of the area surrounding the airport. Thus within an economic context airports have a role to play both by being a significant economic activity in their own right and by supporting business and tourism activity.

At the most basic level, a key indicator of an airport's economic impact is the number of jobs generated. This is the most readily understandable measure and can be used, albeit in a very simplistic manner, to determine an airport's relative importance within an economy. In addition, there are income/earnings and output indicators such as the contribution to gross value added or GDP. Indicators related to capital investment and tax revenues can also be considered.

Airports as generators of economic activity

Economic effects can be classified as direct, indirect and induced impacts. The direct or primary impact is the employment and income generated by the direct operation of the airport. This is the most obvious economic impact and the most easily measured. This impact is associated with the activities of the airport operator itself, the airlines, the concessionaires providing commercial facilities, the handling agents and other agencies that provide services such as ATC, customs and immigration and security. Some of these activities, including car parking, car hire, in-flight catering, freight forwarders and hotels, may be located off-site in the surrounding area of the airport.

However, the economic impact of an airport is not limited just to these direct, airport-related effects, although this is the impact that is most frequently quantified and studied. The role of the suppliers to the airport industry also needs to be considered. This requires an examination of the indirect impact, which is defined as the employment and income generated in the chain of suppliers of goods and services to the direct activities located both at and in the vicinity of the airport, i.e. backward flows within the aviation value chain. These types of activity include the utilities and fuel suppliers, construction and cleaning companies, and food and retail good suppliers. In addition, the impact that these direct and indirect activities have on personal spending also needs to be taken into account. This so-called induced impact can be defined as the employment and income generated by the spending of incomes by the direct and indirect employees on local goods and services, including retail, food, transport and housing, i.e. forward flows within the aviation value chain. The indirect and induced effects are together often known as the secondary effects (Figure 9.1).

These indirect and induced impacts are clearly much more difficult to measure, involving an understanding of how the airport interacts with other sectors within the economy. Their combined impact can be assessed by the economic multiplier. This concept takes account of the successive rounds of spending that arise from the stimulus of the direct impacts and assumes that one individual's or organisation's spending becomes another individual's or organisation's income in the next round. Some of the money spent on airport-related activities will be re-spent on purchases from suppliers of goods and services – the indirect effect – with a proportion of this leaking out of the economy as imports. Much of the remainder will be spent on labour or will go to the government in the form of taxes. The suppliers will then make purchases locally, import goods and

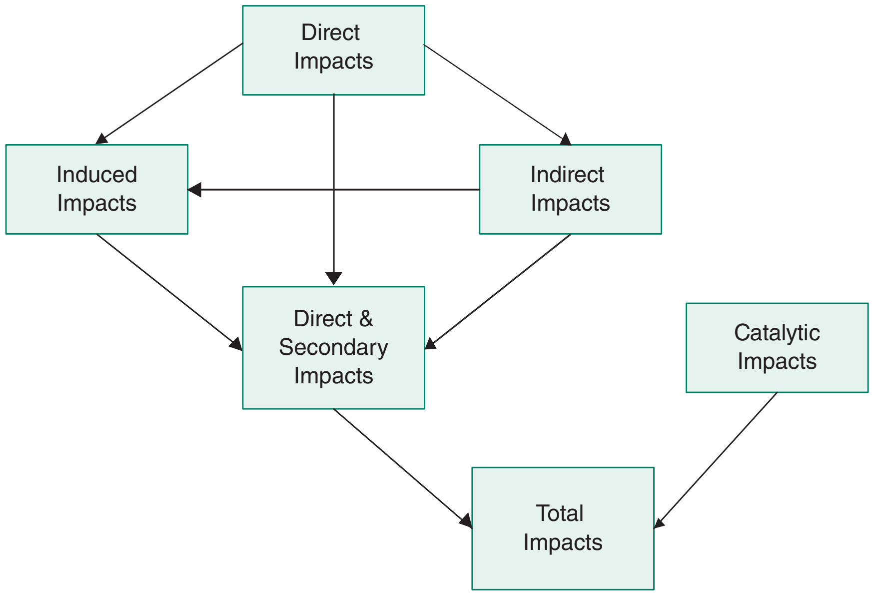

Figure 9.1
The economic impact of airports

services, distribute wages and salaries, and pay government taxes. During each round of spending a certain proportion of the money will accrue to local residents in the form of wages, salaries and profits. Some of this money will then be re-spent again, producing the induced effects. The rest will be saved and not recirculated within the economy. Eventually, the successive rounds of spending will become so small that they will be considered negligible. The multiplier analysis thus quantifies the economic value and jobs from the financial transactions that take place within any economy.

There will be new investment associated with these direct, indirect and induced activities in the form of airport facilities, IT systems, maintenance facilities, offices and so on. Airport activities can also have a significant impact on local, regional and national government revenues. Employees will pay income tax and sales transactions will be subject to sales or value-added taxes. Airports, particularly in the private sector, will probably also be subject to other taxes, including property or land taxes and business or corporation taxes. On one hand, some airports in the public sector may be exempt from these but may, on the other hand, pass over a considerable share of their profits to their government owners. In return, many government owners have traditionally allocated considerable public sector funds to aid airport development. Then there are the taxes collected through airport charges. These may be required to cover some specific airport services, including immigration and public health inspection, as in the United States, to provide funds for investment, including the US transportation tax, or just to boost public sector funds, as in the United Kingdom with the APD. Conversely, in the duty- and tax-free sales area of operation it can be argued that the airports and their passengers receive a direct tax subsidy.

Measuring the direct, indirect and induced impacts

Direct impacts

There are a number of different techniques, of varying levels of sophistication and accuracy, available to airports that want to measure their economic impacts. It needs to be noted that while many areas of airport management, including financial and operational performance, are monitored at least annually, the difficulties involved with assessing economic impacts, as well as the additional resources required, tend to mean that the data are collected less frequently. As a result, some of the examples provided below may not relate to the most up-to-date year.

Direct impacts are the easiest of all the impacts to measure. Employers at the airport can be asked to provide details of their employees, how much they earn and where they live. Information concerning purchases of goods and services, location of suppliers, revenues, expenditures and CAPEX also needs to be gathered. While such a process for on-site airport activities should not pose too many difficulties, the off-site data collection may be more difficult. First, a definition of ‘off-site’ needs to be established – a rule-of-thumb figure is an area within a 20-minute drive time. Then the relevant companies within this area need to be identified by taking into account the knowledge of the airport operator and other industry bodies and, perhaps, by direct visual inspection. Many airports regularly measure the direct economic impacts, particularly the employment effects. For example, at London Heathrow airport there is a full employment survey carried out every five years, supplemented by an annual or biennial survey that provides an overview of the size of the Heathrow workforce. The full survey is divided into two parts: an employer and an employee survey.

The direct employment at an airport will vary according to a combination of factors, including the volume and mix of passenger traffic, the amount of freight, and the actual capacity utilisation of the airport. The role of the airport also has to be considered, for example whether it is a major hub, whether it acts as a base for airline activity, and/or whether it provides other opportunities including office or other commercial development. Globally the Air Transport Action Group (ATAG, 2016) estimated that in 2014, of the 9.9 million jobs directly generated by the aviation industry, 0.45 million were employed by airport operators, in airport management, maintenance and security, and also there were 5.5 million other jobs on-site at airports – for example in retail outlets, restaurants, hotels and government border agencies. In addition, 2.7 million worked for airlines or handling agents, including flight crew, check-in staff and maintenance crew, 0.22 million were air navigation service/ATC providers and a further 1.1 million worked in civil aerospace.

A study of employment at European airports showed that the airlines were, on average, the largest employers at the airport, followed by the handling agents, airport operators and air traffic controllers (Figure 9.2). Overall, there tends to be a regional difference in the ratio of airport staff to total on-site airport employment. On average, the ratio is around 12:1, but for Europe it is around 10:1 per cent and for North America 29:1 per cent (ACI, 2017). The ratio is much larger for North American airports because many more activities are outsourced, and lower in Europe primarily because of direct involvement of airport operators in activities including handling and security.

For meaningful airport comparisons to be made, airport direct employment is often related to the traffic throughput of an airport to produce an employment density figure. This is usually equivalent to the number of employees per million passengers per annum (jobs per MPPA) or per WLU if freight is an important activity at the airport. A figure of 900–1,000 jobs for every million passengers or WLU equal to a density figure of 900–1,000 tends to be the rule-of-thumb figure generally accepted by the industry. Whilst there is considerable variation at different airports, previous studies of direct employment density at both UK and German airports have both shown averages fairly close to this rule-of-thumb figure of 900–1,000 (Oxford Economic Forecasting, 2006; Klophaus, 2008).

For smaller airports, the average employment density tends to be higher due to the fact that they are unable to achieve economies of scale. Other factors, including capacity utilisation, the existence of airline bases and development opportunities, may have an impact. For example, it was observed that airports including Malaga, Edinburgh, Gothenburg, Nice and Cork had much lower density values because of limited development at the airports,

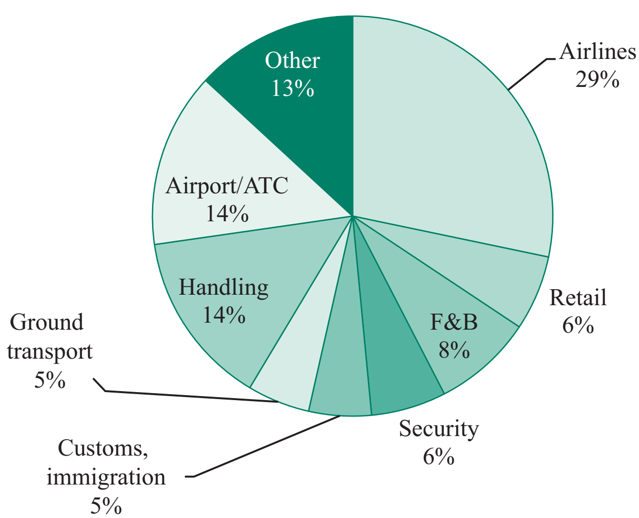

Figure 9.2
Direct jobs at airports, 2013
Source: Adapted from InterVISTAS (2015a)

high utilisation and no base airlines. By contrast, airports including Paris CDG, Amsterdam, Frankfurt and Copenhagen had high values because they are major airline bases and have substantial development (York Aviation, 2004). Airports serving LCCs tend to have lower values because the number of airline staff employed by LCCs at the airport is kept to a minimum and often other services, such as in-flight catering and airport lounges provided at the airport may be more basic or non-existent. Airports having a considerable amount of transfer traffic may also find that the employment impact will be less than O&D passengers since the transfer passengers will not use certain facilities such as car parking, car rental and other ground transport. InterVISTAS (2015a) undertook some econometric research to quantify the relationship between airport employment and some of these factors (Table 9.1). For airports of less than one million passengers it was found that an increase of 1,000 WLUs or traffic units raised employment by 1.2 jobs, whereas above this size such a growth increased employment by less than one job. LCCs generated significantly less employment than transfer passengers. However, these types of passengers may have different catalytic impacts, as are discussed below.

In general, density figures are declining for a number of reasons. The airport and airline industry has become more productive, which has been helped, for example, by having larger and fuller aircraft that may not require any increase in cabin crew. More and more airlines are also cutting back on the frills – as with the LCC sector – which reduces the manpower requirement, for instance with in-flight catering. In addition, technology developments and, in particular, shifts to a greater self-service role for passengers, have also caused a drop in the density measures. Globally, in 2015 it was estimated that there were 800 staff employed at global airports per million passengers. This compares with density figures of around 1,100 in 2007 and 1,600 in 2001 (ACI, 2002, 2008, 2017). This drop in density is likely to continue in the future.

Indirect and induced impacts

While it is possible to gather this direct employment data from surveys, this is not usually possible for the secondary impacts. This is because for the indirect impacts this would

Table 9.1 Direct employment and passenger volume/characteristics

Airport size	Impact on jobs	Passenger type	Impact on jobs
<1 million WLUs	Increase 1,000 WLU = 1.2 jobs	Connecting	3% less direct jobs than O&D passengers
1–10 million WLUs	Increase 1,000 WLU = 0.95 jobs	LCC	20% less direct jobs than O&D passengers
>10 million WLUs	Increase 1,000 WLU = 0.85 jobs		

Source: Adapted from InterVISTAS (2015a) involve surveying the numerous organisations indirectly connected to the airport, while for the induced impacts this would be even more difficult, as the entire economy linked in some way to the airport would have to be considered. A more realistic approach is to use economic multipliers for the indirect and induced effects. At the most crude and basic level this can involve just applying general rule-of-thumb multiplier values, typically gathered from previous similar studies, to the direct impact data. Estimates also have to be made using the direct employment to calculate the direct income and other effects using typical values of indicators such as direct income per direct employee.

The most common more developed approach involves using an input–output model. This model looks at the linkages that exist within any economy by considering the relationships between the different economic sectors (agriculture, manufacturing, construction and services) within a certain area. This methodology involves constructing a transaction table that shows, in money terms, the input–output relationships for the sectors in the economy. Each sector is shown as a column representing purchases from other sectors and as a row representing sales to the other sectors. From this table, coefficients or multiplier values can be obtained for each economic activity. This technique will allow the impact of additional spending in any one specific economic activity to be identified sector by sector as well as for the area as a whole; in other words, what each sector must purchase from every other sector in order to produce a certain value of goods or services. Flows of economic activity associated with any change in spending can be traced backwards (passengers purchasing meals leading to restaurants purchasing more supplies, i.e indirect impacts) or forwards (spending generating income which induces further spending by employees, i.e induced impacts). The indirect impacts are called the production-induced effects and the induced impacts are called the consumption-induced effects. Some studies identify two types of multiplier: type 1 and type 2. The former covers just the indirect effects, while the latter includes both the indirect and induced impacts.

One country that has extensive experience of using the input–output method to measure impacts is the United States. There are three models that are most commonly used: the US Department of Commerce RIMS II model (used by the FAA); the Minnesota IMPLAN Group, Inc. model; and the Regional Economic Modeling, Inc. (REMI) model. These have been used widely in the United States to estimate regional impacts in both the public and private sectors, and form the basis of many airport economic impact studies. In 2014 the IMPLAN model was used to estimate the overall impact of the US airport industry (CDM Smith, 2014). This study estimated an employment multiplier in the region of 2.96 (for every 1,000 direct jobs there were another 2,960 induced and indirect). InterVISTAS (2015a) also used input–output tables to estimate direct income and GDP impacts, as well as multiplier indirect and induced effects, at European airports, combined with a survey for gathering direct employment data. The overall employment multiplier here for secondary impacts was 1.62.

In general, the multiplier effects need to be related to the size of the economy under consideration, depending on whether the national, regional or local situation is being assessed. The indirect impacts tend to increase with the size of the study area, as this increases the likelihood of goods and services required by airport-related companies being supplied within the area rather than being imported from outside. The choice of study area will depend primarily on the role and size of the airport and the reason for measuring the impact. Large capital city and main international airports tend to have such an important impact on the overall economy that it makes sense to assess their impact within a national context. Specific issues, however, particularly related to the employment market, may be more appropriately considered at a regional or local level. The impacts of smaller airports usually need to be considered within a narrower context. The differences in the indirect and induced employment impacts when different surrounding areas are chosen were demonstrated by Optimal Economics (2011) with their assessment of employment impacts at Heathrow airport, estimating that in total there were 83,700 direct jobs. As regards indirect jobs, there were 11,100 generated in the local area surrounding the airport, 20,800 in the London area and 44,400 for the whole of the UK. The estimates for induced jobs were 18,600, 31,500 and 77,200, respectively.

Multiplier values at individual areas will depend on many factors, including the nature of the traffic at the airport, propensity to travel characteristics, employment sector mixes and the role of the airport. They will also depend on the methodologies used and the precise definitions adopted. For example, sometimes all off-site impacts are considered as indirect impacts, irrespective of whether the activities are directly airport-related. This makes it very difficult to compare multiplier values. Then there is the problem of how to treat any activities that are based at the airport but not actually related to airport operations. Very often the split of activities on- and off-site will depend on whether or not the actual site is constrained. One of the major areas of discrepancy is in the treatment of jobs associated with leisure and business tourists who arrive via the airport. These jobs are in tourism industry activities, including hotels, restaurants, attractions, conferences and exhibitions. Some airports, particularly in the United States, treat these as indirect jobs, which can have a dramatic effect on the overall magnitude of indirect impacts. Other studies separately identify the visitor impacts, or adopt a more qualitative approach to assessing this effect. Another area of inconsistency between airports occurs with the treatment of construction activities. Sometimes the temporary staff employed in the construction industry will be included in the impact figures and sometimes they will not. When there is a major capital investment programme, including a new runway or terminal, airports tend to identify the impacts separately to add additional support to the case for new capacity.

One of the major problems with the multiplier and input–output analysis is that it is a static measure which takes a snapshot of the economic situation and does not take account of the interaction between all elements in the economy if there is a change in the inputs or outputs. An alternative approach is to use computable general equilibrium (CGE) models which are dynamic and more flexible, and can be applied to analyse the effect of any change through the whole of the economy. This is discussed further below.

Overall, by way of illustration, Table 9.2 presents some individual multiplier values that have been calculated for Dublin, McCarren and Luton airports. There are some very varied findings, which undoubtedly reflect the unique characteristics of the three airports, albeit that they are also likely to be influenced by the adoption of different detailed methodologies.

Table 9.2 Economic impacts at Dublin, McCarren and Luton airports

	Direct	Indirect	Induced	Direct: indirect ratio	Direct: induced ratio	Passengers (million)	Passengers per direct employee
Dublin airport (2013)						20.2	1,287
Employment	15,700	9,600	12,000	1:06	1:08		
Income/wages (€ million)	639	373	397	1:06	1:0.6		
GVA (€ million)	1,256	717	781	1:0.6	1:0.6		
*McCarren (Las Vegas) airport (2014)**						42.9	365
Employment	117,669	28,869	54,818	1:0.2	1:0.5		
Income/wages (US$ billion)	4.8	1.2	2.1	1:0.3	1:0.4		
Output (US$ billion)	15.9	4.6	7.9	1:03	1:0.5		
Luton airport (London) (2013)						9.7	1,032
Employment (000')	9,400	7,700	10,000	1:08	1:1.1		
GDP (£ million)	425	338	506	1:08	1:1.2		
Income/wages (£ million)	356	181	203	1:05	1:06		
Tax revenue (£ million)	237	122	169	1:05	1:07		

*Includes North Las Vegas airport and Henderson Executive airport.

Sources: InterVISTAS (2015b); Oxford Economics (2015); McCarran International Airport (2015)

Airports and economic development

The airport's catalytic role

As well as being a generator of economic activities in its own right, an airport can also play a role in attracting and sustaining wider economic activity in the surrounding area – in terms of both business and tourism development. This is the catalytic, magnetic or spin-off impact that captures the way in which the airport facilitates the business of other sectors of the economy. This impact can be defined as the employment, income, output, investment and tax revenues generated by the wider role that an airport can play by acting as an economic magnet for the region it serves. Airports can give a company easy access to other parts of the company as well as to suppliers and customers, and can offer speed and security for goods being transported. Hence airports can play an important role in influencing company location decisions. They can encourage inward investment and the relocations of businesses by attracting industries that rely on quick and convenient access to air services for both people and goods. These businesses will not rely directly on the airport for their operation, but they will have a preference for a location near an airport because of the accessibility benefits that can be gained.

Airports can also help retain current businesses or encourage them to expand. By providing access to a wide range of both passenger and freight services, an airport can enhance the competitiveness of the economy and can contribute to the export success of businesses located in the vicinity of the airport. In some cases, the airport can be the lifeline to local economies, as has been the situation in some developing countries in Africa and Latin America, where air travel has enabled the export of fresh and perishable fruit and flowers to Western economies.

Globalisation, in terms of both multinational companies and greater reliance on imported components and products, has increased the importance of locating in the vicinity of an international airport. Some of the fastest growing knowledge-based industrial sectors, including computing, electronics, communications and pharmaceuticals, are the most international and are heavily reliant on air travel for the transportation of their high-value/low-weight products. The increasing reliance on just-in-time inventory systems for these expanding industries and more traditional sectors, including car manufacturing, has meant that air travel has become a critical element for a quick and efficient distribution system and rapid delivery times.

The impacts of these broader business effects are often considered within the context of an airport bringing greater 'connectivity' to a region. As discussed above this may bring inward investment and increase trade because of the ability of companies to be more connected. It will also have an impact on labour markets as it may influence where individuals are attracted to live and work. It may well encourage skilled employees to an area or region, which will potentially have favourable productivity implications for the economy. In addition, there are the so-called agglomeration effects. These relate to the productivity impacts that can be gained through having companies close to each other, such as knowledge spillover and improved access to suppliers or larger labour markets.

Hence this impact is affected by the concentration of economic activity, with the more companies in a specific area increasing the likely agglomeration effects. The development of an airport city or an aerotropolis surrounding an airport is also likely to have a major effect on an airport's wider economic impacts (WEIs) and again will influence company choice (see Case Study 9.1).

In economically disadvantaged areas, where unemployment is high and there is a narrow, declining economic base, airport development is often seen as a way of generating new employment, creating wealth and regenerating the area. These arguments are frequently used to gain approval for airport expansion or development. Airports undoubtedly play an integral part in economic development, and for areas that are relatively inaccessible by air this will be a distinct economic drawback. Certain regions will find it difficult to attract inward investment if their airports have not reached the critical mass needed to provide an adequate range of services. Thus airports are often considered a vital component of a regional development policy and can be viewed as giving a real advantage to competing regions. However, as discussed below it is difficult formally to establish the causality between the expansion of an airport and wider economic development.

Airports can play an additional role in encouraging both business and leisure visitors to the surrounding area. There are many examples of countries, particularly in developing areas including the Caribbean, Asia and Pacific, where the tourism potential of a destination has been realised only after direct services and suitable airport infrastructure have been provided. The increase in visitor numbers may then have a spin-off effect on the income and employment generation in tourism industry activities such hotels, restaurants, attractions, conferences and exhibitions. Tourism markets that are particularly dependent on air travel include package holiday travel, city break tourism, long-haul travel and the conference industry. Also, the LCCs, particularly in Europe, by flying to airports in relatively unknown regions have had the effect of transforming some of these into new international tourism destinations. An important issue though is that not only may airports encourage visitors to the local region, they may also enable local residents to holiday abroad rather than staying in the local region, which may not be beneficial to the region.

Causality between airport growth and tourism development, as with business development, is very difficult to prove. For example, is it new air services at a resort that encourage new hotel development, or do more bedspaces encourage more frequent flights? Some impact studies, particularly in the United States, have a separate visitor impact category. An estimate of spending is often calculated by multiplying the visitor numbers by average daily spend and length of stay. Other airports choose to categorise the visitors' impact as indirect. Admittedly, many of these tourism businesses will be reliant on air services for their tourism demand, but it is unlikely, except in an isolated island situation, that this tourism industry would not exist if a certain airport was not present. It thus seems inappropriate to include these tourism impacts as indirect impacts. Instead, it is preferable to consider them alongside the catalytic impacts causing business development.

It is generally true that investment in airport infrastructure is not usually sufficient in itself to generate sustained increases in economic growth. The WEIs will depend very much on the scale of the airport and, very critically, its ability to attract air services. In the end, it will be the airlines that will determine the success of an airport and broader economic impacts, in choosing whether to operate from the airport or not. As discussed in Chapter 8, their primary concerns will usually be whether sufficient passenger demand exists and the nature of the airport's strategic and geographical location (Graham and Guyer, 2000). In many cases it is impossible to establish whether it is the nature of the surrounding economy of an airport, in terms of wealth and population size and distribution, that has encouraged airlines to operate from the airport, rather than the development of air services influencing the economy. It is particularly difficult to assess the overall impact of LCCs and their impacts on the regions surrounding the airports they serve (Graham and Shaw, 2008; Williams and Baláž, 2009).

CASE STUDY 9.1
THE AIRPORT CITY OR AEROTROPOLIS

Airport cities are developed when airports expand beyond the boundaries of the traditional business in the terminal and diversify by developing facilities such as office complexes, business parks and free-trade zones; distribution and logistics centres; sport, cultural and entertainment amenities; shopping centres; and medical services (Morrison, 2009). Such initiatives are driven not only by the airport operators' desire to grow non-aeronautical revenues, but also by the commercial sector's pursuit of affordable, accessible land, by increased passenger and traffic throughput, and by the recognition of the ability of an airport to act as a catalyst and magnet for landside business development. So, as a result of this commercial expansion and diversification, there are these multimodal and multifunctional businesses called airport cities. Way back in 1994, Amsterdam airport defined itself as an airport city, and later adopted this concept at Brisbane airport which it partially owned.

Some airport cities have continued to develop outwards, with the boundaries between the airport and its surrounding urban area becoming increasingly blurred. As a consequence, a new urban form, known as an aerotropolis, has emerged. This development, similar to a traditional metropolis, consists of a central city core (the airport city) surrounded by rings or clusters of business and residential suburbs extending as far as 30 km outwards from the airport, connected with corridors of transport links and efficient communication systems. Initially, many of these airport cities and aerotropolises had limited planning behind them and grew in a rather haphazard, uncontrolled and organic manner. However, as these developments have matured and as competition has become fiercer, it has been recognised that in order to fully exploit the potential benefits, much greater attention must now be given to planning and strategic management decisions (Reiss, 2007; Poungias, 2009).

Airport cities and aerotropolises now exist in all global regions. In 2013, Kasarda (2013) identified 80 in total (38 in North America; 20 in Europe; 17 in Asia-Pacific; 7 in

Africa and the Middle East; and one each in Central and South America) and so there are likely to be more now. They have become particularly popular in Asia and the Middle East in recent years, where there tends to be newer airports surrounded by a large amount of open land. Notable examples are Hong Kong's SkyCity, Incheon's Air City and Kuala Lumpur's Gateway Park; and there are many others currently under development, including Beijing's World City and Dubai World Central. The actual type and nature of development can vary significantly, as van Wijk (2009) illustrated in his detailed study of the monocentric airport city of Amsterdam, compared with the polycentric airport city of Frankfurt and the sprawling aerotropolis of Narita in Tokyo. Nor are these concepts confined to just the large global hubs of the world; there are an increasing number of airports on a smaller scale, including Dublin, Washington Dulles, Vancouver, Helsinki and Zurich, that have also given priority to this type of commercial development.

An example of an airport city that is being planned for a smaller airport is at Manchester airport, the first in the UK (MAG, 2012). It became fully operational in April 2012 and will be created through phased delivery during the next 15 years, at a cost of £650 million. It will have space for businesses involved in manufacturing, logistics, accommodation, retail and leisure, across a 150-acre regeneration site. It has also been designated as an enterprise zone, which gives relief from business taxes, support for inward investments, a simplified planning process and fast broadband connections. In October 2013, it was announced that the Beijing Construction Engineering Group would invest £800 million into the project, which was one of the largest single investments in Britain from China at the time.

Whilst many airports aspire to be airport cities or aerotropolises, not all can be successful and there is strong competition between the different airports. Indeed, Yeo *et al.* (2013) undertook an analysis of five key aerotropolises in East Asia, namely Beijing, Hong Kong, Incheon, Shanghai and Taoyuan, and identified that the most important competitiveness criteria were 'flight and transfer hub', 'geographic hub', 'airport access modes' and 'land use and cost'. The Hong Kong aerotropolis was ranked as the most competitive, followed by Incheon, Beijing, Taoyuan and Shanghai.

However, contrary to much popular discussion, Hirsh (2017) argued that although the aerotropolis concept looks good on plans, it may not work well in practice. He contended that the airport location may not actually be that attractive to multinational companies or logistic firms, and so the proximity to an airport is no guarantee for success. Moreover, he cited examples of aerotropolises, such as Schiphol Amsterdam or Las Colinas near Dallas Fort Worth, that have been successful because of their location in the middle of a dense metropolitan region.

Measuring the catalytic impacts

It is very challenging to measure these catalytic impacts, as they cannot be covered by methods such as conventional input–output models because they reflect a different relationship between businesses. For instance, it is extremely difficult to isolate and quantify the economic effects that are due to the presence of the airport from the wide range of other factors that will affect a company's location or inward investment decision. The exact location of any business activity will be only partially related to the existence of any nearby airport services, with other factors being the availability, quality and cost of any potential development sites, the nature of the local labour market, tax incentives, trade policy, and the supporting communications and transport infrastructure. The situation is made more complex by the fact that many economic regions are served by a number of airports, with either complementary or competing roles.

In this case, it is not usually feasible or suitable to identify with any certainty the exact number of jobs, or the amount of income generated from these catalytic or spin-off impacts. A more qualitative approach is often adopted which will involve investigating factors including the significance of the airport to location decision, competitiveness and business performance by surveying and holding discussions with relevant businesses in order to gain a closer understanding of the nature of the interaction between the airport and the wider elements in the local economy. In a survey of 500 European companies' views of leading business cities in 2011, 42 per cent stated that transport links with other cities were an absolutely essential factor for locating a business. Only three other factors – availability of qualified staff (53 per cent), proximity to markets (60 per cent) and quality of telecommunications (52 per cent) – were selected by a higher percentage of companies. Also, the top five cities for external transport links with other cities, London, Paris, Frankfurt, Brussels and Berlin, were also rated as 1, 2, 3, 8 and 5 in terms of best city in which to locate a business (Cushman and Wakefield, 2011).

Likewise, a survey of 165 UK companies examined the most important factors in determining the country in which the organisation chooses to invest, and around 40 per cent stated that the air transport network was vital or very important. Again, only three other factors were selected by more organisations – size of local market, availability of skilled labour and the extent of government regulations on business (Oxford Economic Forecasting, 2006). Specifically for London, 59 per cent of the members of the Institute of Directors agreed that a lack of spare capacity at Heathrow would have a damaging effect on inward investment to the UK, compared to just 17 per cent who disagreed (Institute of Directors, 2012). In a rare quantitative study in this area, Bel and Fageda (2008) considered the headquarters of the 1,000 largest European firms and found that the supply of direct intercontinental flights was a major influencing factor, finding that a 10 per cent increase in flights involved a 4 per cent increase in headquarters in the surrounding area. Specifically in Italy, Bannò and Redondi (2014) found that foreign direct investment increased overall by 34 per cent in the two years after opening of the new routes while FDIs in the control group decreased by 17 per cent.

As regards measuring the business and leisure tourism effects, again the importance of the role of the airport can be discussed among industry experts. A difficulty with this interview approach is to ensure that respondents give genuine comments. They will often have a very positive, but perhaps not totally realistic, view of the value of new air services, for example, since the respondents will bear no direct costs associated with the new services but may benefit from the gains. Alternatively, the impact of opening up specific new routes can be considered in order to see how air services have a direct impact on business or tourism development (Button and Taylor, 2000). For example, in the San Diego region it was estimated that a new domestic flight would produce additional annual visitor spending of US$1.7 million that would not have occurred if there was no new flight (i.e. these visitors would not have used other means, including connecting flights or other modes, to travel to the region). For an international flight, this figure was US$5.4 million (San Diego International Airport, 2008).

As discussed above, one of the key catalytic effects that need to be analysed is the extent to which better connectivity can provide better access to markets and resources, and lead to productivity gains through regional economies of scale and agglomeration economies. For this a definition and measurement of 'connectivity' is needed. There are a number of connectivity indices in use, and whilst their methodological approaches vary they all have similar aims in quantifying how well connected an airport is in terms of destination served, the frequencies of services and often onward connections available, all weighted by the quality of the service. IATA has a connectivity index which was used in the InterVISTAS (2015a) EIA study of European airports. SEO also has its NetScan connectivity model which was used in its recent impact study. Figure 9.3 shows the top 10 European airports in terms of connectivity from this model.

Another potentially useful tool for assessing these business development impacts is the York Aviation's Business Connectivity Index. This seeks to examine the relative 'connectedness' of an airport in terms of its route network's ability to service business-focused destinations. In other words, it looks at whether the airport is connected to important business destinations, rather than to just any destinations. It thus provides a proxy

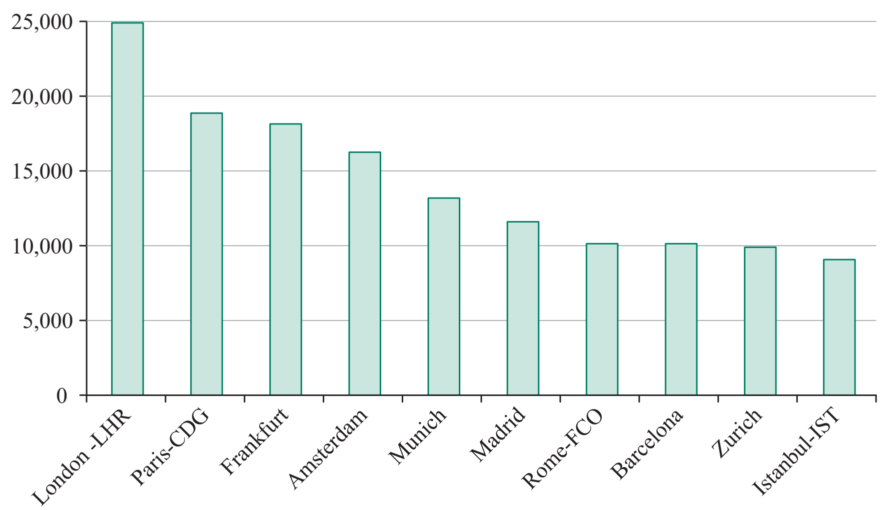

Figure 9.3
SEO air connectivity index of top 10 European airports, 2017
Source: Adapted from ACI Europe (2017)

indicator of an airport's ability to support catalytic or wider economic benefits (WEBs) in its catchment area economy. The index compares the destinations served by an airport against established rankings of world cities, which indicate their usefulness and importance as business destinations. An airport's connection to any of these cities is then weighted according to the frequency of service to that destination. The top 10 ranked airports in 2012 were London, New York, Paris, Frankfurt, Amsterdam, Dubai, Munich, Chicago, Atlanta and Los Angeles. Istanbul, Zurich and Madrid within SEO's top 10 were positioned 11th, 12th and 13th, respectively (Oxford Economics/York Aviation, 2013).

More generally, an increasing number of studies have sought to investigate the relationship between air travel and overall economic development, for example in terms of economic productivity (e.g. GDP per employee), GDP and employment. Some of the more recent research includes Allroggen and Malina (2014), Baker *et al*. (2015), Button and Yuan (2013), Green (2007), Littorin (2015), Mukkala and Tervo (2013), Percoco (2010), and Sellner and Nagl (2010). A few of these have considered whether the causality runs both ways, i.e. economic growth stimulates air passenger demand which drives air connectivity, which in turn enhances economic growth.

The first of two recent European studies is InterVISTAS (2015a), which by using IATA connectivity measures found that a 10 per cent increase in air connectivity yields a 0.5 per cent GDP per capita increase. This research also found a two-way relationship between connectivity and economic growth. Meanwhile, SEO Aviation Economics (2015), using their own connectivity measures, found positive and significant causal relationships between airport characteristics and GDP per capita as well as employment in the knowledge-intensive sectors. The relative economic impact of an increase in passengers also appeared to be stronger for the larger airports. For example, at larger airports (>1,000 weekly flights) a 10 per cent increase in passengers leads to a 1.7 per cent increase in GDP per capita in the next year. The same percentage increase at a medium-sized airport (100–1,000 weekly flights) produces a 1.2 per cent GDP per capita increase. At the smaller airports (<100 weekly flights) the same percentage increase in passengers results in an increase of 0.3 per cent of next year's GDP per capita.

These two reports actually provide analytical work that underpins ACI-Europe's economic impact online calculator. This was made available to member airports in 2015. It calculates the direct jobs, and uses this as a basis to determine the number of indirect and induced jobs, as well as the direct, indirect and induced impact on GDP. For the catalytic impacts, it calculates the national catalytic impacts of the airport industry of the country under consideration and then calculates the proportionate catalytic impact to the actual airports (ACI Europe, 2015). Clearly, as ACI Europe notes, though, it is not a substitute for a full, detailed and tailored economic impact assessment.

Impacts and policy decisions

The discussion so far has very much focused on economic impact assessments. Whilst these can provide airports with an overview of their impacts or an airport's significance, they are inappropriate to use when considering airport policy decisions related to airport development and investment, even though they have been used quite extensively for this purpose (Jorge-Calderon, 2015). There are a number of reasons why they should not be employed in these circumstances (Njoya, 2016).

First, it is important to emphasise that the impacts that have been discussed are not necessarily net benefits, as is often implied. The employment impacts are a good example, as while the promise of greater employment may be seen as a positive outcome of airport expansion in relatively underdeveloped areas, the views on airport employment may be different at a major established airport. In this case the presence of the airport may already mean there is full employment in the region and hence extra job vacancies would be hard to fill, especially as many of the jobs are not seen as very attractive, because they tend to be low-skilled and are likely to involve anti-social hours because of the 24-hour nature of operations. Moreover, the impact assessments do not identify the costs involved, both internally related to airport operations and externally especially related to environmental problems, including noise and air pollution. Nor do they take into account other benefits such as time savings to passengers.

Second, impact assessments ignore the fact that resources are finite. Hence if an airport is expanded, it will use additional resources such as employment that may be diverted from other economic sectors and so the net beneficial impact on employment will be less. The impacts should ideally be compared with possible alternative, non-airport-related economic activities, with an assessment being made of the comparative economic benefits and opportunity costs. Alternative developments could have a better overall impact on the economy. The crossover effects on other industries, for example the impact on other modes of transport, all need to be considered. Increased industrial and economic activity around an airport may merely be draining resources from other areas, including city centres. The negative or adverse potential impacts of airport development, including extensive urbanisation and industrialisation, overheating of the economy and consequences of local labour shortages, also need to be taken into account. The overall impact on the local community of tourism development related to aviation activity also needs to be assessed. The positive effects may not be very substantial if the tourism industry has to be supported by a substantial level of imports and foreign investment.

Third, with economic impact assessment the direct and indirect effects of an investment are greater the more costly and unproductive the airport. Hence in favouring development which produces the highest benefits, it may very well not encourage the most efficient uses of resources.

So these are three of the major factors why it is inappropriate to use economic impact studies for investment decisions. In essence, these studies cannot provide a rigorous measure of the welfare effects of the investment, namely whether the economy is better off as a result of the investment. They only estimate some impacts such as employment and output, and can exaggerate these as the assumption is that these are always positive. So EIA can be used to estimate local effects but not the impact on the economy as a whole. For similar reasons, they should not be used to argue against, for example, the introduction of night curfews or to support, for instance, the introduction of subsidies to support airline services, although in practice there are examples of when they have been used for this purpose. In short, EIA is a useful but descriptive technique but not usually suitable as a decision tool.

There are two other main methods, a traditional Cost Benefit Analysis (CBA) and the newer CGE which are more suitable. CBA aims to measures all the costs and benefits of certain investments for society as a whole, rather than from a financial or business viewpoint, typically for public policy decision-making (CE Delft, 2013). CBA can be used to rank alternative projects as well as evaluating the net benefit (or whether the benefits actually outweigh the costs) or increase in welfare of one particular project. All costs and benefits are expressed in monetary terms as in welfare economics, both the financial effects such as investment costs and profits, and the societal effects such as air pollution, noise and travel times. Thus CBA does not look at impacts but instead evaluates costs and benefits and looks at the social value for money. CBA has been a popular method to evaluate airport investment in countries such as the UK and Australia and has recently been used to assess a new airport at Lisbon and a second terminal and runway at Dublin. It is also a requirement for airports in the United States if they are seeking AIP discretionary funding for projects that exceed US$10 million (increased from US$5 million in 2011) (Landau and Weisbrod, 2009).

CGE models are more recent, having only been occasionally used for airport evaluation since the 2000s. Their use has included Australia, the UK and Japan. They build on the concepts of multipliers and overcome many of the weaknesses with using the conventional input–output models. They have the potential to assess whether an economy is better off as a result of an airport investment, if they include a spatial dimension which can measure welfare. CGE models are broader than CBA models as they measure the positive or negative impacts of an investment using many variables such as employment and GDP, and sometimes welfare as well. CBA/CGE models can also consider WEIs and WEBs which are similar in some ways but not the same as catalytic impacts. For example, EIA tends to only identify certain positive catalytic impacts, whereas WEIs consider both positive and negative broader impacts and WEBs consider broader welfare benefits and costs. Each model has its limitations, which influences which one may be chosen but they can also be used in a complementary manner. For instance, both measures were used in studies considering the airport capacity provision in the Sydney area (Steering Committee – Australian Department of Infrastructure and Transport/NSW Department of Planning and Infrastructure, 2012) and London area (Airports Commission, 2015).

Social impacts of airports

Aviation can have a multitude of impacts on society as well. In the broadest context, it is often claimed that air travel brings wider benefits to society in the form of strengthening ethnic and cultural links between countries, enhancing opportunities for travel and increasing consumer choices for foodstuffs and other products. It can broaden people's leisure and cultural experiences, and bring personal fulfilment. Air transport can also provide educational opportunities for students to travel and study in other regions and countries. These are all very general impacts, which are extremely difficult to quantify or attribute to any one airport. In acting as a catalyst for economic development, airports will also have a major social impact on the surrounding area. Employment and living patterns will change, with positive and negative implications for housing, health, education and other social needs. An overheated economy associated with a successful airport development may bring problems of labour shortages, insufficient housing and rising prices.

In addition to all these impacts, it must be remembered that since airports can provide accessibility and mobility, they can have a major role in promoting social inclusion – especially for remote and island communities. These social impacts are very difficult to quantify, but undoubtedly without such airports, certain communities would suffer and would have a reduced quality of life. Airports can enable regions to have access to essential services, including hospitals and higher education. They can also make the communities more attractive places to work and can contribute to attracting and retaining skilled labour in the area. For example, a survey of residents in the Highlands of Scotland found that 50 per cent felt the existence of air services made the area a better place to live, with 75 per cent agreeing that they made it less remote, and 40 per cent saying that they made it more likely that they would remain there (York Aviation, 2004). Meanwhile, in Norway it was found that local airports have a significant influence on resident location and retention in remoter regions (Halpern and Bråthen, 2011).

Other impacts exist. For example, aviation can facilitate the delivery of emergency and humanitarian aid relief to areas facing natural disasters, famine and war. This can involve cargo deliveries, refugee transfers or the evacuation of people, in areas which may often have been totally cut off from elsewhere. For instance, 62,500 tonnes of food and commodities were delivered by air to relieve victims of floods, conflict and disease by the World Food Programme in 2015. Air transport can also help with swift delivery of medical supplies and organs for transplantation. Not only are many of these time-sensitive, but their destinations are often very remote, making air transport the only option. For example, in 2012 UPS transported over 375,000 influenza vaccines from the United States to Laos. Moreover, in many countries there will be air ambulances that provide an essential medical service (The Industry High Level Group, 2017).

Incentives to encourage economic development

Overall, whilst there are still considerable differences in the terminologies and methodologies used to assess the impacts and benefits of airports, there is little doubt that airports can have a substantial economic and social effect on the region in which they are located. For this reason, there are various incentives to support air service or airport growth and encourage economic growth.

Chapter 8 describes how various airport operators may offer financial and other incentives to encourage new carriers or more services. This may be undertaken purely to grow the airport business – particularly if the airport is privately owned. However, if the airport is publicly owned such incentives may be adopted because of the broader catalytic impacts that additional services to the surrounding region may bring. Alternatively, governments, destination management organisations, tourist boards, regional development agencies, or chambers of commerce may contribute directly to supporting airline services.

It is common practice for public bodies in North America to provide marketing support to airlines that offer new services. These so-called co-op marketing funds are used to promote the new air service at the same time as the region. Risk-sharing mechanisms, including revenue guarantees, are also used. In this case, public and private institutions as well as local businesses in a region raise a minimum amount of money as a guarantee to an airline to cover the costs associated with provision of the service during a limited period. There are also community ticket trusts or travel banks which require the airport operator and/or public institutions to persuade the major airline customers in their region to commit to booking a minimum number of tickets during the early stages of operation of a new service (Martin, 2008; Klophaus, 2016; GAO, 2003). Companies may be prepared to do this if it means the local air services will improve. Again, this will reduce the risk for the carrier and will not necessarily involve any extra cost to the public authorities. However, many airlines are not in favour of trust funds as they find them cumbersome to administer and it is difficult to ensure the pledged funds are actually used on air services (STRAIR 2005; Weatherill, 2006).

Since airlines have different economic impacts, the incentives must be designed to appeal to the airlines that will bring the public agencies the specific economic benefits that they desire. For example, network or legacy carriers can bring much business traffic to an area, and often link the region to their global air service networks through hubs. By contrast, LCCs may be able to encourage inward tourism, but may also promote outbound tourism – which in the end might have a net negative economic impact. Charter carriers can also bring in extra tourists, but they may have the disadvantage of being highly seasonal.

Relevant examples in Europe include the UK, which is discussed in Case Study 9.2. In Malta, there was an incentive scheme which was supported by both the government and the airport, and which had the aim of encouraging LCCs and achieving diversification of the tourism industry by generating more urban and cultural tourism and in spreading the tourism demand more evenly throughout the year (Graham and Dennis, 2010). Elsewhere in Spain, between 1996 and 2014, public bodies in Spain paid out at least €511 million to airlines in order to facilitate route start-ups or ensure their continuity (Ramos-Pérez, 2016). A more recent example here includes a flight development fund for the Canary Islands that was launched in 2014 in collaboration with Canary Islands Tourism. In the same year a charter fund scheme was initiated in Norway to support some of the costs of charter services in North Norway in collaboration with the Northern Norway Tourist Board.

CASE STUDY 9.2
ROUTE SUPPORT IN THE UK

The UK route is an interesting example of funds provided by regional development bodies to support new services that are deemed beneficial to the region's overall economic development by encouraging better business links or inbound tourism. Such funds are designed to have a catalytic impact in that airlines potentially could share the same based aircraft on these supported routes that brought inbound benefits, using them on additional non-subsidised outbound leisure services.

The first route development fund (RDF), which ran from November 2002 to May 2007, amounted to £6.4 million and was created by the Scottish Executive and managed on a partnership basis by Scottish Enterprise, Highlands and Islands Enterprise and VisitScotland (Pagliari, 2005). This was followed in 2003 by a £3.6 million fund that was set up by the Northern Ireland Department of Enterprise, Trade and Investment and managed by Invest Northern Ireland. Then, in the UK Airports White Paper of December 2003, other regional development agencies and the Welsh Assembly government were invited to consider such funds. Subsequently the Welsh Assembly government and One Northeast (the regional development agency of the north-east) set up RDFs in June 2006 (CAA, 2007).

In order to examine the likely benefit of the route proposals to the economy as a whole, an economic appraisal framework was established. The first stage of this was to undertake the net user benefits of the new route. This involved looking at the net present value to users by considering generalised cost savings from journey time savings and airfare savings. It also involved calculating the benefit/cost ratio by considering the benefits to users compared with the cost of funding support. If either the net present value was negative or the benefit/cost ratio was less than one, the proposal was rejected; otherwise it was assessed according to a route appraisal score. This was calculated by quantifying the business efficiency benefits (in terms of service frequency, hub connectivity, business centre links); the tourism impacts (in terms of net additional tourism employment); the direct employment impact; the social impacts (in terms of connectivity); and the environmental impacts (in terms of aircraft noise and carbon dioxide emissions). The final appraisal score was calculated by weighting these impacts according to the strategic priorities and primary drivers for the route development funding. A risk assessment was also undertaken to investigate the risk that the route would not be sustained by the airline in the long term by considering the airline's financial position and route network. If this score was greater than some threshold or calibrated score, the route proposal was recommended for support (STRAIR, 2005).

Figure 9.4 shows the routes that were set up as a result of the RDFs – although a number of these are no longer operated. In general, the RDFs do seem to have helped improve the connectivity of the more peripheral UK regions, but experience has been varied according to which specific region decided to adopt such a fund. Related to Scotland, Smyth *et al.* (2012) found through surveys that two-thirds of non-Scottish businesses saw the RDF services as instrumental in maintaining connectivity and competitiveness in Scotland. Nearly three-quarters of non-Scottish businesses stated that the RDF-supported flights had reduced the feeling that Scotland was remote from the centres of business activity.

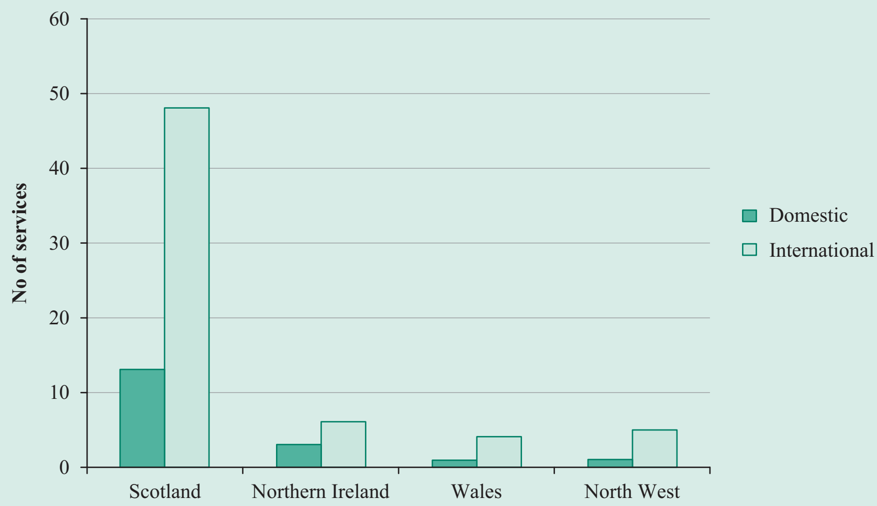

Figure 9.4
Services funded by the UK route development funds
Source: Adapted from CAA (2007)

This RDF funding ceased to exist, largely as a result of the changes to the EU State Aid Guidelines, as described in Chapter 8, which restricted the types of services and the amount of support which could be given. However, in 2013 the UK government set up a new Regional Air Connectivity Fund to maintain important regional air connections. Seven million pounds pounds was provided to support new services at airports with fewer than 5 million passengers per year on unserved routes. Eleven routes were selected in 2015 to commence services in 2016 (Table 9.3) although a number of these have not actually commenced operations or ever will. The fund also supports the new PSO routes of London–Dundee, London–Newquay and London–Londonderry. In 2016, the Northern Ireland government announced that £4 million would be made available over the next three years to support the development of new routes for Northern Ireland.

Table 9.3 Routes granted support from the Regional Air Connectivity Fund, 2016

Origin	Destination	Airline
Carlisle	Belfast City	Stobart Air
Carlisle	Dublin	Stobart Air
Carlisle	Southend	Stobart Air
Dundee	Amsterdam	Flybe
Londonderry	Dublin	Citywings
Newquay	Leeds-Bradford	Flybe
Norwich	Exeter	Flybe
Norwich	Newcastle	Linksair
Oxford	Edinburgh	Linksair
Southampton	Lyon	Flybe
Southampton	Munich	Flybe

Source: Department for Transport (2015)

The impact of passenger taxes

While the above discussion illustrates how public money may be used to encourage air services and economic development, the imposition of additional government taxes potentially could have the opposite effect. This is a topical issue because of the increasing number of airports that have introduced passenger or ticket taxes which are often defined as environmental or eco-taxes by internalising the external effects of flying. These tend to be highly controversial and have been fiercely debated (ACI Europe, 2011; IATA, 2017). This is particularly because such taxes are generally considered to be a rather blunt instrument in terms of tackling environmental problems, and the money tends not to be used on any environmental projects but instead just goes to support the general public sector budget (see Chapter 11).

As discussed in Chapter 4, in 1994 the APD was introduced in the UK and now ranges from £13 to £156 (excluding aircraft of greater than 20 tonnes but fewer than 19 passengers – typically business jets – which are charged considerably more). Up until March 2015, there were four destination bands for this, namely 0–2,000 miles, 2,001–4,000 miles, 4,001–6,000 miles and >6,000 miles. There were two rates, reduced (normally economy class) and standard (normally business and first class). However, significant opposition to this tax has led the government to abolish the top two bands and also exclude children from the tax. In France in 2006, a 'solidarity tax' of €1 (economy) and €10 (premium) for European passengers and €4/40 for intercontinental passengers was introduced to fund development aid in poorer countries. This was in addition to a civil aviation tax, together with an airport tax for safety that had been introduced in 1999. In 2008, the Dutch government started levying a passenger tax of €11 for European travel and €45 for long-haul travel. Then in 2009, a tax in Ireland was introduced. Originally it was €10 for destinations further than 300 km and €2 for shorter flights. However, in 2010 the EC found this discriminatory as almost all cross-border flights were charged at the higher rate whereas all domestic flights were covered by the lower rate. As a result, from 2011 there was a single rate of €3 per passenger, regardless of the destination of the flight. Also in 2011, Germany imposed a tax of €8 on short-haul trips, €25 for medium-haul and €45 on long-haul, and a similar tax (€8 short-haul, €35 long-haul) was introduced in Austria in the same year. All these can make up a significant proportion of the combined airport charges and taxes. For example, Leigh (2013) calculated that in Austria they made up 14 per cent of charges, in the UK 28 per cent, in Germany 37 per cent, including a security tax, and in France 60 per cent.

Similar taxes exist elsewhere outside Europe as well. In Australia a departure tax, called the passenger movement charges, was introduced in 1995. In 2012, it increased from Australian $47, which it had been since 2008, to Australian $55. There are also taxes in India, and particularly in a number of Caribbean and South American countries.

While the exact impact of these taxes on passenger demand is not entirely clear, there is evidence in the Netherlands to suggest that they can have a significant impact on an airport's competitive position if there are alternative airports nearby. Research found that the tax reduced the number of Dutch passengers departing from airports in the Netherlands, especially Amsterdam. A survey of 3,000 passengers was undertaken, with questions related to whether the tax had affected their choices. Fourteen per cent said that the tax had influenced their travel behaviour, with about half of these saying they had chosen not to travel, or to travel by car or train. The other half said they had switched to another airport, with Dusseldorf being the most popular (36 per cent) followed by Weeze and Brussels (Figure 9.5). An analysis was also undertaken of the traffic figures before and after the tax, where it was estimated that there had been a decrease of two million passengers when the tax had been in force. This resulted in estimates of traffic going to Dusseldorf of 450,000, to Weeze 275,000, to Brussels 175,000 and to Charleroi 75,000 (KiM Netherlands Institute for Transport Policy Analysis, 2011). Veldhuis (2012) also found that the tax had little environmental benefit and provided little net revenue for government. The tax was abolished in 2009.

In Ireland, SEO Economic Research (2009) estimated that revenue from the tax would have been approximately €130 million per annum if no demand reduction had occurred as a result of the tax. In addition, if airline capacity had been maintained at the previous levels and the tax passed on in full to the passengers in the form of higher fares, it was estimated that the total resulting demand reduction would be between 0.5 and 1.2 million departing passengers. The study concluded that there would be a direct loss of jobs

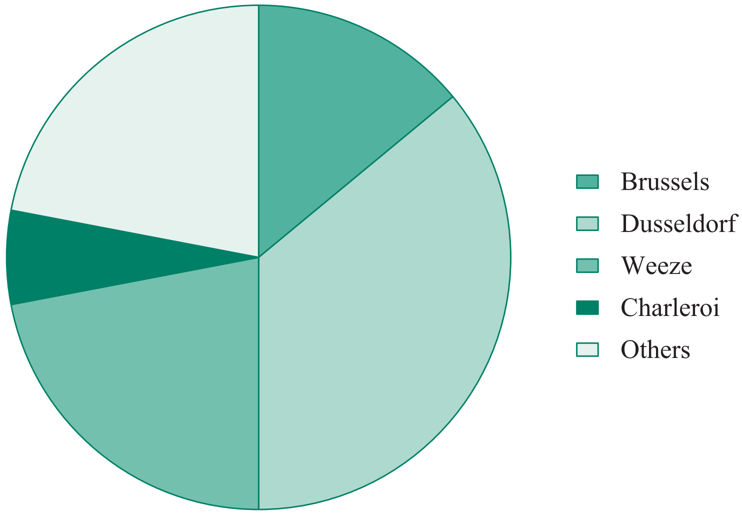

Figure 9.5

Passenger use of alternative airports to Amsterdam after the introduction of the passenger tax
Source: Adapted from KiM Netherlands Institute for Transport Policy Analysis (2011)

of at least 2,000 to 3,000, affecting airports, airlines and the tourism industry, dependent on the extent to which companies were willing to accept the inherent diseconomies of scale from a reduction in demand. In addition, it was concluded that the reduction in passengers would give rise to significant reductions in income tax, corporate tax and sales tax. Therefore, the analysis concluded that the tax would result in a decline in revenue to specific sectors of the Irish economy of a far greater magnitude than the amount of tax likely to be collected. This was similar to findings in the Netherlands, although in the Irish case there would be few shifts to surface modes or foreign airports.

The impact of these taxes has also been assessed for other countries which usually reinforce the criticism of these taxes by the aviation and tourism industry. Most of these have involved using input–output analysis, which as discussed cannot deal effectively with net benefits to an economy and the different gainers and losers. However, a few more recent studies have used CGE approaches instead. For example, in their analysis the increase in the Australian tax, Forsyth *et al.* (2014) found that the tourism industry will suffer, whilst the Australian economy will gain, thus indicating a clash between the industry and wider economic interests. PWC (2013, 2015) also used CGE with their analysis of the UK APD abolition. PWC's 2015 updated analysis of the effects of the APD found that in the first year there would be a positive stimulus to the economy of around 0.5 per cent of GDP, which would then reduce to a longer-term gain of around 0.1 per cent. This could increase economic output and lead to almost 61,000 jobs created by 2020 and extra tax receipts to the government which would fully offset the initial costs of the APD abolition.

Relevant experience also exists in other countries. Denmark had a tax, but because of negative impacts on traffic it halved it in 2006 and then abolished it entirely in 2007. Belgium has proposed such a tax, but has yet to introduce one. An interesting example of the potential impact of taxes on airport competition can be found in the UK with the APD. Largely as a result of Continental Airlines threatening to shift its North Atlantic services from Belfast to Dublin in Ireland (where the tax is much lower), it was agreed in 2012 that passengers would be allowed to pay the lower short-haul rate on long-haul services from Belfast International airport to help maintain its competitive position. From January 2013 all direct long-haul flights from Northern Ireland had no tax. There has also been fierce opposition to this tax elsewhere, particularly in Scotland and some areas of northern England, where again it has been argued that the beneficial economic impact for governments is outweighed by the impact on traffic, tourism and business. In Scotland, responsibility for the tax is planned to be devolved to the Scottish Government

From January 2018, the Austrian tax will also be halved, with the aim of increasing the attractiveness of Austria as a business and tourism destination, to secure the future of Vienna airport as an international aviation hub. The taxes will be €3.50 short-haul per passenger, €7.50 medium-haul and €17.50 long-haul. However, a recent development in the opposite direction has been the introduction of a Norwegian tax of NOK80 for both domestic and international flights. As in other countries this has been the subject of much opposition and in fact Ryanair blamed it for its closure in October that year of its Oslo Rygge base and the reduction of 50 per cent in its Norwegian traffic. In 2017, Sweden became the latest country to propose an aviation passenger tax. Table 9.4 provides examples of some of the current passenger taxes within Europe. (Other examples exist in Croatia, Greece, Italy, Latvia and Luxembourg.)

Table 9.4 Example of passenger taxes in Europe, 2017

Country	Tax	Basis for tax	Amount per Passenger
Austria	Passenger tax	Short-haul	€7
		Medium-haul	€15
		Long-haul	€35
France	Civil aviation tax	Europe	€4.44
		Other	€8.00
	Solidarity tax	Europe	€1.13
		Other	€4.51
	Airport tax	Depends on airport	€7.50–€14.00
	Noise tax	Depends on various factors	€2.00–€35.00

Country	Tax	Basis for tax	Amount per Passenger
Germany	Passenger tax	Europe and some neighbouring countries	€7.47
		Other countries <6,000 km	€23.32
		Other	€41.99
	Security tax	Depends on airport	€2–€10
Norway	Passenger tax	All passengers	NOK 82
UK	Air passenger duty	0–2,000 miles	Reduced rate: £13 Standard rate: £26 Higher rate (>20 tonnes and <19 passengers): £78
		>2,000 miles	Reduced rate: £75 Standard rate: £150 Higher rate (>20 tonnes and <19 passengers): £450

Source: Compiled by author from various sources

Overall, Zuidberg (2015) summarised the potential impacts of such taxes as being: demand reduction, modal shift, O&D airport shift for passengers; limited or even negative environmental impacts; revenue loss for airports and the tourist industry; and increase in passenger tax revenue to the government but decreasing VAT and profit tax, with increasing unemployment expenses. PWC (2017) estimated the total European tax revenue to be €6 million.

References

ACI (2002) *ACI Airport Economics Survey 2001*, Montreal: ACI.

ACI (2008) *ACI Airport Economics Survey 2007*, Montreal: ACI.

ACI (2017) *ACI Airport Economics Survey 2017*, Montreal: ACI.

ACI Europe (2011) *ACI Europe Position on Aviation Taxes in the EU*, Brussels: ACI Europe.

ACI Europe (2015) *A Guide to the ACI Europe Economic Impact Online Calculator,* Brussels: ACI Europe.

ACI Europe (2017) *Airport Industry Connectivity Report 2017*, Brussels: ACI Europe.

Airports Commission (2015) *Airport Commission Final Report*, London: Airports Commission.

Allroggen, F. and Malina, R. (2014) 'Do the regional growth effects of air transport differ among airports?', *Journal of Air Transport Management*, 37: 1–4.

ATAG (2016) *Aviation: Benefits beyond Borders Global Summary*, Geneva: Air Transport Action Group.

Baker, D., Merkert, R. and Kamruzzaman, M. (2015) 'Regional aviation and economic growth: cointegration and causality analysis in Australia', *Journal of Transport Geography,* 43: 140–50.

Bannò, M. and Redondi, R. (2014) 'Air connectivity and foreign direct investments: economic effects of the introduction of new routes', *European Transport Research Review*, 6(4): 355–63.

Bel, G. and Fageda, X. (2008) 'Getting there fast: globalization, intercontinental flights and location of headquarters', *Journal of Economic Geography*, 8(4): 471–95.

Button, K. and Taylor, S. (2000) 'International air transportation and economic development', *Journal of Air Transport Management*, 6(4): 209–22.

Button, K. and Yuan, J. (2013) 'Airfreight transport and economic development: an examination of causality', *Urban Studies*, 50(2): 329–40.

CAA (2007) *Air Services at UK Regional Airports: An Update on Developments*, CAP 775, London: Civil Aviation Authority.

CDM Smith (2014) *The Economic Impact of Commercial Airports in 2013*, Cincinnati: CDM Smith.

CE Delft (2013) *The Economics of Airport Expansion*, Delft: CE Delft.

Cushman and Wakefield (2011) *European Cities Monitor 2011*, London: Cushman and Wakefield.

Department for Transport (2015) *New Regional Air Routes Offer Fast Journeys across UK and Europe*, Press release, 2 December, London: Department for Transport.

Forsyth, P., Dwyer, L., Spurr, R. and Pham, T. (2014) 'The impacts of Australia's departure tax: Tourism versus the economy?', *Tourism Management*, 40: 126–36.

GAO (2003) *Factors Affecting Efforts to Improve Air Services at Small Community Airports*, GAO-03–330, Washington, DC: General Accounting Office.

Graham, A. and Dennis, N. (2010) 'The impact of low cost airline operations to Malta', *Journal of Air Transport Management*, 16(3): 127–36.

Graham, B. and Guyer, C. (2000) 'The role of regional airports and air services in the United Kingdom', *Journal of Transport Geography*, 8(4): 249–62.

Graham, B. and Shaw, J. (2008) 'Low-cost airlines in Europe: reconciling liberalization and sustainability', *Geoforum*, 39(3): 1439–51.

Green, R.K. (2007) 'Airports and Economic Development', *Real Estate Economics,* 35(1): 91–112.

Halpern, N. and Bråthen, S. (2011) 'Impact of airports on regional accessibility and social development', *Journal of Transport Geography*, 19(6): 1145–54.

Hirsh, M. (2017) 'What's wrong with the Aerotropolis Model?', *Site Selection Magazine*, March. Online. Available at: http://siteselection.com/issues/2017/mar/airport-cities-whats-wrong-with-the-aerotropolis-model.cfm (accessed 5 August 2017).

Hoyle, Tanner & Associates and RKG Associates (2008) *ACRP Synthesis Report 7: Airport Economic Impact Methods and Models*, Washington, DC: Transportation Research Board.

IATA (2017) 'Taxing times', *Airlines International*, 19 April. Online. Available at http://airlines.iata.org/analysis/taxing-times?_ga=2.27588340.973166213.1506595338-1501440428.1503159690 (accessed 1 September 2017).

Institute of Directors (2012) *Flying into the Future*, London: Institute of Directors.

InterVISTAS (2015a) *Economic Impact of European Airports,* Bath: InterVISTAS.

InterVISTAS (2015b) *Dublin Airport Economic Impact Study,* Bath: InterVISTAS.

Jorge-Calderon, D. (2015) 'How much is your airport worth?', *Airports International*, April/May: 32–33.

Kasarda, J. (2013) 'Airport cities: The evolution', *Airport World*, April–May: 24–27.

KiM Netherlands Institute for Transport Policy Analysis (2011) *Effects of the Air Passenger Tax: Behavioural Responses of Passengers, Airlines and Airports*, The Hague: KiM Netherlands Institute for Transport Policy Analysis.

Klophaus, R. (2008) 'The impact of additional passengers on airport employment: the case of German airports', *Journal of Airport Management*, 2(3): 265–74.
Klophaus, R. (2016) 'Air travel banks: A public-private partnership approach to air services development at smaller airports', *Journal of Airport Management*, 10(2): 200–08.
Landau, S. and Weisbrod, G. (2009) *ACRP Synthesis Report 13: Effective Practices for Preparing Airport Improvement Program Benefit-Cost Analysis*, Washington, DC: Transportation Research Board.
Leigh (2013) Aviation Taxes in Europe: a Constraint on Economic Recovery, 13 December. Online. Available at http://www.aviationeconomics.com/NewsItem.aspx?title=Aviation-Taxes-in-Europe:-a-constraint-on-economic-recovery (accessed 25 August 2017).
Littorin, H. (2015) 'Catalytic effects of aviation and their importance for airport development' *Journal of Airport Management*, *9*(4): 384–89.
MAG (2012) Airport City Manchester. Online. Available at http://www.airportcity.co.uk/opportunities (accessed 15 December 2012).
Martin, S.C. (2008) *ACRP Report 18: Passenger Air Service Development Techniques*, Washington, DC: Transportation Research Board.
McCarran International Airport (2015) *Economic Impact Study*. Online. Available at https://www.mccarran.com/fsweb/file/395349 (accessed 20 August 2017).
Morrison, G. (2009) 'Real estate, factory outlets and bricks: a note on non-aeronautical activities at commercial airports', *Journal of Air Transport Management,* 15(3): 112–15.
Mukkala, K. and Tervo, H. (2013) 'Air transportation and regional growth: which way does the causality run?', *Environment and Planning A*, 45: 1508–20.
Njoya, E. (2016) 'Economic Impacts of Airports', *University of Westminster Airport Policy and Planning Short Course*, London, March.
Optimal Economics (2011) *Heathrow Related Employment*, London: Optimal Economics.
Oxford Economics (2015) *The Economic Impact of London Luton Airport,* Oxford: Oxford Economics.
Oxford Economic Forecasting (2006) *The Contribution of the Aviation Industry to the UK Economy,* Oxford: Oxford Economic Forecasting.
Oxford Economics/York Aviation (2013) *The Economic Value of International Connectivity*, Oxford: Oxford Economics/York Aviation.
Pagliari, R. (2005) 'Developments in the supply of direct international air services from airports in Scotland', *Journal of Air Transport Management*, 11(4): 249–57.
Percoco, M. (2010) 'Airport Activity and Local Development: Evidence from Italy', *Urban Studies,* 47(11): 2427–43.
Poungias, P. (2009) 'Airport city developments: an airport investor's perspective', *Journal of Airport Management*, 4(1): 14–22.
PWC (2013) *The Economic Impact of Air Passenger Duty*, London: PWC.
PWC (2015) *The Economic Impact of Air Passenger Duty Analytical Update*, London: PWC.
PWC (2017) *The Economic Impact of Air Taxes in Europe*, London: PWC.
Ramos-Pérez, D. (2016) 'State aid to airlines in Spain: An assessment of regional and local government support from 1996 to 2014', *Transport Policy*, 49: 137–47.
Reiss, B. (2007) 'Maximising non-aviation revenue for airports: developing airport cities to optimise real estate and capitalise on land development opportunities', *Journal of Airport Management*, 1(3): 284–93.
San Diego International Airport (2008) *Airport Economic Impact*, San Diego: San Diego International Airport.
Sellner, R. and Nagl, P. (2010) 'Air accessibility and growth – The economic effects of a capacity expansion at Vienna International Airport', *Journal of Air Transport Management*, 16(6): 325–29.
SEO Aviation Economics (2015) *Regional Economic Impact of Airports*, Amsterdam: SEO Aviation Economics.

SEO Economic Research (2009) *The Implications of the Irish Air Travel Tax*, Amsterdam: SEO Economic Research.

Smyth, A., Christodoulou, G., Dennis, N., Al-Azzawi, M. and Campbell, J. (2012) 'Is air transport a necessity for social inclusion and economic development?', *Journal of Air Transport Management*, 22: 53–59.

Steering Committee – Australian Department of Infrastructure and Transport/NSW Department of Planning and Infrastructure (2012) *Joint Study on Aviation Capacity in the Sydney Region Report to Australian Government and N.S.W. Government*. Canberra and Sydney, Canberra: Steering Committee.

STRAIR (2005) *Air Service Development for Regional Development Agencies*, Brussels: STRAIR.

The Industry High Level Group (2017) Aviation Benefits. Online. Available at http://www.iata.org/policy/Documents/aviation-benefits-%20web.pdf (accessed 24 September 2017).

van Wijk, M. (2009) *Airports as Cityports in the City-Region: Spatial–Economic and Institutional Positions and Institutional Learning in Randstad-Schiphol (AMS), Frankfurt Rhein-Main (FRA), Tokyo Haneda (HND) and Narita (NRT),* Utrecht: Netherlands Geographical Studies 353.

Veldhuis, J. (2012) 'The implications of airport taxes in Europe', *University of Westminster Airport Economics and Finance Symposium*, London, February.

Weatherill, J. (2006) 'North American airline incentives: best practices and emerging trends', *Journal of Airport Management*, 1(1): 25–37.

Williams, A. and Baláž, V. (2009) 'Low-cost carriers, economies of flows and regional externalities', *Regional Studies*, 43(5): 677–91.

Yeo, G. T., Wang, Y. and Chou, C. C. (2013) 'Evaluating the competitiveness of the aerotropolises in East Asia', *Journal of Air Transport Management*, 32: 24-31.

York Aviation (2004) *The Economic and Social Impact of Airports in Europe*, Macclesfield: York Aviation.

Zuidberg, J (2015) 'The implications of air travel taxes', *Journal of Airport Management,* 10(1): 64–72.

10 The environmental impact of airports

Growing concerns for the environment

The airport industry, like all other industries, is facing the effects of increasing environmental pressure. The level of environmental concern varies from country to country, or from one airport to another, depending on views about aviation and other social and political attitudes. In many countries increased prosperity has led to greater expectation for the quality of life and more sensitivity to the environmental impacts of airports. For this reason it has become progressively difficult to substantially expand airport operations or to build new airports. All indications are that this will become even more problematic in the future as concern for the environment grows. At the same time, continual long-term growth in demand is putting greater commercial pressures on airports to develop further. The problems are particularly acute for airports that are popular because of their proximity to local population centres, but in turn this means that a significant proportion of the community is affected by airport operations. In addition, airports need to prepare for climate change impacts by increasing the resilience of their infrastructure and services. In short, environmental issues must be seen as one of the greatest challenges to, and possible constraints on, the future activities of the air transport industry.

The environmental impacts have to be considered at two levels: global and local. Within a global context, the role aviation plays in contributing to world problems, including global warming and ozone depletion, is increasingly under scrutiny. These are long-term issues that society as a whole has to address. The meeting of governments in Kyoto in 1997 was one of the first attempts to introduce constraints on environmental impacts at the global level, followed by the COP21 agreement in Paris in 2015, albeit that international aviation was largely excluded from these discussions. At a local level, impacts associated with noise and air quality have to be considered. In some areas of operation, airport operators may be legally required to minimise the adverse effects, whereas elsewhere many airport operators are increasingly voluntarily introducing measures to mitigate the impacts. It is the local problems that airport operators mostly have to address on a day-to-day basis. The focus of this chapter, therefore, is very much at this level, although some examination of the global developments has also been made to put the local issues into a broader context.

Consideration of the environmental impacts at airports is made more difficult because of the many different bodies involved in, or affected by, airport operations. These include the airport operator, the airlines, governments and statutory organisations, amenity and conservation groups, and local residents. These will have a complexity of different and often conflicting interests. Issues including resident safety or loss of wildlife habitat can cause anxiety among certain sectors of society and generate considerable emotive concern. Other impacts may require complex technical data to be assessed, which may be difficult for all interested parties to understand fully. Some impacts cannot be measured adequately. Then, when mitigation measures are considered, most standard procedures have to be adapted to suit each airport's individual circumstances because of variations in aircraft use, night flights, land-use rules, closeness to residential areas and overall environmental sensitivity of the community.

The main impacts

The main environmental impacts can be divided into five categories:

- noise
- emissions
- water pollution and use
- waste and energy management
- wildlife, heritage and landscape

Noise

Aircraft noise has traditionally been considered the most important environmental problem at airports, and in many cases public tolerance of aircraft noise has been diminishing. This is despite the fact that over the years the noise levels associated with aircraft movements have been declining. This reduction has been due primarily to the development of less noisy aircraft and the pressure of more stringent requirements for noise certification of new aircraft types. Noise certification was first introduced in 1969 by the United States in the Federal Aviation Regulations Part 36 (FAR Part 36). ICAO adopted similar international standards in 1971. These standards were included in the Environmental Protection Annex 16 of the Chicago Convention. The initial standards for jet aircraft, based on the maximum noise level given a certain flight procedure, became known as Chapter 2 or Stage 2 in the United States. In 1977, more stringent standards, known as Chapter or Stage 3, to be applied to all new aircraft designs, were adopted by ICAO. Chapter 2 aircraft include the Boeing 727, DC-9 and older types of Boeing 737 and 747. Newer aircraft certificated under Chapter 3 included the Boeing 757, 767, 777 and all the airbus family of aircraft.

Since 1990, the first generation of noisy aircraft (Chapter/Stage 1), including Boeing 707s, have been prohibited. After that the second generation Chapter 2 aircraft were the noisiest types. They were phased out completely in the United States at the end of 1999 and worldwide in 2002. An issue that complicated this noise certification process was the treatment of hush-kitted or re-engined jets. These are Chapter 2 jets that were modified to comply with the Chapter 3 rules. They are the noisiest of the Chapter 3 aircraft and so there were pressures, particularly in Europe, to phase them out. However, this was opposed elsewhere, especially by the United States, which was a major supplier of the hush-kitting equipment. Subsequently, in 2001 it was decided by ICAO that a new Chapter 4 standard would apply to all new aircraft designs, beginning in 2006, which cumulatively had to be 10 decibels quieter than Chapter 3. Then in 2013 a new standard, namely Chapter 14, was agreed. This meant that all large aircraft above 55 tonnes had to be at least 7 decibels quieter than the Chapter 4 standard from 2017, with this applying to smaller aircraft from 2020.

In 2001, ICAO also agreed the concept of a 'balanced approach' to noise management, comprising four principles:

- reduction of aircraft noise at source
- land-use planning and management measures
- noise abatement operational procedures
- local noise-related operating restrictions.

Within Europe in 2002, the EC adopted a new directive (2002/30/EC) which incorporated ICAO's balanced programme (EC, 2002a) which was then actually repealed in 2014 when a new, more stringent regulation (598/2014), related to the balanced approach, was introduced (EC, 2014). The original directive identified the need to follow ICAO's four principles in any decisions concerning noise-mitigating measures as these can have significant impacts on areas including capacity and airline operations. However, in practice it was found that there had been too many inconsistencies in the assessments of whether such measures were the safest they could be; produced excess impacts on capacity; created holding patterns; or even encouraged inappropriate residential development (EC, 2008). Therefore, the new regulation brought the legislation up to date in line with technological developments to make it easier to phase out the nosiest planes and increasing the transparency in the process of setting noise-related restrictions at airports. Also in 2002 the EU Environmental Noise Directive (2002/49/EC) was agreed, which is not specifically related to airports but requires all major ones to prepare strategic noise action plans and submit them for government approval (EC, 2002b).

Undoubtedly, the first principle of ICAO, the reduction of aircraft noise at source, which has been brought about by international certification, has had an impact on reducing overall aircraft noise levels. The newest generation of aircraft, including the Airbus A380, A330neo and A321neo, and the Boeing 787 and 737 MAX, are the quietest yet and research continues into new technology solutions to reduce noise from jet engines. However, such reductions of noise at source can take a considerable length of time to achieve – given the heavy investment needed by both aircraft manufacturers and airlines and the long lifetime of an aircraft. This is why other measures, detailed in the balanced approach, are also needed.

The appropriate control of land use near the airport is vital when the mitigation of noise impacts is being considered. This is in order to prevent the gains achieved by using quieter aircraft being offset by people living closer to the airport. To overcome this problem, noise zoning is often applied to airports. This involves defining a certain area, or noise buffer, around an airport where the construction of new houses and other noise-sensitive buildings is not allowed. In a study of European practice, it was found that 33 out of 52 airports had used some land-use planning or management controls, including London Gatwick, London Heathrow, Vienna and Athens airports (MPD Group Ltd, 2007).

Individual airports can also introduce unilateral noise abatement operating measures that can reduce the annoyance caused by aircraft noise (Girvin, 2009). For example, many airports have introduced noise preferential routes (NPRs) to minimise the noise impact on the surrounding population. This is usually done by directing aircraft away from the most densely populated areas. Airports may also choose to place restrictions on flight procedures by requiring, for example, reduced power and flap settings for take-off or approach. Other noise abatement procedures may involve having favoured runways with flight paths over uninhabited areas, and continuous descent approach, which entails having a continuous steady descent to a runway rather than a number of short descents to set cleared altitudes, as was traditionally required by ATC. Similarly, there are continuous climb departures, and take-off gradients can be increased, as at Brussels airport where there is a requirement for a gradient of at least 7 per cent. Runways can also be operated in segregated rather than mixed mode, as is the case at Heathrow airport.

Flight-track monitoring equipment combined with airport surveillance radar is used to improve airline departure and arrival procedures and to monitor adherence to the NPRs. In some cases airport operators may impose financial penalties on airlines that deviate from their required flight track. Money from penalties may be used for soundproofing or other community projects. For example, there is a fine at Manchester airport, which is higher at night, which goes to the Manchester Airport Community Trust Fund. There may be difficulties with this, however, because airlines quite legitimately may be required to depart from their preferred route for ATC reasons. Most airports also use noise monitoring equipment. This can be used to measure local noise levels and calculate noise contours, or to enforce noise limits. The information gathered from the noise and track monitoring procedures can be provided for the airlines, local community, governments and other interested parties, and a growing number of airports publish the results. There can even be further incentives; for example, San Francisco airport has a 'Fly Quiet' programme where it awards airlines that perform particularly well in relation to noise pollution.

There is also the noise from airline engines running, especially during maintenance. To reduce the noise emission levels, a number of airports have introduced mufflers or noise attenuating walls and special noise attenuating hangars. Restrictions have been placed on when and how engine tests can be undertaken. In addition, limits have been imposed on the use of reverse thrust by airlines. However, the noise problem is not confined to aircraft landing, taking off, taxi-ing or engine testing. There is also noise from ground vehicles and auxiliary power units. Noise has been reduced in many airports by having fixed rather than auxiliary power units, or restrictions on the use of auxiliary power units.

The fourth aspect of the balanced approach is local noise-related operating restrictions. A common measure is a night curfew or limitations on night flights. This may involve a blanket ban on all aircraft (including at London City, Wellington and Bermuda airports) or a limit on the noisier aircraft (including at Manchester, Bahrain, Lisbon, Madrid, Brussels, Toronto and Geneva). At a number of Australian airports, including Sydney and Adelaide, the airport is closed at night to all except very small aircraft. Other airports, for instance Beijing, and a number of US airports, including Lambert-St Louis and Las Vegas, do not allow movements on certain runways at night. However, night constraints may have a significant impact on the development of freight or charter traffic, which often relies on night movements, and makes scheduling long-haul services more difficult. A fairly recent example of a night ban is at Frankfurt airport since 2012, which was strongly opposed by the German aviation industry, especially because of Frankfurt's strongly competitive position in the cargo market. Brussels airport is also another example of an airport where there has been extensive debates on the noise-related aircraft operation restrictions, imposed by the federal government.

The application of a 'noise budget' is a noise-related operating restriction. In this case the budget will restrict the overall noise during a certain period at night, such as a season or year. For instance, the UK airports Heathrow, Gatwick and Stansted use a noise budget called a Quota Count (QC) system. The quota count is based on the aircraft's noise performance, with noisy aircraft receiving a higher quota count than a quieter one. For example, a 747–400 has a QC count of 4 on departure and 2 on arrival, compared with an A380, which has a QC count of 2 and 0.5, respectively, and a 787–8 with a count of 0.5 and 0.25. The sum of all the QCs is then the noise budget or noise limit for the specified time. At Amsterdam, Copenhagen and Brussels airports, noise budgets are also set based on different aircraft usage within the day and night. Long Beach airport in California, which has one of the strictest noise control policy in the United States, has a somewhat similar system.

Many airports also impose noise surcharges for noisier aircraft and an incentive to use quieter aircraft. These charging policies are, however, unlikely to influence an airline's choice of aircraft unless the fee differential is very large. Frankfurt, Heathrow, Gatwick and Manchester were among the first airports to introduce such charges in the 1970s. Noise charges are now used in many countries, particularly in Europe but also in a number of other countries such as Australia, Japan and Taiwan. There is, however, no consistency in the way these noise charges are structured. In addition, at many airports, the landing charges are higher at night to reflect the fact that noise nuisance is acute when people are trying to sleep. Steer Davies Gleave (2013) found that in Europe in general, there are three ways in which the airports levy their noise charges: noise charge directly related to noise category of the aircraft (Prague, Munich and Frankfurt airports); noise charge related to landing charge (UK, ADP, AENA airports); and noise charge related to noise-threshold (used at Stockholm Arlanda, Helsinki Vantaa and Vienna airports).

By way of illustration, Table 10.1 shows the charges for Paris where the basic charge varies by noise levels during the day by 0.7–1.3 and at night by 1.05–1.95. The landing fees are multiplied by a noise level coefficient based on the aircraft's noise classification according to certain specifically defined acoustic groups.

Table 10.1 Landing and noise charges at Paris CDG airport, 2017

Aircraft category	Price per landing (€), day (06:00–22:00)	Price per landing (€), night (22:00–06:00)
Tonnes (t)	286.03 + 3.993 × t	
Acoustic group	Noise level coefficient	
1	1.300	1.950
2	1.200	1.800
3	1.150	1.725
4	1.000	1.500
5a	0.850	1.275
5b	0.700	1.050

Source: Groupe ADP (2017)

In spite of all these measures to reduce noise levels, there will always be some residents who will be subject to noise annoyance, and for this reason many airport operators will fund or assist in the funding of noise insulation for properties in the vicinity of the airport – either voluntarily or because it is a legal requirement. Housing and buildings including schools and hospitals may be insulated. In most cases the cost of insulation will be covered by the airport operator alone, but sometimes national or regional governments will also contribute, as is the case at Copenhagen and Milan. Sometimes the funds may come from specific noise taxes, as at Amsterdam airport and Paris CDG, but such tax revenues are not always earmarked for noise mitigation initiatives.

Finally, collecting and monitoring complaints about aircraft noise is a good mechanism for airports to review levels of annoyance and assess reactions to changes in noise exposure. However, airports tend to have their own approaches to capturing and recording data, which makes it very difficult to compare the relative levels of noise complaints at different airports and set any benchmarks (Budd and Ison, 2017). Many residents can now track detailed flight patterns over the internet with systems such as WebTrak.

Emissions

Global impacts

Through the combination of the development of quieter aircraft and noise abatement operating procedures, most airports are attempting to contain many of the problems arising from aircraft noise. However, a comparatively newer environmental threat that has been growing in recent years is that of aircraft emissions and their impact on climate change (Gossling and Upham, 2009). By consuming fuel, aircraft are producing emissions of carbon dioxide (CO_2), nitrogen oxide (NO_x) particles (mainly soot) of sulphur oxide, carbon monoxide (CO) and other effects including water vapour trails and induced cloudiness.

At a global level, CO_2 is the most important of all the greenhouse gases and is the emission for which there has been the most developed and conclusive research. One of the most comprehensive studies of aviation emissions, albeit rather old now, found that globally aviation's contribution to the world total of human-made CO_2 was fairly small in the 1990s, at around 2 per cent. If other less scientifically certain effects were also taken into account, including the NO_x emissions and the creation of vapour trails, it was estimated that the radiative forcing or global warming effect of all aircraft emissions would be around 3.5 per cent (this excluded possible damaging unknown changes in cirrus clouds). However, because of the growth of air transport and the relative ability of other industrial sectors to reduce their emissions, by 2050 this global share was predicted to rise to around 4–15 per cent, depending on different growth scenarios and other assumptions (Intergovernmental Panel on Climate Change, 1999). According to ATAG (2016), airline operations produced 781 million tonnes of CO_2 in 2015, still accounting for around 2 per cent of all emissions. Specifically in the EU in 2012, CO_2 represented 13 per cent of all transport emissions and 3 per cent of all CO_2 emissions. The equivalent figures for NO_x were 14 and 7 per cent (EASA *et al.,* 2016). Such figures vary quite significantly by country. For example, for an island such as the UK, in 2015 aviation emissions represented 22 per cent of all transport emissions and 8 per cent of total emissions (Department for Transport, 2017). However, overall aviation emissions having been growing at a much higher rate compared to total emissions and this trend, if left uncontrolled, would be expected to continue into the future.

Emissions from international flights (but not domestic flights) were excluded from the Kyoto Protocol which was adopted in 1997 and came into force in 2005 – and instead ICAO, through its Committee on Aviation Environmental Protection, was given the responsibility for developing proposals on international aviation emissions. In 2010, ICAO agreed overall targets related to future emissions that included an average improvement in fuel efficiency of 2 per cent per year up to 2050 and a cap on CO_2 emissions from 2020 to ensure carbon-neutral growth (ICAO, 2010). These targets are similar to those agreed by IATA (2009), which included an average improvement in fuel efficiency of 1.5 per cent per year from 2009 to 2020, a reduction in CO_2 emissions of 50 per cent by 2050 relative to 2005 levels, and again a cap on emissions from 2020.

Lighter airframe materials and more efficient engines will help reduce emissions. In fact in 2017, ICAO adopted a new aircraft CO_2 emissions standard, which is the first global design certification governing CO_2 emissions. It will apply to new aircraft type designs from 2020 and to aircraft-type designs already in production as of 2023. Those in-production aircraft which by 2028 do not meet the standard will no longer be able to be produced unless their designs are sufficiently modified. However, it is generally agreed that future global air traffic will increase at growth rates that will outperform the impact of any technology improvements that will reduce engine emissions. In addition, while more fuel-efficient aircraft may produce less emissions including CO_2, the higher combustion temperatures needed for greater efficiency may actually produce more NO_x emissions. All this has to be viewed within the global context where major CO_2 reduction efforts are taking place in other industrial sectors.

At present there does not appear to be a totally viable commercial alternative to jet fuel. There has been some experimentation with non-carbon based biofuels that have been tested by a number of airlines including Virgin, Qatar, Air New Zealand, Finnair, Lufthansa, Thomson and Japan Airlines and approval has now been given by ICAO for the use of biofuels in passenger flights. In Europe the EC, in coordination with Airbus, leading European airlines and key European biofuel producers, launched the first industry-wide initiative to speed up the commercialisation of aviation biofuels in Europe. Called 'Biofuel Flightpath', this was seeking to produce two million tonnes of sustainably produced biofuel by 2020 but progress has been very slow (EASA *et al.,* 2016). The widespread lack of uptake of biofuels in aviation is not due to technical constraints, since various technologies are ready for, or close to, commercial deployment, but rather the economic, policy and market-related issues. In the long term, access to low-cost feedstock for commercial-scale deployment is a major challenge, but in the shorter term there is the issue of finding investment to ramp up the biofuel production. There are other factors that need to be considered such as the emissions actually caused by the feedstock production, the risk of competition with food production, fresh water use and the significant potential effects of a change in land use, such as deforestation and reduced biodiversity.

Elsewhere in the United States there was the launch of the Commercial Aviation Alternative Fuels Initiative in 2006, which is exploring the use of alternative jet fuels. It is a coalition of airlines, aircraft and engine manufacturers, energy producers, researchers, international participants and US government agencies. Overall, whilst there has only been very limited progress to date to introduce biofuel as a regular fuel source, interestingly at the beginning of 2016, Oslo airport became the first airport, a so-called bioport, to receive regular deliveries of biofuels and to offer it to its airline customers. This was followed by Los Angeles airport in the same year. Other airports such as Amsterdam and Brisbane are also planning to become bioports (Grey, 2016).

Improved operational procedures, including more efficient air traffic management and flight operations, perhaps with larger and fuller aircraft and coupled with reduced airport and airspace congestion, could also bring about a further reduction in fuel burn. European and US ATC projects, including Single European Sky Air Traffic Management (SESAR) and NextGen, should help in the area of ATC, as should the adoption of A-CDM when airport delays are being considered.

However, all these developments will not by themselves reduce emissions to an acceptable level. As a consequence, the airline industry through IATA now has a four-pillar strategy for reducing emissions, covering the three areas that have already been discussed – technology investment, more efficient infrastructure and more efficient operations – and a fourth area, 'positive' economic or MBMs, which many industry experts now feel are an essential feature of any emissions reduction policy.

There are a number of possible MBMs, including a kerosene tax. Currently, aviation kerosene fuel is exempt from tax on international flights under the Chicago Convention, and many bilateral air service agreements between countries prohibit such a tax. (Domestic fuel taxes are allowed and are in fact levied in a few countries, including the United States, India, Japan and the Netherlands.) Some time ago, the EC undertook some detailed research of the effects of taxing EU airlines and concluded that it would give them a distinct competitive disadvantage and produce fairly marginal emission savings. The environmental effectiveness of taxing all routes would be far greater, but it was concluded that this option would be very difficult to implement because of the legal and political implications (EC, 1999). The case of emissions trading (discussed below) demonstrates clearly the international political obstacles that the EC can face when introducing EC-specific policies.

Within this context, it is worth revisiting environmental passenger taxes (see Chapter 9), which are growing in popularity. Taxing on a per-passenger basis is a very blunt instrument for tackling the emissions problem, as each passenger pays the same regardless of the level of emissions from the aircraft and how full it is. In the UK there have been several unsuccessful attempts to replace it with a tax payable per plane rather than per passenger, which would take account of the carbon impact of each aircraft type and its occupancy. In addition, the passenger taxes are criticised as the taxes are not normally used on any environmental projects.

A more attractive option to many industry stakeholders is emissions trading or a 'cap-and-trade' system. In this case an overall target for emissions is set and then individual participants can choose to meet the target; reduce their emissions below the target and sell excessive emissions allowance; or keep their emissions above the target and buy more emissions allowance. There is either a closed system where individual companies just buy or sell emissions certificates from others in the same sector; or a more radical open system where companies can buy/sell from other industries. Overall, it is felt that this gives a much greater incentive to monitor and regulate emissions than the other options.

Since 2005, a multi-sector emissions trading scheme (ETS) has been applied in the EU to fixed-source energy intensive installations. In 2012, aviation was included in this scheme. This covered all flights to and from EU airports, with the total allowances capped at 97 per cent of the average 2004–06 value. It was an open scheme with 18 per cent of the allowances auctioned and the rest issued free based on the historic share of tonne-km traffic in 2010. This was greeted with some opposition from European carriers, who were opposed to the auction because they regarded it as a tax and were fearful of how the money, which had to be spent to mitigate climate change, might be spent. A few airlines, notably Ryanair, introduced a new ETS charge of €0.25 per passenger.

However, the greatest opposition was from the non-EU airlines (especially the Americans, Indians and Chinese) who argued that the EU ETS was illegal under international law and that the industry ought to adopt a global approach through ICAO. Retaliatory trade measures from some of these countries were threatened, and in November 2012 the scheme was temporarily suspended for non-EU flights (the so-called 'stop the clock' measure) to avoid conflicts with these international trading partners, and to allow for the development of emissions reduction measures at a global level with ICAO. This organisation, with its global coverage, was considered by many to be the most appropriate organisation to address these issues, with international aviation being largely excluded from the more general initiatives of COP21 in Paris in 2015, where the first climate change agreement to be binding for the world's major countries was signed (although the United States subsequently pulled out of the agreement in 2017).

In 2016, ICAO reached an agreement on a scheme for carbon-neutral growth from 2020. It is called the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). There is a pilot stage (2021–23) and a first phase (2024–26) which are voluntary, and then it will be applied to all airlines from 2027. However, there are some exceptions for less developed countries, small island developing states, landlocked developing countries and states with low levels of international aviation. The years for the baseline emissions levels are 2019–20 and the mechanisms that can be used are both emissions trading and offsetting projects (ICAO, 2017). Whilst the agreement was a landmark in achieving a global consensus on carbon-neutral growth, there has been significant criticism, too, by Gossling (2018), amongst others, that it is too complex and has not gone far enough, especially allowing growth in emissions until 2020 and being voluntary until 2027. By mid-2017, 69 governments had signed up for the initial voluntary stages but more were being encouraged to show their support.

Local impacts

While the global impacts of aircraft emissions have attracted a great deal of attention in recent years, clearly they are not the only impacts that need to be considered. At a regional level the emissions from aviation contribute to acid rain. At a local level the air quality of the area in the immediate vicinity of the airport can be affected – primarily due to emissions of hydrocarbons, CO and NO_x. These can all have detrimental impacts on human health, causing difficulties in breathing and respiratory problems, and pollution-related and health conditions (Kim *et al.*, 2015). Most airports monitor their local air quality, although the monitoring systems vary considerably in their level of sophistication and accuracy. Many airports use these systems to help them model predicted air quality in the future. Since 1981, ICAO has laid down standards for four categories of engine emissions: smoke, hydrocarbons, CO and NO_x. These standards are aimed at local air pollution problems, as they are based on the aircraft landing and take-off (LTO) cycle and do not cover emissions during the cruise phase. Over the years, these standards have been strengthened, specifically in 1993, 1999 and 2005. The latest standards, which were agreed in 2010 and effective from 2014, lowered the air-allowed NO_x levels by 15 per cent. However, they are not legally binding and it is up to member states to include these standards in their laws. Local air quality may also be regulated by general national or international laws related to air quality. For example, within Europe the 1996 Framework Directive on Ambient Air Quality has limits for NO_x that became binding after 2010. These standards may be breached by some airports as traffic grows. For example, there has been considerable debate as to whether this would occur if there were to be a third runway at London Heathrow.

Emissions charges were initially introduced in a few airports (Scheelhaase, 2009). This happened in the late 1990s at the Stockholm airports of Arlanda and Bromma, some other Swedish airports, and the Swiss airports of Zürich, Basel-Mulhouse, Bern and Geneva. Aircraft were initially classified according to their specific emissions, with five classes in Switzerland and seven classes in Sweden. Emissions charges have subsequently been introduced at a number of airports, including Heathrow, Gatwick, Luton, Copenhagen, Munich, Hamburg, Dusseldorf and Frankfurt, based on the ERLIG (Emissions Related Landing Charges Investigation Group) formula which provides a methodology for calculating NO_x and hydrocarbons emissions from different aircraft engines. So, at most airports these emissions charges are based on a charge per NO_x emissions, although at Swiss airports they are based on an emissions value based on the engine value and the number of engines, multiplied (in 2017) by 1.40 Swiss francs. However, while emissions charges in Europe are still very common, they are very rare outside this region.

Just as with noise abatement measures, airport operators and airlines can work together to reduce emissions, and very often certain practices such as CDA will reduce noise and emissions. Likewise, the length of time that engines are run on the ground can be reduced, fixed ground power can be used and taxi-ing times can be minimised. As with the noise issue, the problem at airports is not limited to aircraft operations – the local air quality may also be affected by ground service vehicles which traditionally have tended to be fuel-powered. At some airports, electric vehicles that are more economically and environmentally favourable have been used. Then there are emissions from maintenance and cleaning processes, auxiliary power units, and cars and other surface transport modes. London Heathrow is one of many airports where a considerable amount of ground-level NO_x is from landside vehicles. For this reason, in 2003 the airport established its so-called Clean Vehicles Programme that still exists, to encourage users to employ lower emissions vehicles and to increase fuel efficiency. Hong Kong airport also has a 'Green Apron' policy that involves replacing the existing fleet with alternative fuel or low-emission vehicles. Similar policies exist, for example, at Amsterdam, Dallas/Fort Worth and Bristol airports, which have mixtures of electrical and biodiesel vehicles. Phoenix airport uses compressed natural gas for its car and bus fleet, whilst Boston airport has recently replaced its ageing fleet of diesel buses with new diesel–electric hybrid and compressed natural gas buses. Meanwhile, in 2013 Hamburg airport adopted its Mobility Concept 2020, which stipulated that half of all vehicles operated by the airport group had to be powered by alternative fuels by 2020, with all standard vehicles such as cars, small vans, trucks and buses using these fuels (ATAG, 2015).

Water pollution and use

Water pollution at airports can occur for a number of different reasons. Surface water discharge or run-off that goes into local watercourses from runways, aprons, car parks and other land development may be contaminated by anti-icing and de-icing fluids, including glycol, used during the winter months. The chemicals used in maintaining and washing aircraft and vehicles, as well as fire training activities and fuel spillages, can contribute to this pollution. Leakages from underground tanks and pipes, and grass fertilisers used in landscaping activities, can contaminate the soil. Then there is the normal wastewater from buildings and facilities, including domestic sewerage. An increasing number of airports now monitor water quality as well as air quality and have adopted various measures to minimise water pollution. These include revised operational practices to reduce the use of harmful chemicals, to improve cleaning processes and to minimise spillage and leakage. For example, at Hamburg airport de-icing takes place only on sealed apron surfaces to ensure the fluid run-off does not leak elsewhere, whilst at Munich airport this is done in a specially designated remote area so that the de-icing fluids can be recovered for recycling. A by-product of this recycling process is heat, which can be used to help warm the terminal. Many other airports recycle de-icing fluid. Balancing reservoir treatment may be undertaken before the surface water joins local watercourses.

Waste and energy management

Waste pollution is also an issue. In many cases there may be general legislation related to waste management. However, airports are also faced with specific operating restrictions because of the nature of the aviation business. For example, airports need to incinerate or send to a controlled landfill site all 'international' food waste from aircraft. In addition, the transfer of waste from airside to landside at airports is problematic because of security, customs and insurance restrictions.

The waste at airports is generated by airlines, airport operators and other airport-related companies. While most of the waste comes from the airlines, it is usually the airport operators that have overall responsibility for waste management for the entire airport activities. Most of the individual companies, especially the airlines, do not have enough space for waste management facilities, and there are cost economies of scale to be gained by having communal recycling and other waste management procedures. Improvements can usually be brought about by an assessment of on-airport treatment methods and the scope for reducing, re-using or recycling waste. In-flight catering waste, with the disposable nature of most of the packaging, is considered a particular problem. Off-airport disposal methods that typically involve incineration and landfill also need to be considered.

Most airports now have recycling initiatives. One of the earliest airports to undertake this was Zurich airport, which introduced an airport-wide waste management concept in 1992. Other examples range from concrete recycling at Jersey airport, to re-using cut grass instead of fertiliser at Stansted airport, airline pillow recycling at Oakland airport, and re-use of excavated soil at Dallas/Fort Worth airport. At Los Angeles in 2017, a pilot scheme was undertaken to recycle food waste into renewable natural gas, with the residual solid and liquids being made into reusable products such as soil amendments. At Seattle airport the food waste is given to a food bank in the city. Other airports, including Canberra, recycle their water or collect rainwater to be used in the toilets, as at Calgary airport. Interestingly, Hong Kong airport undertook a waste-handling survey of 27 airports as well as liaising with its home carriers. It found that airports and airlines had different procedures for recycling which hindered the efficiency of the whole recycling process and has developed policies to overcome this. It also has developed a three-pronged management approach to tackle food waste at the airport, which covers food waste recycling, the conversion of waste cooking oil to biodiesel and food donation (Kilburn and Lee, 2015). Phoenix Sky Harbor is another example of an airport that has been very active in achieving waste diversion goals and at the same time reducing costs. Some of its initiatives include a dedicated recycling programme, a construction waste programme and a runway friction rubber removal recycling plan (Lissner, 2014).

Energy management associated with the provision of heating, ventilation, air conditioning and lighting is also very important. Many airports undertake energy audits and have effective building management systems to provide optimal control of such systems. With energy conservation, as with waste and water management, there are good financial reasons why airports should address these issues, since environmental improvements may bring about considerable cost savings. Many airports have replaced terminal or parking ramp lights with led fixtures. Paris CDG airport has replaced the gas boilers that it previously used and now has a biomass plant that produces heat through the combustion of wood waste in the form of wood chips, with the ashes being reused as agricultural fertiliser by the company providing the wood chips. Meanwhile, some airports, including Vancouver, Chicago, San Francisco, Malta, Barcelona, Brisbane, Athens, Kuala Lumpur and Bologna are using solar energy – in total around 100 airports worldwide have solar installations (ATAG, 2015). Others, such as La Palma airport in Spain, have wind power generators.

Wildlife, heritage and landscape

There is also a need to protect the wildlife, heritage and landscape of the local environment, and there are many examples of how specific airport operators in the past have tackled the disturbance of certain wildlife habitats – particularly during the construction of a new airport or during airport expansion. While the Chek Lap Kok airport in Hong Kong was being built, a 1 km exclusion zone for dolphins was set up to ensure their sensitive hearing was not harmed during blasting work. At Indianapolis airport, 3,000 new homes for Indiana bats had to be installed due to a new maintenance building that displaced the bats. At Perth airport, development was halted when a rare western swamp tortoise colony was discovered. At Miami airport, the death of four manatees beneath the runway forced the airport operator to take action to protect this endangered species. At Manchester airport, badger sets had to be relocated and a rare breed of newts had to be protected when the second runway was being built. At Oslo Gardermoen airport, a bridge had to be built to prevent the 1,000 moose who annually migrate across the region from wandering onto the airport approach roads. At Stansted airport, some great crested newts had to be moved to a habitat especially created by the airport operator, while Tallahassee airport in Florida also developed an onsite conservation area for the gopher tortoise. Many more examples exist.

Heritage may also be affected by airport development. For example, historic buildings may be situated within the area that has been allocated for airport expansion. In the case of Manchester and Copenhagen airports, this meant moving such buildings brick by brick to other locations. In addition, landscapes can be radically changed by airport developments which can disturb the ecosystem and may be visually intrusive. To compensate for this, some airports have established 'green areas', including Athens airport where there are five such projects that cover a total area of six hectares and include features including walking paths, playgrounds and planted areas. Detroit airport developed a wetlands area, whereas at Southwest Florida airport a nature reserve was established.

An interesting development is the so-called 'Green Belt' that is planned at Bologna airport. This will be a strip of vegetation on the northern perimeter of the airport consisting of woodland planted with tree species with good CO_2 absorption, covering an area of around 36 hectares. It will have a number of different functions, such as absorption of CO_2, acting as an air pollutant screen, improving the local landscape, enhancing the local ecological functionality and using leisure activities to discourage the presence of birds. Farmers who are involved with the project could potentially get involved in the production of biofuel derived from the crops grown (dAIR, 2014).

Community impacts

Airport environmental impacts may have a detrimental impact on the quality of life for residents in the vicinity of the airport. The major areas of concern are aircraft noise, air pollution, fuel odour, ecological damage and the safety of aircraft. While the exact relationship between human health and well-being and these factors is still not entirely clear, an area that has received particular attention is the problem of sleep disturbance due to night flying. It is for this reason that many airports restrict aircraft movements at night or ban noisier aircraft types. The rising number of aircraft movements has also increased concerns about aircraft safety and has resulted in some airports establishing risk contours around airports associated with third-party death and injury.

Forging strong links with the community and ensuring continual public dialogue with all interested parties is often considered an important role. Airports become involved in community relations, including the provision of information about environmental and other developments, offering a complaints-handling service, supporting and sponsoring local arts, culture and sports events, and developing educational links. Some airports set up residents' forums. Many airports also have consultative committees with representatives from local government, amenity groups, local commerce and industry and airport users. These may be a legal requirement. Another important stakeholder to consider here will be the airport employees, and issues including equal opportunities, ethics policies, skills training and workplace safety and security.

Most airports are addressing such social and community issues within the framework of broader sustainability policies or corporate responsibility strategies (CSRs) that consider all stakeholders and all impacts, both positive and negative (Berry *et al.*, 2008; Paling and Thomas, 2018). Skouloudis *et al.* (2012) undertook a content analysis of CSR reports and noted that whilst publication of such non-financial information by airports was increasing, it was very much restricted to North America and Europe – although as this research is somewhat dated it is likely that the airport CSR reports now have more widespread use. A growing number of airports are publicly reporting their sustainability or corporate responsibility performance against the Global Reporting Initiative (GRI) guidelines. These give stakeholders a universally applicable and comparable framework in which to understand the disclosed information about economic environmental and social performance. The ultimate aim is that such reporting will become as routine as financial reporting. However, Koç and Durmaz (2015) studied the use of GRI sustainability reporting standards at 10 major airports and concluded that much more effective use of these was needed, especially in the social and environmental areas.

The role of other transport modes

Returning more specifically to the environmental aspects of airport operators, an important consideration is that of other transport modes. There are two ways in which the use of other modes can affect the direct and indirect environmental impacts of airports. First, there may be some opportunity for passengers on short- and medium-distance flights to be diverted onto high-speed rail services. In the 1980s and 1990s there was continuing growth in the number of high-speed rail services, notably in France and Germany in Europe and Japan in Asia. More recently, other countries such as Spain and Italy in Europe, and notably China as well as Taiwan and South Korea, have also developed significant high-speed links.

Various studies showed that a quick city centre to city centre rail service had been quite successful in attracting a certain share of the population away from competing air services. For example, in Europe it was estimated that the rail share of traffic on the Frankfurt–Munich route increased from 30 to 37 per cent in the first year of operation, with a drop in airline share from 27 to 23 per cent. On the Stockholm–Gothenburg route, the rail share was estimated to have increased from 40 to 55 per cent in the first 4 years of operation, and the first TGV route in France between Paris and Lyons was claimed to have gained a 90 per cent market share (CAA, 1998). More recent research on routes from the UK airports to Paris and Brussels shows that traffic declined annually by 6 per cent between 2004 and 2007, while passengers travelling on the Eurostar rail service across the Channel increased by 5 per cent per year over the same period. In terms of market share, in 2005 rail share of point-to-point traffic between London and Paris/Brussels was below 70 per cent, but by 2010 it had increased to 80 per cent. Another European example is in France, where the TGV Mediterranean was introduced in 2001 between Paris and Marseille. In 2001, rail held a market share of only 22 per cent of the combined Paris–Marseille air/rail market, but by 2005 this had increased to 65 per cent (Thelle *et al.*, 2012). Meanwhile, in Taiwan the air share of all transport on the Seoul–Daegu route fell to zero in 2008 after being 15 per cent in 2004 before the high-speed link opened, whilst on the Seoul–Busan the share fell from 42 to 17 per cent. Likewise, a comparison of before and after shares in 2004 and 2008 in Taiwan shows a reduction of 29 to 5 per cent on the Taipei-Kaohsiung route and a fall of 14 to 2 per cent on the Taipei–Tainan route (Givoni and Dobruszkes, 2013).

However, switching from air to rail is feasible only when dense routes are being considered. Such rail links also require huge capital investment. In the end, passengers will choose the rail option when the time, fare, frequency and access characteristics of the service offers them an advantage. Rail services are not usually an attractive option for transfer traffic unless the high-speed network is linked to airports. An interesting development occurred in Germany when, in 1998, Lufthansa and the railway company Deutsche Bahn (DB) signed a memorandum of understanding that enabled them to produce their AIRail product on completion of the high-speed train link. This involved a partnership on the high-speed routes of Frankfurt–Stuttgart from 2001 and Frankfurt–Cologne from 2003. This is a code-sharing agreement between Lufthansa and DB, and in 2013 such code-sharing was extended to the Frankfurt–Düsseldorf sector, and in December 2014 to Kassel and Karlsruhe as well. At Paris CDG, a number of airlines have similar agreements with the French railways, SNCF. The services are also operated with through baggage check-in and the same transfer times as at the air terminal. This initiative switched passengers to high-speed trains and reduced the use of feeder flights as well as shifting some demand from cars and local urban rail services (Fakiner, 2005).

The individual airport operator has far greater control in influencing the mode of surface travel used by passengers, employees and others to reach the airport – the other aspect of surface transport that needs to be considered. Ground transport makes a major contribution to the overall noise levels and air pollution at an airport, with the impacts rising as the transport system becomes congested. Many airports are trying to develop more effective public transport alternatives to the car for accessing the airport. They have also introduced many initiatives to encourage passengers and airport employees to use public transport. A few airports, such as Pittsburgh airport in the United States, have dedicated buses and high-occupancy bus lanes to discourage individuals from using their cars. Overall, reducing car use is a key way in which airports can yield important environmental benefits, but matching such reduction policies with the commercial pressures to maximise the revenue potential of airport parking can be very challenging (Ison, 2008).

Historically, most passengers arrived at airports by private car or taxi, with only a small proportion using bus or coach transport. With airport growth in the 1970s and 1980s, some existing suburban or local rail services were extended to reach the airport. They are still the most common form of rail link today, with many examples being found in North American airports (e.g. Cleveland, Boston, Atlanta and Chicago) and other airports, including Munich, Stuttgart, Barcelona, Malaga, Rome Fiumicino, London Luton, Changi Singapore and Shanghai. There are also underground or light rail links at some airports, such as London Heathrow, Madrid, Newcastle, Nuremberg, Bremen, London City, Vancouver, Salt Lake City, Portland Oregon, Dallas/Fort Worth, Baltimore, Dubai, Beijing, Shanghai and Singapore.

Many of these services are relatively slow, with a rather basic quality of service, and are not dedicated links to the airport. They may be popular with employees, but are less attractive to passengers. This has meant that a number of airports, particularly those with large traffic volumes or a long journey away from the city centre, have instead developed high-speed dedicated links. Such links bring environmental benefits and alleviate road congestion as well as bringing extra convenience for passengers. Arlanda, Stockholm airport's third runway, was approved only subject to a rail link being built. Other dedicated airport rail link examples include Gardermoen in Oslo, Heathrow in London, Chek Lap Kok in Hong Kong, Milan in Italy, Brussels in Belgium, Nagoya and Narita in Japan, Incheon in Korea, Kuala Lumpur in Malaysia and Johannesburg in South Africa.

A number of airports have also developed high-speed links connecting airport terminals to international routes, including Paris CDG, Lyon, Frankfurt, Zurich, Cologne and Dusseldorf. Some airports also have integrated regional and high-speed rail links – Paris CDG being a good example. Frankfurt airport has three railway interfaces. There is a regional train station below terminal 1, the AIRail terminal for the long distance services and a rail connection to Cargo City South. In Germany, there is also a concept called DB Rail and Fly offered by Deutsche Bahn that offers train tickets from many German railway stations to 20 airports in Germany, Austria, Switzerland and the Netherlands. Remote baggage services are also available in Europe, one of the most developed examples being the Fly Rail baggage system in Switzerland that provides check-in and delivery of baggage at all rail stations.

In total there around 200 airports with rail links but there may be 400 more links in various stages of planning, design or construction (Le Blond, 2014). Within this context it is noteworthy that based on a sample of 15 examples of new rail services in Europe and North America, some tentative conclusions suggested that once the rail services start, the bus and car mode shares are likely to decline and as expected the overall public transport mode share is likely to increase (International Air Rail Organisation, 2015).

However, a growing number of airport operators have recognised that encouraging passengers onto any form of public transport is much more than just consideration of journey time. It also includes looking at the accessibility of the surface modes, ease of transfer to the airport and arrangements for baggage. Some airports are designing better interchange processes between public transport and the airport and offering more remote check-in, as in Switzerland. Others have tried making improvements in marketing, signage and the availability of information. Digital information is particularly important, as Martin-Domingo and Martín (2015) found that airport apps provided very limited functionality to help passengers to plan and book public transport, whilst giving higher priority to parking information and services. Budd *et al.* (2014) have also suggested that airports need to examine any attitude–behaviour gap that their passengers may have in order to ensure that positive environmental attitudes are translated into the use of more sustainable surface modes.

It is difficult to obtain up-to-date comparable information showing public transport use at global airports. Some somewhat dated research – although still probably highly relevant – found that the highest shares of public transport worldwide were achieved at airports in Europe and Asia, particularly Oslo, Hong Kong, Narita and Shanghai, where at least half the passengers use public transport. In the United States and Australia, higher dependence on the car generally and the smaller number of specific rail links mean that public transport use is generally less – even below 10 per cent for a number of airports (Coogan, 2008).

Specifically within Europe, using data from a total of 51 European airports (corresponding to approximately 56 per cent of European passengers), EASA *et al.* (2016) found that overall 43 per cent of these passengers gained access to these airports by using public transport. Selecting Germany as an example, using a travel survey of 22 major airports shows how typically the public transport share might be split amongst the different options (Figure 10.1). Within Europe, Norway tends to lead the way for public transport use at airports. In 2008, Avinor adopted a goal of reaching the 70 per cent public transport share at Oslo airport in 2020 but it achieved this ahead of schedule in 2015. It claims that it remains on track to achieve a 75 per cent share by 2030. It has challenging targets at some of the regional airports as well (Figure 10.2). For those who drive to and from Oslo airport, the airport has a huge charging area, which is free, to encourage more use of electric cars.

Employees also tend to make heavy use of private transport to travel to and from the airport. For example, research in the UK found that there were only three major airports (London Gatwick, London City and Birmingham) where the public transport share for employees was above 10 per cent (Humphreys and Ison, 2005). Likewise, in the United States typically very few employees travel by public transport, with a few exceptions, including Boston, Chicago and Denver (Coogan, 2008). However, some European airports, including Amsterdam, Frankfurt and Zurich, tend to achieve a higher share of public transport use.

Many airport operators have been trying to encourage more airport employees to use public transport. Inherently, there are a number of characteristics of airport employment that encourage the use of a private car. Many of the jobs tend to be on a shift basis, often at unsociable times when public transport services are inadequate. Employees' residences tend to be dispersed around the vicinity of the airport, which makes it much more difficult to provide an effective public transport system. Airport employees traditionally

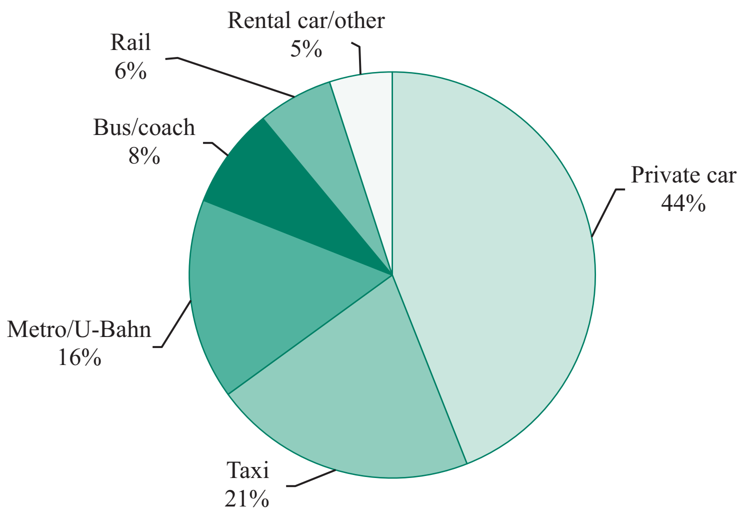

Figure 10.1
Surface access mode used at German airports, 2014
Source: Adapted from ADV (2015)

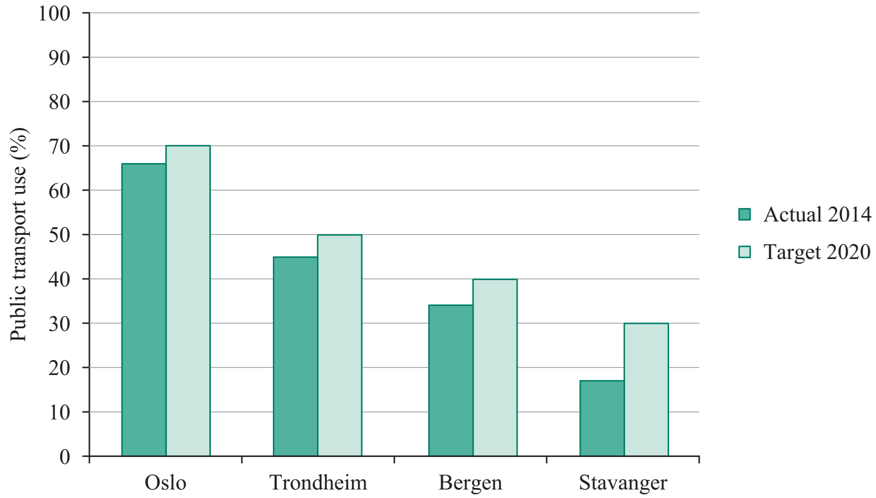

Figure 10.2
Public transport use and targets at selected Norwegian airports
Source: Avinor (2016)

have been provided with free parking spaces at airports, thus increasing the attractiveness of car transport (Ison *et al.*, 2007). Staff initiatives to encourage public transport use include discounted bus and rail travel, dedicated airport workers' buses, the development of cycling networks, and park-and-ride schemes. Manchester airport is an example of an airport that provides cycling facilities and services, including bike parks, showering facilities and loans for purchasing bikes. When car use is still necessary, car sharing has been encouraged at some airports. Restrictions on car use within the airport area have also been introduced. One of the many examples of a staff travel plan is the 'lift' plan at Auckland airport, which had an initial goal of encouraging staff to car-pool once a week or use public transport once a fortnight, and subsequently has developed into a significant initiative for car-pooling. The internet has greatly improved the opportunities for car-pooling systems.

A third group of car users at the airport are visitors and meetings and greeters. These generate so-called 'kiss-and-fly' journeys. With these users, for every flight there are four vehicle trips (dropping off and collecting) rather than two if passengers drive themselves. These journeys also put extra pressure on airport roads and kerb space, which can lead to increased congestion and raised levels of emissions and so are particularly problematic for airports (Budd *et al.*, 2011). Traditionally, these users paid nothing at the airport, but some airports are now charging or limiting such practice. This is because of a number of reasons, such as security concerns, to minimise congestion, to promote a healthier environment, to encourage use of public transport, and to generate new revenues. This is a particularly prevalent trend in the UK, where Birmingham was the first airport to introduce such 'kiss and drop-off' charges in 2007. Now 14 UK airports have adopted this practice, with prices varying around £1–3 for around 10–20 minutes (Nix and Mundy, 2017).

For all users, greater use of technology may help encourage less use of the car. For example, Ryley *et al.* (2013) found that a sizeable proportion of passengers in addition to employees would actually be prepared to car share if this was facilitated by digital technology. RFID tagging of luggage could also help to overcome the difficulty of taking luggage on public transport to access airports. Moreover, telepresence where passenger, relatives or friends could order an on-demand virtual event to say goodbye to the traveller could help cut down on the kiss and fly journeys. If users have to use taxis, it makes sense for them to be as environmentally friendly as they can be. Stockholm airport has been very active in this area, giving priority to eco-taxis (low-emissions electric, hydrogen and natural gas cars). As a result, the share of these taxis rose from 16 per cent in 2009 to 84 per cent in 2014 (ATAG, 2015). It now has 100 per cent targets, which have also been applied at Bromma Stockholm and Gothenburg airports, which have all been realised. Stockholm airport, in collaboration with Taxi 020 and Mitsubishi, also launched Sweden's first electric taxis.

Many airports have developed strategies to encourage better public transport use by all users of the airport. Occasionally these can be demanded by governments. For example, since 1999 in the United Kingdom, all airports with scheduled services have been required to form airport transport forums (ATFs) and prepare ASASs as part of a national policy framework for integrated transport (see Case Study 10.1). Meanwhile in Australia, all major airports have recently been required to produce separate surface access plans for the first five years of a master plan's 20-year life span, with these being used primarily to prepare the airports for forecast growth of traffic (Ison *et al.*, 2014).

Another example of cooperation with different stakeholders is a Letter of Intent signed by Stockholm Arlanda airport, public transport providers, the Swedish Road Administration and local and regional planning authorities, in September 2008. This Letter of Intent aims at improving public transport connections to the airport and discouraging the use of private cars. It supports a specific Action Programme that includes measures to increase accessibility to the airport; reduce carbon emissions from ground transport; and achieve the zero vision for CO_2 (from heating, electricity consumption and airport vehicles). As already discussed, Arlanda airport has a cap on its overall carbon emissions and an effective airport surface access strategy (ASAS) has to be key for maintaining emissions below the cap.

CASE STUDY 10.1
AIR TRANSPORT FORUMS IN THE UK

Since 1999 in the United Kingdom, all airports with scheduled services have been required to form ATFs and prepare ASASs as part of a national policy framework for integrated transport.

The ATF has three specific objectives:

- to agree to short- and long-term targets for decreasing private car usage to and from airports
- to devise a strategy for achieving these targets
- to oversee implementation of the strategy

The ATF consists of the airport operator and representatives from local businesses, local government, transport operators, the local community and other interested parties. It is the responsibility of the airport operator to develop proposals in line with the ASAS and to secure corresponding funding. The ASAS should cover both passengers and airport workers.

A detailed recent analysis of 10 ASASs (Ison *et al.*, 2014) identified five common aspects of the plans, namely environmental footprints, employee access, passenger access, car parking and constrained location/land use issues. The policy measures were both short term (e.g. improved public transport bus services – frequencies and route provision; improved public transport marketing and information – airport website details; car parking charges) and long term (development of rail links; development of ground transport interchanges). In preparing an ASAS, the forum has to ensure the proposals are consistent with the broader integrated transport plans for the area (Humphreys *et al.*, 2005).

As can be seen from Figure 10.3, public transport to UK airports varies considerably. So too do the targets. For example, for the London airports, Heathrow has a target to maintain the share above 40 per cent until 2019, whereas for Stansted this is 50 per cent. Luton airport's target is to increase its share to 40 per cent by 2017. Gatwick airport has a target to achieve a 40 per cent share by the time the airport is handling 40 million passengers and to identify feasible measures to achieve a stretch target of 45 per cent once this has been achieved. So this indicates that a share of 40–50 per cent for London is seen as a reasonable target, but they are generally lower for the less accessible regional airports (e.g. East Midlands – 15 per cent, Birmingham 37 per cent, Edinburgh 35 per cent, and Newcastle 30 per cent).

By way of illustration, the targets for the Birmingham ASAS for 2015–20 for both passengers and employees are shown in Table 10.2. The ASAS has the following priorities (Birmingham Airport, 2015):

- Optimise upcoming government opportunities (e.g. franchising, rail devolution, transport infrastructure investment)
- Make public transport (bus, coach and rail) a credible and convenient choice
- Integrate key road and rail infrastructure schemes with the airport
- Improve integrated ticketing across all modes
- Inform passengers across modes using intelligent systems

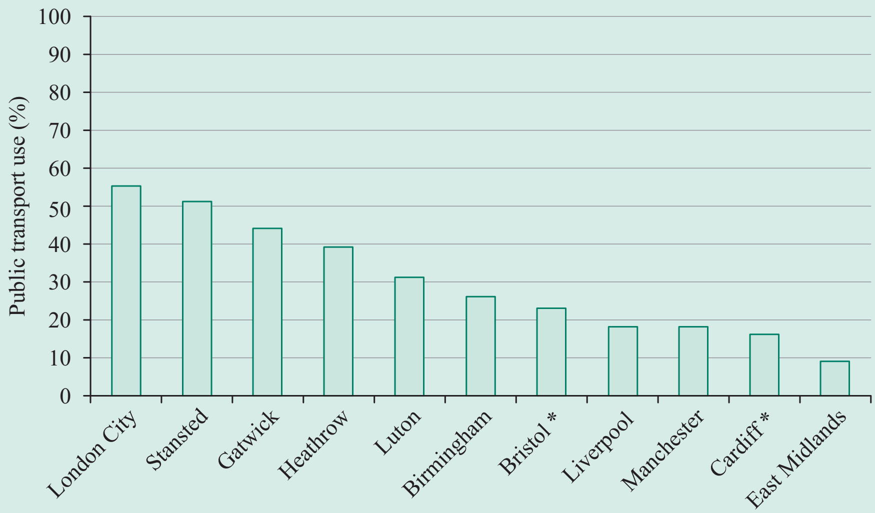

Figure 10.3

Public transport use at selected UK airports, 2016
*2015 rather than 2016 data.

Source: CAA (2017, 2016)

- Support improvements in capacity, accessibility and reliability across and between modes (off-site)
- Improve capacity, accessibility and reliability across and between modes (on-site)
- Improve accessibility and opportunities for increased freight movements
- Ensure reliable access options are available by all modes to all employees
- Review static and dynamic information systems
- Liaise with bus, coach and rail operators and to seek to improve quality and quantity of public transport to the airport
- Review landside road infrastructure for pedestrian and cyclist movements to achieve improvements in the level of provision
- Improve surface access in rail and road to ensure the region is well connected.

Table 10.2 Surface access shares and targets at Birmingham airport

Passengers model share (per cent)			Employee model share (per cent)		
Mode	Existing 2013	Target 2020	Mode	Existing 2013	Target 2020
Car	48	42	Car	84	70
Train	23	25	Train	8	11

Passengers model share (per cent)			Employee model share (per cent)		
Taxi	18	18	Cycle	3	4
Offsite car park	7	7	Car share	2	10
Bus/coach	4	8	Bus coach	2	4
			Other	1	1

Source: Adapted from Birmingham Airport (2015)

Environmental management

For most airport operators, environmental policies are a very important component of their overall business strategy. Environmental pressures from governments, users and other bodies have made it essential for airports to address environmental issues very seriously. In some areas, including air and water quality, airports often have to comply with environmental legislation. Airports have recognised, though, that sound environmental practice can also bring financial benefits through the effective management of resources, including energy, waste and water. As a result, most major airports now have well established environmental strategies and relatively sophisticated policies that typically seek to reduce noise and emissions, control pollution, reduce waste and energy use, and encourage the use of renewables and public transport. Increased technology and new mitigation methods are constantly enabling improvements in the efficiencies of such policies. Smaller airports and airports in the developing world have somewhat less sophisticated approaches, but few have managed to escape the whole issue of environmental management entirely. Since airport operators themselves produce relatively few of the direct environmental impacts, a key to any successful environmental strategy is a partnership approach between all the different interests on the airport site.

As every airport is different, it is difficult to gauge the popularity of the various environmental measures discussed above. However, a survey of 74 North American airports does provide some insight here, albeit that the sample is relatively small and may not be totally representative. Tracking noise complaints (58 airports), having a noise abatement runway use programme (51 airports), and having a flight tracking system (48 airports) were particularly popular initiatives, whereas less than half provided alternative fuel infrastructure (34 airports), had water-saving landscaping (23 airports), encouraged or required low emission ground access vehicles (28 airports), or had employee trip reduction programmes (21 airports). However, with the growing emphasis on environmental issues it is likely that there has been more airport involvement in some of these less popular areas in the few years since the survey was undertaken (ACI North America, 2009).

At many airports, environmental control processes have evolved into comprehensive environment management systems. These provide the framework for airport operators to develop an effective and coordinated response to all the environmental issues. Within any system, clearly defined objectives and targets are set for reducing the impacts and the most appropriate mitigation methods are identified. Through adopting such an approach, the airport operator also sends messages to the outside world that it is tackling the environmental issues in a responsible manner. In addition, when an airport is planning a major extension of its facilities, it is usually required by law to undertake an environmental impact assessment as part of the planning approval process. This will examine the potential impacts of the proposed development during the construction and operational stages. The results of this assessment are typically summarised in an environmental impact statement.

Some airports choose to formalise their environmental management system by conforming to the International Environmental Management System standard ISO 14001. This is equivalent to the ISO 9000 standard for quality management. To meet the requirements of ISO 14001, airports need to review their environmental impacts, formulate an environmental policy, ensure their practices comply with all relevant legislation, set objectives and targets to improve environmental performance, and demonstrate that appropriate measures have been introduced so that environmental practice can be monitored and targets can be reached. Dublin airport became one of the first European airports to receive ISO 14001 certification in 1999, and many other European airports have subsequently been certified. Toronto was the first airport in North America to achieve this standard in 1998. There are also other measures; for example, within the EU there is a system called the Eco Management and Audit Scheme which further develops the ISO 14001 standard.

Irrespective of whether an airport uses the GRI guidelines or some other system, it needs to identify suitable environmental indicators that can be used to monitor performance and set targets. The indicators should provide a representative picture of the issue under consideration, and it must be possible to obtain relatively easily and accurately the data required for such indicators. The indicators need to be fairly simple, easy to interpret, and able to show time trends. However, there does tend to be a lack of total comparability between the indicators that makes any comparison between different airports very difficult to achieve. Table 10.3 presents the set of relevant indicators that have been suggested for US airports.

A growing number of publications have been produced to help airports reduce their greenhouse emissions (ACI, 2009; CDM, 2011) and many airports now have climate change plans. One ultimate target of a growing number of airports is to become carbon-neutral. Swedavia was the first airport company to become carbon-neutral in 2012 and has demonstrated best practice in a number of emissions reduction areas (Abrahamsson, 2017). There are now a number of airports in Europe that are carbon-neutral, as well as a few elsewhere. Interestingly, Stockholm airport is the only airport in the world to have a government-imposed cap on CO_2. This means that its total emissions for aircraft taking off and landing, from surface access transport, from

Table 10.3 Possible performance indicators for environmental management

Energy management	Environmental management
Airfield electricity consumption – change over prior period	Carbon footprint
Airport vehicles and ground service equipment converted to energy-efficient types (per cent)	De-icing – percentage fluid recovered
Renewable energy generated by the airport (per cent)	Leadership in Energy and Environmental Design (LEED) building projects – percentage new building projects being built to LEED standards
Renewable energy purchased by the airport (per cent)	Environmental reviews – timeliness of completion
Tenant vehicles and ground service equipment converted to energy-efficient types (per cent)	Number of environmental violations
Terminal building electricity consumption per square foot – change over prior period	Night operations – percentage using preferential runways
Utilities/energy cost, airport total – change over prior period	Noise-abatement procedures – percentage compliance
Utilities/energy cost per square foot of terminal building	Noise – number of homes within 65 dBA DNL
	Reportable discharges, number
	Stage 2 operations <75,000 lb
	Waste recycling

Source: Adapted from Hazel *et al.* (2011)

internal vehicles and from other sources such as the heating of buildings, must not exceed the level produced in 1990. Since 1990, passenger numbers have increased by about 35 per cent and so this is a challenging cap.

A related and important development has been ACI Europe's airport carbon accreditation scheme, a carbon management standard that was launched in May 2009 and has now been adopted worldwide (see Case Study 10.2). Within a broader context, another recent global project is the Airports Sustainability Declaration. This was initiated by Amsterdam airport in 2016 to tie in with the sustainable goals of the UN, COP21 and ICAO. Around 20 airports from Europe, North America and Australia have already signed this, and in 2017, TUI was the first airline to collaborate with this.

CASE STUDY 10.2
THE ACI AIRPORT CARBON ACCREDITATION SCHEME

In May 2009, ACI Europe launched its carbon accreditation scheme. The programme is administered independently by WSP Environment and Energy, and provides airports with a common framework for active carbon management with measurable targets. It makes a distinction between the emissions the airport operator can control and influence, compared with others. There are four levels of accreditation: level 1 – mapping (which requires compilation of carbon footprint reports); level 2 – reduction (which requires achieving emissions reduction targets for emissions under the airport operator's control); level 3 – optimisation (which requires engaged third parties in carbon reduction); and level 4 – neutrality (which requires offsetting remaining emissions to achieve carbon-neutral operations). In 2011, the scheme was extended to Asia Pacific and 2013 saw the first African airport being accredited. Then in 2014, airports in North America, Latin America and the Caribbean were included – making the scheme's coverage worldwide. In September 2017, there were 196 accredited airports covering nearly 40 per cent of all passenger traffic (Table 10.4). At COP21 climate change negotiations in Paris (December 2015), the United Nations Framework Convention on Climate Change (UNFCCC) members and ACI also signed a partnership to further promote climate action by airports through this programme.

Table 10.4 The airport carbon accreditation scheme, 2017

Region	Number of airports				Share of region passenger traffic (per cent)
	Level 1	Level 2	Level 3	Level 4	
Latin America	4	2	0	0	8.3
North America	9	12	5	1	35.9
Africa	7	2	0	1	30.4
Asia-Pacific	10	8	14	5	30.2
Europe	28	37	23	28	64.8
TOTAL	58	61	42	35	39.1
Level 4 carbon neutral airports/ airport companies	Rome Fiumicino, Lyon, Athens, Avinor (Oslo, Trondheim), Eindhoven, Antalya, London Gatwick, MAG (East Midlands, Manchester), Nice, Venice, Amsterdam, SEA (Milan Linate, Milan Malpensa), Swedavia (Are Ostersund, Gothenburg, Kiruna, Lulea, Malmo, Ronneby, Stockholm Arlanda, Stockholm Bromma, Umea, Visby) TAV (Ankara, Izmir)				

Source: Airport Carbon Accreditation (2017)

Climate change adaptation

This chapter so far has identified the major environmental impacts associated with airport operations and described various environmental management approaches designed to reduce these effects. Environmental issues affect most aspects of airport operations and undoubtedly will become even more important in the future. One of the major challenges is climate change and it has been discussed how the air transport industry has been trying to mitigate this carbon pollution. However, it is inevitable that climate change impacts are going to continue to grow and it is likely that disruptive weather events will become more extreme and more frequent. This means that the airport industry, as well as other sectors in the air transport industry, needs to ensure resilience in its infrastructure and services to cope with this. Table 10.5 summaries some of the key climate risks and typical impacts that airports need to consider.

Adapting to climate change is an issue faced by many sectors of the economy, and an increasing number of countries are producing national adaptation plans that include aviation. Guidelines and tools are being developed to assist airports in this area. For example, in France the French civil aviation authority (DGAC) has launched a programme called VULCLIM, to identify the likely impacts of climate change on French airports, and as a consequence to assess the potential risks to individual airports. This is undertaken by considering the likelihood of the occurrence of the change (low, medium

Table 10.5 Main climate change risks and impacts for airports

Climate risk	Impact
Precipitation change	Disruption to operations (e.g. flooding, ground subsidence) Inadequate drainage system capacity Loss of local utilities provision (e.g. power) Inundation of: • underground infrastructure (e.g. electrical) • ground transport access (passengers and staff)
Temperature change	Changes in noise impact due to aircraft performance changes Heat damage to airfield airport surface and increased heating/cooling requirements
Sea level rise	Loss of airport capacity and infrastructure
Wind changes	Disruption to operations and changes to distribution of noise impact
Extreme events such as sudden precipitation and wind events	Disruption to operations, supply of utilities, ground transport access

Source: Adapted from EUROCONTROL (2014)

or high) and the intensity of the potential impacts (trivial, minor, serious, catastrophic) which are incorporated into a so-called vulnerability assessment grid or matrix. This risk assessment tool has four levels of vulnerability, namely none, low, medium and high (Table 10.6). Using a case study for Nice airport it has been shown that most airport components were located in no or low vulnerability areas, although there was a higher vulnerability for the runway and ATC navigation equipment (DGAC, 2016). Similar approaches using such grids have been used elsewhere, for example at the London and New York airports.

In the United States, Dewberry *et al.* (2015) have provided a guidebook and electronic tool called Airport Climate Risk Operational Screening (ACROS) to help inform airport management of climate change risk and possible mitigation scenarios. The ACROS tool contains climate information for over 500 airports in the United States, as well as over 700 climate change-related impacts that have been identified for airport infrastructure and operations. Its aim, as with the vulnerability matrix, is to provide a relative risk estimate for individual airport components for the years 2030 and 2060, and by doing so will be able to help the airport operation answer the question 'Within the entire airport, what's most at risk to projected climate changes?'

Table 10.6 The vulnerability assessment grid

Climate changes/ Airport components*	Wind	Biodivesity	Sea level	Temperatures (e.g. heat waves, draughts)	Extreme events (e.g. floods, extreme winds or snowfall)
Infrastructure (e.g. runways, taxiways, aprons)	N/L/M/H	N/L/M/H	N/L/M/H	N/L/M/H	N/L/M/H
Buildings (e.g. terminals, airbridges, ATC tower)	N/L/M/H	N/L/M/H	N/L/M/H	N/L/M/H	N/L/M/H
Exploitation (e.g. equipment, human resources)	N/L/M/H	N/L/M/H	N/L/M/H	N/L/M/H	N/L/M/H

*Climate change and airport components are sub-divided further but for simplicity this is not shown on the grid.

N/L/M/H is the vulnerability level (none, low, medium of high) based on the likelihood of the change and its potential impact.

Source: Adapted from DGAC (2016) and Lopez (2016)

Clearly the individual characteristics of the specific airport will have a very significant impact on the level of risk assigned to different climate changes. For example, Norway, which has many airports situated along the coastline, some with runways only a little above sea level, are very concerned with sea level impacts. Whereas with airports where warm temperatures may rise, such as Spain, there may be issues related to what needs to be done if the warmer climates affect the ability to handle aircraft operations with current runway lengths, and what can be done to ensure the prevention of fires. Interestingly, Baglin (2012) undertook a survey of US airports, albeit with quite a small sample, to assess climate change issues of most concern to airports. The type and the scope of concern appeared to shift from 2010 to the 2030 time frame, with snow and ice being the primary concern in 2010, but with heatwaves and high-intensity storms of more concern for 2030.

More and more individual airport operators are now undertaking an assessment of the risks associated with climate change impacts to their own airport and introducing measures to mitigate the impact of the changes, and some governments, such as in the UK, are making this a legal requirement. For instance, Heathrow airport has identified 34 separate risks and classified them as: those needing action; those needing to be prepared for primarily with greater research; and those needing to be watched. Five risks have been identified as requiring action, four related to the increased flood risk and one to the snow/winter conditions risk (Heathrow Airport Holdings, 2016).

In summary, there is no doubt that climate change adaptation is an issue that seems certain to be a major challenge for airports in the future. Some governments and airports have developed appropriate policies and tools to address these issues, and, for example, practice in Norway has shown that minor adaptation investments in already planned and/or ongoing projects can save on future resources (Mosvold Larsen, 2015). However, as argued by Burbidge (2016, 2017) amongst others, there still remains much to be done in progressing forward knowledge and understanding in this area. Although the general impacts and high-level actions that are needed are fairly well known, it is more specific and detailed quantitative assessments of what climate change really means from an operational perspective that is lacking.

References

Abrahamsson, J. (2017) 'The key to environmental sustainability', *International Airport Review*, 21(3): 38–41.

ACI (2009) *Guidance Manual: Airport Greenhouse Gas Emissions Management*, Montreal: ACI.

ACI North America (2009) *Going Greener: Minimising Airport Environmental Impacts*, Washington, DC: ACI NA.

ADV (2015) *Airport Travel Survey*, Berlin: ADV.

Airport Carbon Accreditation (2017) Results Microsite. Online. Available at http://www.airportco2.org/ (accessed 15 September 2017).

ATAG (2015) *Aviation Climate Solutions*, Geneva: ATAG.

ATAG (2016) *Aviation: Benefits beyond Borders Global Summary*, Geneva: ATAG.

Avinor (2016) *Annual and CSR Report*, Oslo: Avinor.

Baglin, C. (2012) *ACRP Synthesis Report 33 Airport Climate Adaptation and Resilience,* Washington DC: Transportation Research Board.
Berry, F., Gillhespy, S. and Rogers, J. (2008) *ACRP Synthesis Report 10: Airport Sustainability Practices,* Washington, DC: Transportation Research Board.
Birmingham Airport (2015) *Birmingham Airport Surface Access Strategy*, Birmingham: Birmingham Airport.
Budd, L. and Ison, S. (2017) 'Capturing aircraft noise complaints: A survey of current practices at UK airports', *Journal of Airport Management*, 11(3): 294–308.
Budd, T., Ison, S. and Ryley, T. (2011) 'Airport surface access in the UK: a management perspective', *Transportation Business and Management*, 1(1): 109–17.
Budd, T., Ryley, T. and Ison, S. (2014) 'Airport ground access and private car use: a segmentation analysis', *Journal of Transport Geography*, 36: 106–15.
Burbidge, R. (2016) 'Adapting European airports to a changing climate', *Transportation Research Procedia*, 14: 14–23.
Burbidge, R. (2017) 'Climate-proofing the airport of the future', *Journal of Airport Management*, 11(2): 114–28.
CAA (1998) *The Single European Aviation Market: The First Five Years*, London: Civil Aviation Authority.
CAA (2016) *CAA Passenger survey report 2015*, London: CAA.
CAA (2017) *CAA Passenger survey report 2016*, London: CAA.
CDM (2011) *ACRP Report 56: Handbook for Considering Practical Greenhouse Gas Emission Reduction Strategies for Airports*, Washington, DC: Transportation Research Board.
Coogan, M. (2008) *ACRP Report 4: Ground Access to Major Airports by Public Transportation,* Washington, DC: Transportation Research Board.
dAIR (2014) *Decarbonising Airport Regions*, Brussels: dAIR.
Department for Transport (2017) *Beyond the Horizon: The Future of Aviation in the UK*, London: Department for Transport.
Dewberry, Smith and Partners Gresham, GCR Inc., and R. Marchi (2015) *ACRP Report 147, Climate Change Adaptation Planning: Risk Assessment for Airports*, Washington, DC: Transportation Research Board.
DGAC (2016) *Airport Vulnerability to Climate Change*, Information note, Paris: DGAC.
EASA, EEA and EUROCONTROL (2016) *European Aviation Environmental Report 2016,* Brussels: EASA, EEA and EUROCONTROL.
EC (1996) *Council Directive 96/62/EC on ambient air quality assessment and management*, OJ L 296, Brussels: EC.
EC (1999) *Air Transport and the Environment: Towards Meeting the Challenges of Sustainable Development*, Com (1999) 640 final, Brussels: EC.
EC (2002a) *Council Directive 02/30/EC of 26 March 2002 on the Establishment of Rules and Procedures with regard to the Introduction of Noise-Related Operating Restrictions at Community Airports*, Official Journal L85, 28 March, Brussels: EC.
EC (2002b) *Council Directive 02/49/EC of 25 June 2002 relating to the Assessment and Management of Environmental Noise*, Official Journal L189, 18 July, Brussels: EC.
EC (2008) *Noise Operation Restrictions at EU Airports*, Com (2008) 66 final, Brussels: EC.
EC (2014) *Regulation (EU) No 598/2014 of the European Parliament and of the Council of 16 April 2014 on the Establishment of Rules and Procedures with regard to the Introduction of Noise-related Operating Restrictions at Union Airports within a Balanced Approach and repealing Directive 2002/30/EC*, Official Journal L173/65, 12 April, Brussels: EC.
EUROCONTROL (2014) *Adapting Aviation to a Changing Climate*, Brussels: EUROCONTROL.
Fakiner, H. (2005) 'The role of intermodal transportation in airport management: the perspective of Frankfurt airport', in Delfmann, W., Baum, H., Auerbach, S. and Albers, S. (eds), *Strategic Management in the Aviation Industry*, Farnham: Ashgate.
Girvin, R. (2009) 'Aircraft noise-abatement and mitigation strategies', *Journal of Air Transport Management*, 15(1): 14–22.

Givoni, M. and Dobruszkes, F. (2013) 'A review of ex-post evidence for mode substitution and induced demand following the introduction of high-speed rail', *Transport Reviews*, 33(6): 720–42.
Gossling, S. (2018) 'Air transport and climate change', in Halpern, N. and Graham, A. (eds), *The Routledge Companion to Air Transport Management*, London: Routledge.
Gossling, S. and Upham, P. (2009) *Climate Change and Aviation*, London: Earthscan.
Grey, E. (2016) 'The rise of bioports: A new trend for biofuels in aviation', *Airport Technology*, 20 April. Online. Available at http://www.airport-technology.com/features/featurethe-rise-of-bioports-a-new-trend-for-biofuels-in-aviation-4864551/ (accessed 15 September 2017).
Groupe ADP (2017) *Fee schedule for services rendered as specified in Articles r. 224–1 and r. 224–2 of the Civil Aviation Code for the Paris – Charles-de-Gaulle, Paris – Orly and Paris – le Bourget airports*, Paris: Aéroports de Paris.
Hazel, R., Blais, J., Browne, T. and Benzon, D. (2011) *ACRP Report 19A Resource Guide to Airport Performance Indicators*, Washington, DC: Transportation Research Board.
Heathrow Airport Holdings (2016) *Climate Change Adaptation and Resilience Progress Report*, London: Heathrow Airport Holdings.
Humphreys, I. and Ison, S. (2005) 'Changing airport employee travel behavior: the role of airport surface access strategies', *Transport Policy,* 12(1): 1–5.
Humphreys, I., Ison, S., Francis, G. and Aldridge, K. (2005) 'UK airport surface access targets', *Journal of Air Transport Management*, 11(2): 117–24.
IATA (2009) *A Global Approach to Reducing Aviation Emissions*, Geneva: IATA.
ICAO (2010) *Resolution A37–19: Consolidated Statement of Continuing ICAO Policies and Practices Related to Environmental Protection – Climate Change*, Montreal: ICAO.
ICAO (2017) What is CORSIA and how does it work? Online. Available at https://www.icao.int/environmental-protection/Pages/A39_CORSIA_FAQ2.aspx (accessed 15 September).
Intergovernmental Panel on Climate Change (1999) *Aviation and the Global Atmosphere: Summary for Policymakers,* Geneva: IPCC.
International Air Rail Organisation (2015) *What happens to Mode Share when Trains start running to Airports?* 2nd edn, Surbiton: International Air Rail Organisation.
Ison, S. (2008) 'UK airport car parking management', *Journal of Airport Management*, 3(2): 164–75.
Ison, S., Humphreys, I. and Rye, T. (2007) 'UK airport employee car parking: the role of a charge?', *Journal of Air Transport Management*, 13(3): 163–65.
Ison, S., Merkert, R. and Mulley, C. (2014) 'Policy approaches to public transport at airports – Some diverging evidence from the UK and Australia', *Transport Policy*, 35: 265–74.
Kilburn, M. and Lee, C. (2015) 'Accelerating environmental footprint reductions at Hong Kong International Airport', *Journal of Airport Management*, 10(1): 5–13.
Kim, B., Nakada, K., Wayson, R., Christie, S., Paling, C., Bennett, M., Raper, D., Raps, V., Levy, J. and Roof, C. (2015) *ACRP Report 135 Understanding Airport Air Quality and Public Health Studies,* Washington DC: Transportation Research Board.
Koç, S. and Durmaz, V. (2015) 'Airport corporate sustainability: An analysis of indicators reported in the sustainability practices', *Procedia – Social and Behavioural Sciences,* 181: 158–70.
Le Blond, P. (2014) 'Airport railways: Keeping airports connected', *International Airport Review,* 18(5): 35–37.
Lissner, H. (2014) 'Emphasising sustainability and exceeding goals – Phoenix Sky Harbor', *Journal of Airport Management*, 8(2): 105–13.
Lopez, A. (2016) 'Vulnerability of airports on climate change: an assessment methodology', *Transportation Research Procedia*, 14: 24–31.
Martin-Domingo, L. and Martín, J.C. (2015) 'Airport surface access and mobile apps', *Journal of Airline and Airport Management*, 5(1): 1–17.

Mosvold Larsen, O. (2015) 'Climate change is here to stay: Reviewing the impact of climate change on airport infrastructure' *Journal of Airport Management*, 9(3): 264–69.

MPD Group Ltd (2007) *Study of Aircraft Noise Exposure at and around Community Airports: Evaluation of the Effect of Measures to Reduce Noise*, London: MPD Group Ltd.

Nix, E.J. and Mundy, R.A. (2017) 'Airport drop-off and pick up charges in the United Kingdom: Will they come to the United States?', *Journal of Airport Management*, 11(3): 309–26.

Paling, C. and Thomas, C. (2018) 'Airport sustainability and corporate social responsibility', in Halpern, N. and Graham, A. (eds), *The Routledge Companion to Air Transport Management*, London: Routledge.

Ryley, T.J., Elmirghani, J., Budd, T., Miyoshi, C.,Mason, K., Moxon, R., Ahmed, I., Qazi, B. and Zanni, A. (2013) 'Sustainable development and airport surface access – the role of technological innovation and behavioural change', *Sustainability*, 5(4): 1617–31.

Scheelhaase, J. (2009) 'Local emission charges – a new economic instrument at German airports', *Journal of Air Transport Management*, 16(2): 94–99.

Skouloudis, A., Evangelinos, K. and Moraitis, S. (2012) 'Accountability and stakeholder engagement in the airport industry: an assessment of airports' CSR reports', *Journal of Air Transport Management*, 18(1): 16–20.

Steer Davies Gleave (2013) *Evaluation of Directive 2009/12/EC on Airport Charges*, London: SDG.

Thelle, M.H., Pedersen, T.T. and Harhoff, F. (2012) *Airport Competition in Europe*, Copenhagen: Copenhagen Economics.

11 Future prospects

A dominant theme running through this book is that airports are going through a period of unprecedented change. Enhanced competitive pressures from airline deregulation and airport privatisation, coupled with increased demands for a more sustainable and quality-conscious industry, have brought many new challenges for airports. New airline models and groupings have emerged. In addition, airports have had to face the unparalleled consequences of a number of unpredictable events, particularly in relation to the global economic crisis in the late 2000s and increased terrorism activity. The price of aviation fuel has been another major uncertainty which continues to fluctuate considerably. All of this means that the sector has been operating in a much more volatile and unclear environment and all indications are that this is not going to change in the future. This is likely to lead to more flexibility and adaptability in the way airports are operated, and will result in the industry devising new coping strategies and becoming more experienced and knowledgeable in areas such as resilience, crisis and recovery management.

One of the most important changes that has occurred within the airport sector is privatisation. While a number of significant airport privatisations have taken place, currently the degree of concentration and private sector involvement within the airport industry is fairly small – much less than in the airline industry. However, more privatisations are planned for the future. This may be in order to finance and develop airports in regions including Asia, Africa and South America, or it may be just to continue to help reduce public sector debt problems of governments. Whatever the reason, investors are much more cautious than they were in the early days of privatisation, and particularly the number of traditional airport operators that may be interested in getting involved with other airports does not seem likely to expand dramatically. At the same time, though, new investors that were not present in these early stages of privatisation, most notably from the financial sector, have now emerged as dominant players. As the industry evolves, more secondary sales are likely. All this raises the fundamental question – are airports really any different from any other business once the technical and operations know-how has been acquired? It is arguably still too early in the evolutionary stage of airport privatisation to answer this question with any degree of certainty, or to identify the factors that will determine the most successful type of airport management or that will bring the greatest value-added in the long run.

The impact of such fundamental structural changes within the airport industry cannot be assessed without considering the parallel airline developments towards deregulation. The post-deregulation environment in many countries has meant that airlines are trying hard to control costs to improve their operating margins, and consequently are exerting greater demands on the airports to control their costs and keep down their level of airport charges. Slower and maturing traffic in some markets, on top of the effects of the last economic recession, has resulted in such pressures becoming very much greater. The evolution of joint ventures and airline alliances at one extreme and the LCC sector at the other is producing new challenges for airport operators in coping with different types of customer. Such developments are irreversibly changing the traditional airline–airport roles and interactions that have existed for many years. The situation is also continually changing, as can be demonstrated by the recent trend of LCCs moving away from their traditional home of regional and secondary airports and into primary markets and larger airports.

The creation of airline alliances and airline mergers has meant that airlines are no longer automatically linked to the national airport of the country, and airports can no longer, as before, be guaranteed of their custom. Even if they retain the business of such airlines, the needs and requirements of the customers will be different. Alliance members want to be able to share and achieve cost economies and brand benefits from operating joint facilities at airports. For other airports, it may be the emergence of the LCC sector that has been the key driver of change. Naturally, these airlines have a very strong focus on costs, which requires appropriate responses from the airport operator. In these and other cases, airports have to devise different strategies to cope with these diverse airlines, and a 'one-size-fits-all' approach is now rarely appropriate. However, this is complicated by the fact that at the same time there are also indications of some convergence between airline models. A major consideration for airports in their selection of the most appropriate strategies must be the associated impact on the non-aeronautical revenues because of the arguably two-sided nature of the business. In short, the challenge here is to balance the airline requirements with optimising commercial revenues while at the same time maintaining a favourable passenger experience.

Undoubtedly, the airline and airport industries are operating in a more competitive environment nowadays. However, the actual extent of competition that each airport will face will always remain variable depending on location, the nature of the airlines and their services, and other factors. A major issue within the industry that is becoming more important is consideration of whether airports possess sufficient market power to warrant economic regulation. Experience, particularly in Europe, Australia and New Zealand, has shown that different stakeholders have very contrasting views about this.

This all depends on what impact the apparent rise in protectionism and uncertainty regarding trade policies in certain countries, such as the United States and the UK, will have on the demand and supply of the air transport industry. These protectionist policies threaten further air transport liberalisation. A key issue specifically within Europe is the decision of the UK to leave the EU – so-called 'Brexit'. This has created a considerable amount of uncertainty and will continue to do so until it is clearer how such a move will be implemented. The type of trading relationship that emerges will have major consequences for not only air transport demand, in terms of trade and tourism, but also for the degree of liberalisation that will remain – particularly the extent to which the UK will continue to be covered by EU-wide policies in this area and any involvement in the EU's Single Aviation Market. This is already having an impact on airline route development plans. Moreover, there are numerous EU regulations and laws that may cease to be applied to the UK. Many of these are aviation-specific, in areas such as passenger rights, ground handling, airport charges and slot allocation, but others are more general, for instance covering competition and mergers and environmental protection. There is the issue of duty- and tax-free sales and whether this will once again become available for passengers travelling from the UK to other EU countries. In addition, there are the initiatives and partnerships that the UK is also involved with, ranging from the European Aviation Safety Agency, which aims to ensure effective common levels of security, to SESAR to improve airspace provision, to the European Investment Bank that provides finance for certain airports. In 2015, the EC published a new comprehensive aviation strategy which has four priorities (placing the EU as a leading player in international aviation; tackling limits to growth in the air and on the ground; maintaining high EU standards; and making progress on innovation, digital technologies and investments) and so it is unclear exactly what role, if any, the UK will play here in the future.

Meanwhile, technology developments for essential processes, including check-in, security and border control, potentially can offer considerable advantages to passengers, airlines and airports. Passengers will have simpler and quicker services, airlines will reduce their costs, and airports will be able to use their scarce terminal space more effectively and enhance the passenger experience by providing a better-quality product. Ultimately, how far these technologies and digitisation can go in producing overall simplified and integrated processes rather than the cumbersome and discrete ones that exist today will depend on many factors, including the cost of the technology; the ability of the different stakeholders to work together and coordinate their efforts; and the ability of governments to reach agreements on very sensitive and important matters concerning national security and immigration. One area of certainty is that the days are long gone when everyone at the airport queued up at a traditional airline desk to check in. It seems very likely that mobile technology, combined with innovations such as sensors and beacons, will play a major role both in aeronautical and non-aeronautical areas in the future.

Technological improvements to airfield and airspace infrastructure (e.g. remote ATC), and initiatives including A-CDM should improve efficiency and at the same time reduce some of the undesirable environmental impacts of airports. The evolving e-economy will also continue to have a major impact on the nature of cargo operations at airports, as will industry e-procurement policies. Another major technological development relates to drones and unmanned aerial vehicles. These have been increasingly used for both commercial/military activities and public service, ranging from security surveillance, dropping off medical supplies, environmental monitoring, surveying pipelines and delivery parcels as well as just a recreational activity. Their everyday availability and lack of barriers to entry raises very significant safety concerns and presents future challenges with integrating these new airspace users into an already crowded sky. More disruptive technologies are likely to emerge in the future. Generally, as technological advances, so will the need to adopt more and more sophisticated cyber security to protect against damaging cyberattacks.

The more uncertain airport environment makes it increasingly difficult to produce accurate forecasts, but overall most stakeholders are of the view that demand, if accommodated, will grow significantly. In the longer term, ACI is predicting that passenger numbers will increase by around 4 per cent per annum to reach 14 billion by 2029 and over 20 billion by 2040 (ACI, 2016), with an overall average growth rate of 4.9 per cent (Table 11.1). ICAO, IATA and the main aircraft manufacturers have similar forecasts. Growth in aircraft movements is likely to be less than growth in passengers, as more larger aircraft, such as the A380, are used and as airlines continue to fly with higher load factors.

As in the past, economic growth, which affects business activity and personal wealth and the cost of travel, will continue to play a major role in shaping the growth in passenger demand. For certain markets, particularly within the United States and Europe, the responsiveness of demand to changes in income may be weakening as demand maturity sets in - in spite of ultra-mobile millennials. Elsewhere, especially in more emerging markets of the world, the relatively immature market and higher-than-average predicted economic growth will ensure high growth rates. In 2015, 56 per cent of passengers were from advanced economies compared to 44 per cent from emerging markets. By 2024, ACI estimates that there will be an equal split between these two markets and by 2040, 62 per cent will be associated with emerging economies and only 38 per cent with advanced economies. Further liberalisation, if this occurs, and higher economic growth in these emerging economies, will encourage greater competition, reduce airfares and stimulate demand among large groups of middle-income classes that are developing in a number of these countries. Airbus (2017) estimated that trips per capita in India and China will be 0.4 and 1.3, respectively, in 2036, compared to 0.1 and 0.4 in 2016.

Overall, just 2.8 per cent growth rates are being predicted for North America and 3.7 per cent for Europe. Meanwhile, Middle Eastern traffic is forecast to continue to grow significantly (7.7 per cent) as a result of the aggressive airport and airline expansion plans, the region's convenient location, a huge guest worker population in need of air travel, predicted economic and tourism growth, and a young population with the potential to travel in the future. Asian traffic will also experience above-average growth rates (6.2 per cent), led by China but also for other countries, including India, Indonesia and Vietnam. Latin America/Caribbean and Africa will see growth rates of around 4 per cent. There is much potential in South America but economic and political issues, as recently experienced in Brazil, always tend to play a major role. Some African countries are now experiencing strong economic growth and this, combined with tourism development and poor ground transport links, is likely to cause moderate growth in the future (Figure 11.1). Overall, these trends will result in the Asia/Pacific market having a market share of just under half of all traffic (47 per cent) in 2031, followed by Europe (20 per cent) and North America (15 per cent), which is considerably different from the global split shown in Figure 1.1 where the Asia/Pacific region accounted for around a third of all traffic (Figure 11.2).

Cargo traffic is generally expected to increase, albeit at a slower rate than passenger traffic, again with Middle Eastern and Asia/Pacific markets (consisting of major air cargo markets in China – including Hong Kong, Japan, Korea, Taiwan and Singapore) having

Table 11.1 Long-term forecasts of global traffic growth

Organisation	Time period	Traffic measure	Average annual growth rate (per cent)
Passengers			
ACI	2015–40	Passengers	4.9
Airbus	2017–36	Passenger-km	4.4
Boeing	2017–36	Passenger-km	4.7
IATA	2016–35	Passengers	3.7
ICAO	2012–32	Passenger-km	4.6
ICAO	2012–40	Passenger-km	4.5
Aircraft movements			
ACI	2015–40	Aircraft movements	2.5
Cargo			
ACI	2015–40	Cargo tonnes	2.3
Airbus	2017–38	Cargo tonne-km	3.8
Boeing	2017–36	Cargo tonne-km	4.2
ICAO	2012–32	Cargo tonne-km	4.3
ICAO	2012–40	Cargo tonne-km	4.2

Sources: ICAO (2016); IATA (2016); ACI (2016); Airbus (2017); Boeing (2017)

the highest average growth rates. Air cargo demand is also driven primarily by economic growth and travel cost, as well as international trade. Growth in the past has occurred because of increased reliance on global components and products that need to be transported around the world. The rapidly expanding knowledge-based industrial sectors, including computing, electronics, communications and pharmaceuticals, are the most international and are heavily reliant on air travel for the transportation of their high-value/low-weight products. Increasing reliance on just-in-time inventory systems favours air cargo. E-commerce has also brought substantial reductions in the distribution costs of air cargo and increased demand for the integrators and the express mail sector. However, uncertainty within the global economy and a volatile trade environment can dampen the demand, as it did during the last economic recession. Moreover, high fuel prices caused a

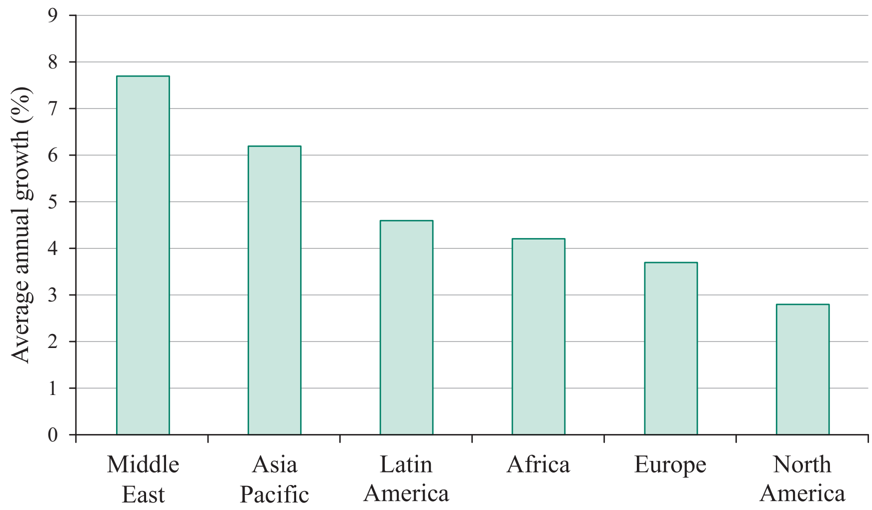

Figure 11.1

Airport passenger growth forecasts by region, 2015–40

Source: Adapted from ACI (2016)

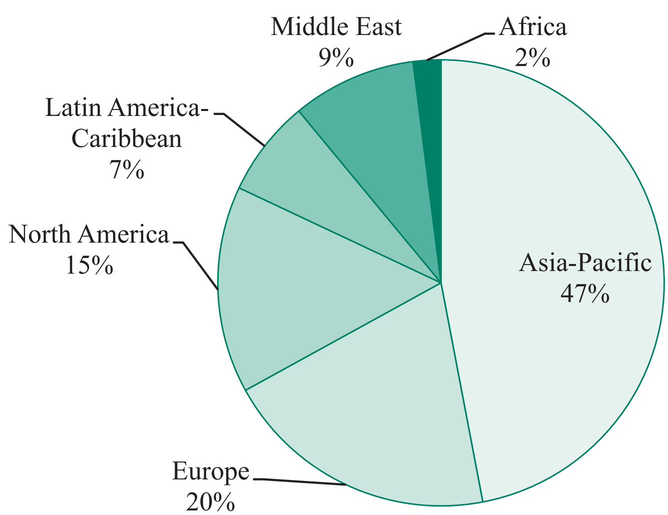

Figure 11.2

Airport passenger forecasts by region, 2040

Source: Adapted from ACI (2016)

shift towards other transport modes. In the future, there is also considerable uncertainty concerning the impact on demand of digital purchases (e.g. e-books and other non-physical products) and other advancements such as 3D printing.

If the growth in both passenger and cargo traffic in Table 11.1 is to be accommodated, there is a need for much more airport capacity. As of July 2017, worldwide there was over

US$255 billion of investment in new greenfield airport projects and US$845 billion in existing airports, bringing the total airport investment to US$1,100 billion (CAPA, 2017). By far the greatest investment in new airports is in the Asia Pacific region – over US$130 billion – compared with just US$70 billion in Europe (which is dominated by the New Istanbul project) and just US$3.6 billion for 11 projects in all of the United States and Canada, which has the least investment. Also, around US$400 billion is being spent on existing airports in Asia Pacific, compared to between US$100 billion and US$150 billion in North America, Europe and the Middle East, and considerably less in Latin America and Africa.

In many emerging economies, especially in the Asia Pacific region, where greater than average traffic levels are being forecast, many current airports are unable to cope with the traffic volumes and this, combined with both a general desire to use air transport to support economic development and generally less resistance to expansion from an environmental angle, has encouraged the building of new airports. By contrast, in more developed or advanced economies the difficulties in finding suitable new sites, as well as greater opposition because of environmental concerns, often means that expanding current airports is the more favoured option. However, many argue that this will not be sufficient to meet the forecast demand. For example, within Europe, Eurocontrol (2013) undertook a survey of 108 European airports responsible for 83 per cent of total European flights and found that only 17 per cent were planning a capacity increase by 2035, which was viewed inadequate to cope with the forecast demand. There will be over 20 airports operating at or near capacity for six hours or more a day. Likewise, in the United States it was estimated that nearly US$100 billion in capital needs will be needed just in 2017–21 (ACI North America, 2017).

In general, expanding airport capacity can be very challenging for a number of reasons. First, the finance for such development needs to be found. Many funds traditionally came from public sources, but increasingly this sector is unable or unwilling to provide such support, especially in today's more volatile economic climate. Privatisation may yield a solution in some, but not all, cases. As highlighted above, in certain countries where there is strong political will to develop air transport, as in China for instance, airport expansion can be agreed swiftly and with little trouble. The same is true of a number of other Asian countries. The development of the aerotropolis Dubai World Central with Al Maktoum International airport is a similar example.

Meanwhile, in other regions it can take years for airports to gain approval through the planning process, which can be excessively long and costly. It can often take over 10 years for the process for expanded airport facilities, and even longer if a new greenfield site airport is being considered. The London Heathrow terminal 5 inquiry in the late 1990s in the UK lasted more than four years and was one of the longest planning enquiries in UK history. Overall, the whole planning process took 14 years. Extra runway capacity for the London area is now also being considered, which again has been a very long exercise, involving an independent commission looking at all the options. The government has announced that it favours Heathrow for a third runway, but it is by no means certain when and if this will happen. Likewise, the planning process for Munich airport took 22 years. Other examples include the new parallel runway at Seattle airport which opened in 2008. This was 20 years after it had received initial approval by the local authorities, with the delays being due to environmental objections and a number of lawsuits filed by local residents. Very few new airports or fully expanded airports have been built in the United States or Europe in recent years, Denver, Munich, Oslo, Athens and Milan being the only examples. (Berlin is another, but the opening has been repeatedly postponed.) Elsewhere, in Narita in Tokyo the second runway was opposed for over 10 years by local politicians and farmers, and was eventually approved but with a shorter length, whereas in Auckland it took seven years to get the second runway approved.

Without doubt, the greatest challenge that the airport sector, and indeed the whole air transport industry, faces is coping with the expected traffic growth while at the same time living with the huge pressures to reduce global warming and achieve greater sustainability. The CORSIA agreement is undoubtedly a major breakthrough here but much more needs to be done. At a local level, issues related to quality of life have to be balanced against desires for greater mobility. The more extreme environmentalists will continue to argue that there is no way the potential demand for air transport in the future should be met, and that the solution is to constrain growth. Others hold less radical views, but most agree that the industry has to focus much of its effort and resources on developing sustainable solutions if it is to be allowed to grow at all to meet increasing traffic levels.

In conclusion, airport operators face a challenging time ahead. The volatile operating conditions of the past decade or so show no signs of disappearing, with economic downturns, political instability, terrorism threats and natural adverse events likely to continue to play a major role. Increasingly, airport operators are being confronted with conflicting demands from their different stakeholders. Different airline groupings and types of airline are favouring more differentiated facilities and services, and putting increasing pressures on airports to reduce their costs. Airline customers are also changing more frequently, with the modern-day operating environment encouraging more airline failures. Passenger expectations in terms of service quality and the overall experience are rising. Regional authorities want to ensure airports generate maximum economic benefits while not harming the well-being of the population in the region. National governments want to ensure the environment and society are adequately protected, and may also want to guarantee, perhaps through regulation, that airports are not abusing any excessive market power and are not acting in an anti-competitive manner. Then there are the financial demands from the airport owners or shareholders, which are increasingly driven by private sector motives. Finally, everyone wants the airport to provide a secure, safe and healthy environment, which has arguably become more difficult to achieve in recent years because of the new security and health risks that now exist. This book considers all these important interrelated issues and aims to provide some insight into how airport operators might address the challenges of the future.

References

ACI (2016) 2016 World Airport Traffic Forecasts Infographics. Online. Available at http://www.aci.aero/Publications/ACI-Airport-Economics-and-Statistics/ACI-World-Airport-Traffic-Forecasts-20162040 (accessed 10 December 2016).

ACI North America (2017) *Airport Infrastructure Needs 2017–2021,* Washington DC: ACI North America.
Airbus (2017) *Global Market Forecast 2017–2036*, Toulouse: Airbus.
Boeing (2017) *Current Market Outlook 2017–2036*, Seattle: Boeing.
CAPA (2017) USD1 Trillion for Airport Construction globally – but it's not enough. Online. Available at https://centreforaviation.com/insights/analysis/usd1-trillion-for-airport-construction-globally—-but-its-not-enough-capa-database-356495 (accessed 1 August 2017).
Eurocontrol (2013) *Challenges of Growth 2013*, Brussels: Eurocontrol.
IATA (2016) IATA Forecast Passenger Demand to Double Over 20 Years. Online. Available at http://www.iata.org/pressroom/pr/Pages/2016-10-18-02.aspx (accessed 1 April 2017).
ICAO (2016) *ICAO Long-Term Traffic Forecasts: Passenger and Cargo,* Montreal: ICAO.

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Note: 'N' after a page number indicates a note; italics indicate a figure; bold text indicates a table.