

A new airport for London

Part 2 – The economic benefits of a new hub airport



**Greater London Authority
November 2011**

Published by
Greater London Authority
City Hall
The Queen's Walk
More London
London SE1 2AA

www.london.gov.uk
enquiries 020 7983 4100
minicom 020 7983 4458

Cover photograph © BAA Limited

Mayor's foreword	4
Executive summary	6
Introduction	20
1: The London economy	22
2: The benefits of aviation	26
3: The implications for airport capacity requirements	48
4: Requirements of an efficient national hub airport	64
5: The limitations of Heathrow	68
6: Future hub airport demand	78
7: Hub airport benefits	92
8: Meeting the Government's growth agenda	98
9: Key findings	101
Appendices	
A: 'Hubbing' at Heathrow	105
B: Forecasting methodology	113
C: Other cities' strategies	115
Footnotes and references	125

4 Mayor's foreword

Next summer, the eyes of the world will be on London as the setting for a contest on an epic scale. In many ways, London is involved in a less well known but nonetheless epic contest of its own – one for connectivity with the rest of the world. We cannot afford to lose.

A host of up-and-coming competitors want to beat London at the things we have until now done best. By emulating and then leap-frogging London in terms of its aviation links, they hope to usurp us in terms of all the things aviation has enabled: a dynamic economy, a vibrant, international population and the cornucopia of cultural riches this brings with it, and much more besides.

Since the publication of the first report in this series, *A new airport for London – Part 1*, in January this year, I have observed an ever-stronger tide of opinion behind the need for a long-term plan for aviation in the UK. In the wake of the Government's recent consultation on creating a sustainable framework for aviation – a consultation which I heartily welcome and to which I responded in October – a number of reports have been published outlining the economic benefits of the aviation sector to the UK. A particularly exciting development is Lord Foster's recent publication of a coherent vision for the Thames Estuary, integrating road, rail, flood defences, low-carbon energy projects and a new airport.

This second report aims to contribute to this growing debate by adding evidence of the vital nature of aviation, and of a hub airport in particular, to the economy and wellbeing of London and the UK. China provides perhaps the starkest contrast. This waking giant of a nation will be home to 12 of the 25 fastest growing cities



in 2025 and yet today London offers a direct connection to just two of them, in addition to Hong Kong. Three competing hub airports on the Continent offer more weekly seats to mainland China than London, with the leader Frankfurt, offering about twice as many. This is reflected in the UK's currently meagre record in attracting famously high-spending Chinese tourists to visit. In 2010, France, Germany and Italy each attracted between 500,000 and 700,000 such visitors. The UK only managed 127,000.

Forecasts released by the Department for Transport in August this year show that London's airports will be full by 2030 and that all subsequent growth will have to be catered for at regional airports. Humberside is due to accommodate 12 million passengers in 2050. Will the burgeoning Chinese middle-class bookend their European trip in the Lincolnshire Wolds? Will Exeter offer Brazilian business a golden springboard into the UK? Possibly, but prospective and footloose passengers will more likely turn to

cities abroad that offer the best quality links. The UK's rivals are eager to do the business that we are handing to them on a plate through our inertia.

We cannot afford to withdraw from the world's richest race, especially as we have been in the leading pack. Around 94,000 jobs were created and safeguarded in the UK in 2010/11 by foreign companies' investments. Over the last decade, the UK has been the second largest source and recipient of foreign direct investment. This report sets out why only a new hub airport would be able to support the links needed to emerging parts of the world so that this trend can continue well into the future.

It is my hope that this report will dispel any lingering doubts about whether a new hub airport is needed. The time has now come to grasp the nettle and openly debate which option best meets this urgent need.

I and my team would like to thank York Aviation, Volterra Consulting, ERM, SKM Colin Buchanan, Professor Peter Tyler and Andy Rumfitt for providing advice and guidance upon a range of technical issues.

A handwritten signature in black ink, appearing to read 'Boris Johnson', with a long horizontal flourish extending to the right.

Boris Johnson
Mayor of London

Introduction

Background

This report is the second in a series to be published by the Mayor of London in relation to the planning of London's future airport capacity. A new airport for London - Part 1, which set out the broad case for new airport capacity serving London, was published in January 2011, helping to start an open and prominent debate on the subject.

The Government is planning to publish a draft sustainable framework for UK aviation for consultation in March 2012. Earlier this year it published a scoping document which was intended to help inform this. The Mayor responded in October. His response is available on the GLA website¹. The Government has also recently published its new aviation forecasts, which anticipate that London's airports will be at full capacity by 2030 and that demand growth beyond then will be partly met at regional airports and partly suppressed. Neither of these outcomes will enable aviation fully to meet its potential in serving the wider economy.

This report aims to move the debate to the next stage by demonstrating what is needed if aviation is to play a leading rather than a limiting role in the drive for much needed export-led economic growth. Further reports are planned to assess a number of other aspects, including commercial, environmental and location issues, in more detail.

Issues and aims

Around half the population takes at least one leisure flight each year; three-quarters of the UK's 30m annual inbound visitors arrive by air; and a quarter of the UK's visible trade by value is transported by air. Chief among a whole range of benefits from aviation, however, is London's position as one of the handful of leading cities in the world that host a large concentration of globally oriented financial and business services. The enormous benefits this brings are felt not just in London but throughout the UK. It is a central concern of the Mayor that London is able to retain this role in the long term and it is this that has motivated him to take a lead in the debate over future airport capacity for London.

The Mayor believes that if the UK is to develop an aviation policy which is both environmentally acceptable and consistent with the Government's ambitious economic growth agenda there needs to be a recognition that:

- (i) some types of air travel are particularly important for the wider economy
- (ii) sufficient capacity needs to be available at a hub airport for these benefits to be fully realised
- (iii) the scale of negative impacts of new hub airport capacity are dependent on its location

Chapter 1: The London economy

London has successfully placed itself at the heart of the global network of 'world cities', an 'urban elite' of which just a handful of European cities are members. London is able to sustain and reinforce a virtuous circle of productivity, competitiveness and cultural innovation. Though just one eighth of the UK population, its £265bn-a-year economy accounts for one fifth of the country's Gross Value Added (GVA).

London's service sector is larger, more productive and more export-oriented than those elsewhere in the UK, with service sector exports constituting a third of the UK total. In 2008, London's exports of goods and services totalled £24.8bn. London generates a substantial 'tax export' to other regions each year.

Chapter 2: The benefits of commercial aviation

The South East's airports employ approximately 130,000 people directly – there is approximately one job per thousand annual passengers. There are also thousands of jobs in the supply chain and the induced demand which the sector generates. Most of the benefits which the aviation industry generates arise, however, through the activities enabled by each of commercial aviation's main sub-sectors – business travel, leisure travel and air freight. For example business travel enables flows of people and capital which support London's role as a world city. Outbound leisure travel enables half of UK residents to take holidays and visit relatives and friends overseas at least once a year, while inbound leisure travel enables the UK to

flourish as the world's sixth most popular tourist destination. Commercial passenger services also enable air freight flows, which are important to many industries in which speed adds value. These sub-sectors are examined in more detail below.

Business travel

Despite recent advances in communication technology, air travel continues to play a crucial role in enabling commerce and nowhere more so than in London. Financial and business services and other highly productive sectors which are geographically concentrated in London are highly reliant on aviation services. Banking and Finance, for example, accounted for £1.3bn of expenditure on air transport in 2008, approximately 92% of total transport spending by the sector.

London's aviation links have played a vital role in making the city very attractive for foreign trade and investment: half of all European headquarters established by non-European companies between 1998 and 2009 were in the UK, mostly in the London area; until recently the UK was the world's second biggest source and recipient of foreign direct investment (FDI). Foreign-owned firms created 42 per cent of London's economic growth between 1998 and 2004. Commercial and aviation links to some important emerging sources of global capital, however, are significantly weaker than those of the UK's main European competitors.

Leisure travel

Aviation has enabled about half of the UK's population to make regular holidays overseas, giving them a much broader choice of destinations than they previously had. In recent years participation in this market has stopped growing. Since 2003 the growth has been mainly within a fixed pool of people who have been taking more flights each year. This growth has partly relied on the increased penetration of markets at airports other than Heathrow by low cost carriers.

Outbound tourist spending effectively constitutes a UK import. However, encouraging outbound tourism may generate wider economic benefits, for example through increasing the UK's appeal as a place to live and work. Good opportunities for personal travel help the UK attract skilled foreign workers. Travel for visiting friends and relatives (VFR) is important to people with family and social ties to other parts of the world. The uniquely international composition of London's population makes VFR a particularly important component of aviation demand in the capital.

Inbound tourism to the UK generates valuable export revenue and supports jobs and investment. London acts as an important entry point, particularly for higher spending long-haul tourists who tend to stay for longer. It is the principal destination for about half of the UK's 30 million annual overseas visitors. Inbound tourism from emerging markets, however, has been relatively slow to develop. France, Germany and Italy each received between 500,000 and 700,000 visitors from China in 2010. The UK only received 127,000.

While the ultimate destination for most trips in other sub-sectors is fixed, tourism trips can be considered more flexible, given the extent to which holiday destinations are substitutable. This suggests that while aviation policy should recognise the importance of outbound tourism opportunities to a large number of people, there may be fewer of the essential wider economic benefits associated with other sub-sectors (although where it occurs at a hub airport it will offer important network benefits like all sub-sectors – see chapter 3). On the other hand, deficiencies in the UK's connectivity relative to its competitors could have serious implications for the wider economic benefits which inbound tourism generates and it is the Mayor's view that aviation policy should seek to avoid this.

Air freight

Air freight is used for around a quarter of the value of the UK's international goods movements by value. In 2007 the value of UK air freight exports to non EU countries was £31.3bn. It offers important benefits through improved production processes and access to markets, including for sectors with high economic growth potential. Belly hold freight accounts for 67 per cent of total flows, by weight and much of this is on long-haul routes, for which the freight typically contributes five to ten per cent of total revenue. This supports the viability of thinner long-haul routes while maximising the connectivity and flexibility of the air freight offering.

In summary

Many benefits accrue to the wider economy from business, inbound leisure and air freight. The activities these sub-sectors enable can make a major contribution to export-led economic growth. It is the Mayor's view that ensuring first rate connectivity to serve them should be a national priority. The following chapter sets out why in order to do this a hub airport serving London is needed. It is worth noting that a successful hub airport depends on the consolidation of demand in all the sub-sectors (including outbound tourism) and also from transfer passengers.

Chapter 3: The implications for airport capacity requirements

While most outbound tourist demand could be adequately met by point-to-point airports, the same cannot be said for the other sub-sectors, which deliver greater economic and social benefits. For these, spare capacity at point-to-point airports is unlikely to offer the conditions necessary for a route network to fully develop to meet their needs. Only sufficient capacity at a hub airport will do this. Furthermore, outbound tourism passengers at the hub can help support this.

Heathrow is unique among UK airports, catering for two-thirds of the UK's long-haul demand. It also plays an important role in those sub-sectors which generate the biggest wider benefits. Thirty-four per cent of Heathrow's passengers are travelling on business, compared to an average of approximately 18 per cent at the other London airports and eight main regional airports in England. London's airports handle just under three quarters of all UK

inbound tourist arrivals by air and Heathrow plays a special role as an entry point for the relatively high spending long-haul visitors. VFR travel is also disproportionately important at Heathrow, accounting for approximately 53 per cent of leisure travel there, compared to 24 per cent at Gatwick and 18 per cent at Manchester. Sixty per cent of all UK air freight was carried in the belly holds of scheduled passenger aircraft serving Heathrow, accounting for the vast majority of UK belly hold freight. Ninety-four per cent of it (by weight) moved to and from locations outside the EU. The reason Heathrow is able to perform this role is that it is the UK's hub airport.

Need for transfer passengers

The consolidation of demand which a hub airport facilitates allows sufficient revenue to be generated to support routes which would not otherwise be viable. Typically long-haul services rely on revenue from a combination of 'high yield' business travellers, 'volume' leisure travellers, and belly hold freight. This can be significantly enhanced by transfer passengers who travel via a hub airport, providing additional demand. Transfer passengers play a crucial role at Heathrow. In 2010, they accounted for more than 50 per cent of passengers on 39 of Heathrow's 192 routes, and more than 25 per cent of passengers on a further 92 routes. Overall, transfer passengers accounted for approximately 36 per cent of all passengers at Heathrow. At other airports, the proportion was much lower. At Gatwick, the UK's next highest, just over eight per cent of passengers were transferring. At Manchester, the figure was just over two per cent.

Demand from transfer passengers, along with that from all the other sub-sectors, contributes to the network of routes and frequencies which can be offered. Over time as the network develops, more transfer demand is attracted to the hub airport. Furthermore, the better connectivity on offer starts to enable new economic activity, which in turn generates more aviation demand. This virtuous circle between demand and connectivity can continue to the point where the hub's capacity is reached. Equally, by losing transfer passengers, a hub airport's network can enter a cycle of decline, as has happened at St Louis and Cincinnati in the United States.

Heathrow has historically followed this positive pattern of development, and this explains why its network is so superior to other UK airports. Using a measure of destinations served, their value to business and frequency of service, Heathrow's business connectivity in 2010 was approximately three times better than Gatwick's and five times better than each of the other London airports.

Regional airports

The DfT's recent forecasts envisage that without runway expansion in the South East, all growth beyond 2030 will be at the UK's regional airports, since London's existing airports will have reached their full capacity. By 2050, 42 million people a year are forecast to travel from the South East to airports in other regions, while fifty million others will not use Heathrow who otherwise would have. This is a mixture of transfer passengers choosing different routes and people deterred from flying altogether.

Not only would this result in millions of people travelling further by road and rail to fly but also in a probable deterioration in overall connectivity. At best regional airports could be expected to offer a small range of the most popular long-haul destinations – most likely to overseas hubs – diluting the UK's range of direct long-haul connections. In short they would not be able to replicate the benefits of a hub airport.

This indicates that a chronically capacity constrained South East airport system poses potent dangers to the UK's economy. Not only would the nation's airport capacity be regionally imbalanced, but there is a strong likelihood that the most socially and economically beneficial sub-sectors of demand would be underserved, since they depend on hub capacity to be able to grow. In particular, London would lose its vital business connectivity which is only as strong as it is because of the enormous volume and mixture of demand which feeds through Heathrow.

A hub for London

Developing a hub airport outside the South East would not be workable, even assuming that a site with the capability to meet the requirements could be found (see Chapter 4). London's economy has developed over several decades, and through massive investment, to be heavily dependent on the availability of a comprehensive network of direct flights at good frequencies – and this requires that the airport offering this connectivity is conveniently located. The key sectors are internationally footloose and, rather than migrating to other parts of the UK, would be far more likely to move to established competitors overseas than

to other UK regions. Cities such as Paris, Frankfurt and Amsterdam stand to gain the connectivity and revenue benefits that the UK loses.

A comprehensive long-haul network can only be viably offered in the UK if there is a major hub airport in the southeast of England. If such an airport were a well connected hub airport it would nevertheless promote regional economic rebalancing by allowing London's high level of connectivity to be enjoyed more widely across the UK's regions.

High-speed rail

High-speed rail can offer an effective alternative to short-haul flights for rail journeys of up to three-and-a-half hours. This would represent just 10 per cent of journeys to or from Heathrow. Even with the full High Speed 2 network, the DfT forecasts suggest London airports will be at full capacity by 2030.

HS2 should enable rail to take substantial market share from air on routes between London and Scotland (also Newcastle) since it will allow the rail offer to cross the three-and-a-half hour threshold. Rail already has a dominant share on routes between London and cities in the north of England. The expansion of HS1 services to a wider range of near Continental destinations will have only a modest effect on air demand. Journey times to the bulk of potential destinations will be close to or above the maximum for rail to effectively compete.

A national hub

Connecting London's future hub airport to a national high speed rail system will be important for increasing the hub's catchment. It would allow regions outside the South East to share fully in its global connectivity benefits. This would encourage UK-wide growth in international trade, tourism and investment, and offers the potential for making a strong contribution to the rebalancing of the national economy. This is clearly dependent on the existence of sufficient capacity at the hub.

An efficient hub airport in the South East, which is well connected to the UK regions, mainly by rail, could serve as a truly national airport, with a particular national role. For this reason the Mayor believes hub airport capacity in the South East should be given priority as strategic national infrastructure. It is clearly also important that decisions about high speed rail and future airport hub capacity are fully integrated.

Chapter 4: Requirements of an efficient national hub airport

An effective hub has sufficient slot capacity to offer a comprehensive network of routes at attractive frequencies, recover rapidly from delays in its everyday operation and maximise resilience. If it is to offer a world-class experience for passengers, be environmentally sustainable and efficient, vital elements including runways, terminals, aprons and taxiways should not be routinely operating close to maximum capacity.

To take full advantage of an optimised wave operation, it is also important that the hub airport can minimise connecting time required between flights. This reduces a transfer passenger's total journey time while maximising an airline's fleet utilisation by reducing the time the aircraft spend on the ground. This requires the hub airport to be able to handle large volumes of connecting passengers and baggage in a short space of time. A number of major airports have demonstrated that substantial improvements in minimum connecting times (MCTs) are achievable. For example, Munich Airport's Terminal 2 claims to be the world's first terminal building specifically tailored to the needs of hub traffic, and boasts a MCT of just 30 minutes.

To support the hub's wide range of routes and frequencies, it needs to draw on a substantial passenger catchment. This includes not only transfer traffic from global markets, but also strong transport links to its immediate hinterland. Links must serve both central London and the wider region where many hub airport users live.

A hub airport must also be acceptable in terms of noise and local air quality impacts. New aircraft technologies will help ease these impacts but cannot eliminate them. A hub airport that meets long-term demand growth can only address these impacts effectively if it is located at a site which minimises the overflying of residential areas.

Chapter 5: The limitations of Heathrow

Historically, Heathrow has been very successful in allowing London to be one of the best connected cities in the world. In order to anticipate the extent to which it is able to meet the UK's future hub airport needs, a good starting point is to examine how it currently performs. To some world regions, including North America, India and much of Western Europe, Heathrow maintains a strong network. But this increasingly comes at the expense of other routes. Heathrow has slipped to sixth among European airports in terms of the number of destinations served.

The development of routes to several emerging economies remains hampered by the lack of slots. Whereas there are between three and six runways at the main continental hubs, with runway utilisation of less than 75 per cent in all cases, Heathrow only has two runways and is operating at 98.5 per cent of its regulated capacity. There are very few slots at Heathrow that could be made available from the relocation of non-core activities. In the summer 2011 period, cargo-only flights only accounted for 0.5 per cent of slots at the airport. Furthermore, most of these are at times when slots are less sought after, such as evening departures and late afternoon and evening arrivals.

In a recent survey, 41 per cent of UK firms were dissatisfied with links to the Far East and South America. Heathrow offers just 9,000 seats per week to mainland China and it only serves two routes. In contrast, Frankfurt offers almost twice the number of seats and serves four destinations; Amsterdam serves six.

Part of the problem is that as a result of their high alternative use value, there is little incentive for airlines to use Heathrow slots for new and initially more marginal routes to emerging economies. A more profitable strategy in the short term at least is to use them for mature high yielding routes, for example to the US. This is not necessarily the best strategy in terms of the outcome for the wider economy. One important consequence is that a first-mover-advantage is given to routes from less constrained airports, typically Heathrow's main continental rivals. This makes future entry to the market by UK-based carriers more difficult.

There are also indications that governments in some key emerging economies are unwilling to liberalise their bilateral aviation treaties with the UK when slot constraints at Heathrow serve as a barrier to their airlines. The Nigerian government recently announced a halving of British Airways flights to Lagos in response to the inability of its national carrier to secure slots at Heathrow for its Abuja service. Rival European hubs are the main beneficiaries of such constraints being imposed on UK routes and it is highly likely that wider economic benefits will follow services lost to overseas competitors.

Another problem associated with Heathrow's capacity constraints is that it suffers from regular delays. Aircraft can wait in stacks for 30 to 40 minutes prior to landing at peak times; also, average taxi-out times are 20 to 40 per cent higher than at Paris CDG, Amsterdam and Frankfurt. Moreover, with such high runway utilisation, Heathrow suffers disproportionately in the event of disruption and repercussions for passengers can be severe.

Heathrow's location is such that in 2006 more than 756,000 people were significantly affected by noise in excess of 55dB Lden (this compares to 11,900 at Gatwick and 9,400 at Stansted). All the other main European hubs affect local populations a fraction of the size that Heathrow does.

Air traffic congestion on the ground and in the air, as well as road traffic in the vicinity (of which 30 per cent is estimated to be airport related), all contribute to significant air pollution at Heathrow. At a quarter of nitrogen dioxide monitoring sites at Heathrow, levels exceed the EU limit value. Heathrow, surrounded by residential areas, adversely affects swathes of London and the Home Counties under its flight paths. For these reasons the Mayor is against capacity expansion at Heathrow.

Chapter 6: Future hub airport demand

In assessing the UK's likely future hub capacity needs it is important to consider how demand is likely to be shaped by global developments. There is a strong link between GDP and aviation use. Forecasts of GDP growth, along with the appearance of new 'megacities' participating in the global economy, and aviation industry forecasts, point to strong worldwide aviation growth in the period to 2050. Over a third of this is expected to be either within Europe or between Europe and other world regions.

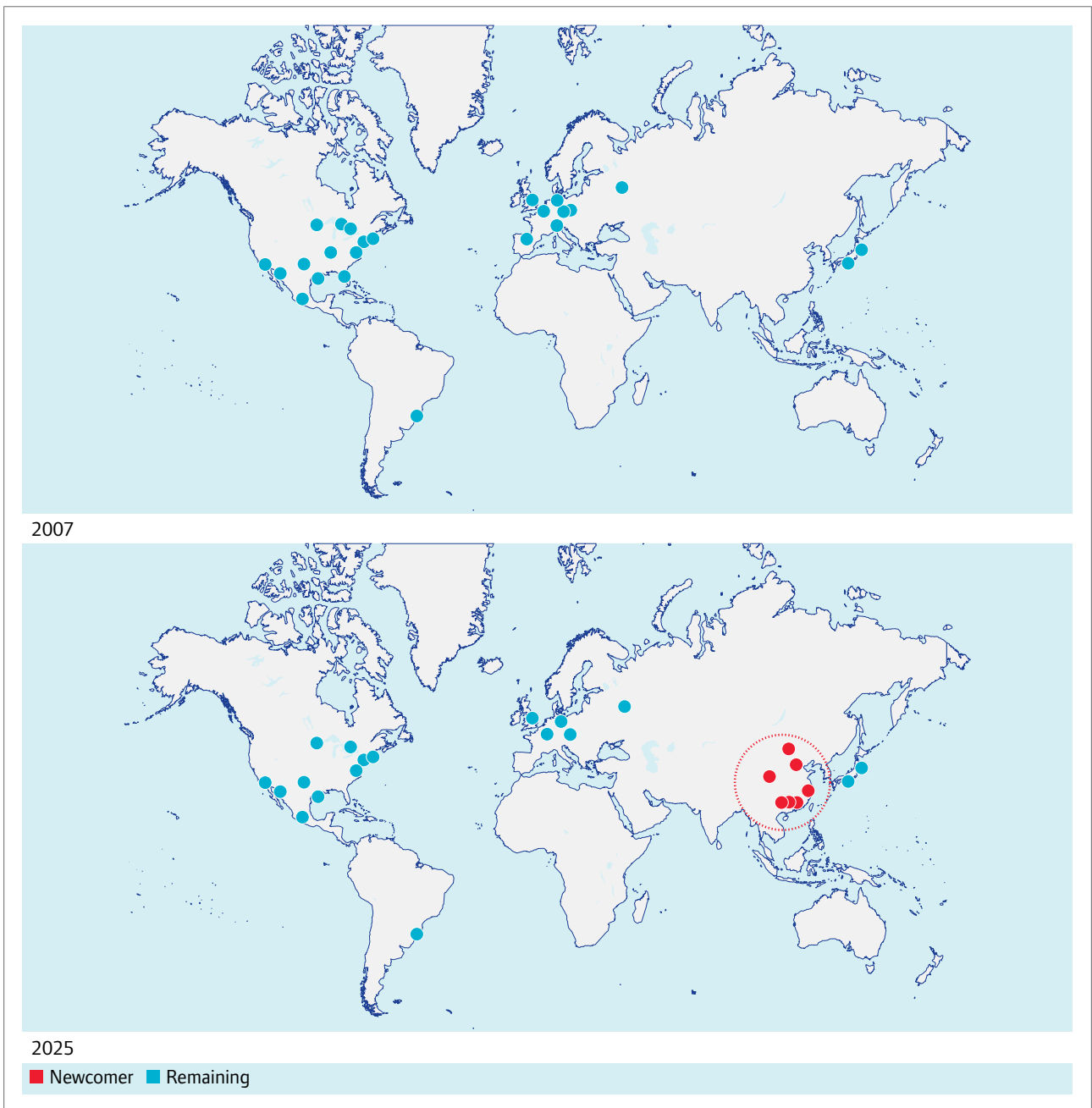
If Heathrow were not capacity constrained and Airbus and Boeing's growth assumptions were applied to its existing route network, there would be a doubling of weekly frequencies over the next 20 years – and this excludes the emergence of new routes. In fact, London currently has no direct routes to 12 (all in mainland China) of the 25 cities with the highest forecast growth in GDP between 2007 and 2025. Figure E1 shows expected changes in the leading 25 megacities between 2007 and 2025. It can be noted that the number of airports in China handling more than 30mppa is expected to increase from three in 2008 to 13 in 2020.

It is also worth noting that there are very large differences in the quality of London's service offer to the remaining cities on the list, strongly indicating that while many of London's established core long-haul markets are well-served, expected changes in the world economy are likely to expose very large gaps in the quality of its overall network over time. For example, while there are 191 flights per week from London to New York, 61 to Hong

Kong and 41 to Mumbai, there are only 17 to Shanghai, 14 to Beijing and 14 to Sao Paulo.

New technologies will allow aircraft fleets to gradually become more fuel efficient. While the introduction of both larger and smaller long-haul aircraft is expected to change the way in which hub airports are used, it is by no means clear that they will reduce the need for hub capacity relative to point-to-point capacity. Indeed, capacity pressure is likely to increase as the range of feasible long-haul routes becomes larger.

Figure E1: Expected change in leading 25 Megacities by total GDP, 2007 - 2025



Source: McKinsey Global Institute, *Urban world: mapping the economic power of cities, 2011*

Chapter 7: Hub capacity options in 2050

Under the DfT's recent forecasts, growth in the use of a hub airport is limited to the additional demand which Heathrow is assumed to be able to accommodate to 2050, which is 21mppa. This is a result of larger planes and consolidation onto 'thick' routes. By contrast, forecast growth to 2050 at point-to-point airports is 239mppa. It is therefore implicit that a far lower proportion of air travel will take place at a hub airport than is currently the case. Since those sub-sectors of demand which generate the greatest economic and social benefits are only fully maximised at a hub, this suggests that neglecting hub capacity is likely to have negative economic and social consequences.

In response to this, an alternative scenario is examined in this report, in which a new hub airport serving London is built. This airport is assumed to be capable of accommodating up to 180mppa, which is broadly equivalent to the size Heathrow would need to be in the DfT's central capacity-unconstrained case. It is assumed that passenger numbers at other London and regional airports would bear the brunt of adjusting to the requirements of meeting overall climate change targets, rather than the hub. Aviation growth facilitated at a hub generates the greatest economic and social benefits and therefore accommodating demand at a hub should be a priority.

The potential route network of a new hub is compared to that which is expected at both Heathrow and Manchester in 2050 if it is assumed there is no new hub. A key feature of a hub is the ability to operate routes at more attractive frequencies than point-to-point airports can sustain.

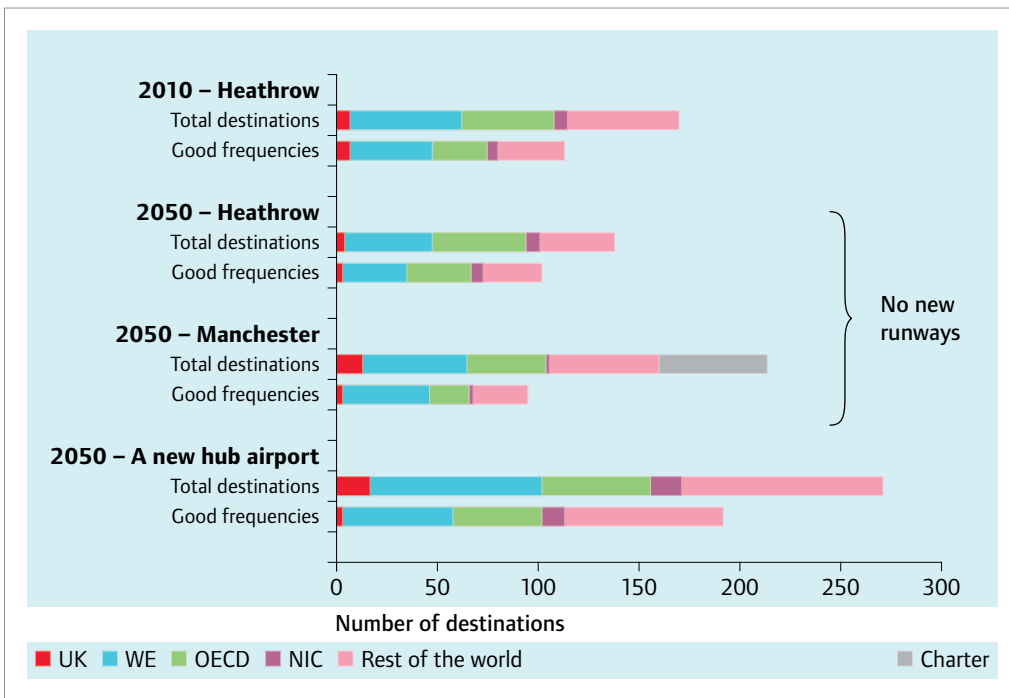
In order to assess the benefit of a new hub airport, the number of routes that could be expected to be served at a 'good' frequency at each airport has also been examined. Destinations are aggregated into five global categories that follow the classification of countries used in the DfT's forecasting model.

With no new runways in the South East, the total number of destinations served at London's hub will diminish, continuing a trend which is in fact already under way. Compared to 2010, it is expected to be around 20 per cent lower. The greatest reduction is seen in the long-haul markets to countries in the rest of the World category – which contains many of the world's fastest growing economies. The main reason for this is the response of airlines to capacity constraints. Services will be concentrated upon more profitable 'thick' routes such as London - New York and London - Hong Kong at the expense of lower yielding routes – many of which are nevertheless strategically vital to the UK economy.

The UK's regional airports will not adequately address the loss of connectivity associated with London's constrained hub capacity. In 2050, despite being increasingly relied upon because of a chronic capacity shortage in the South East, Manchester is expected to perform less well than Heathrow does now in terms of the number of destinations served with 'good' frequencies. This is especially pronounced on long-haul routes.

A new London hub offers by far the largest range of destinations and number of routes served at a good frequencies. Crucially, substantial growth is able to occur to many new destinations including both newly industrialised countries (NICs) and the Rest of the world regions. This growth will be crucial for

Figure E2: Connectivity in 2050 with no new runways and with a new hub



best serving the UK economy’s productive needs in the future

It is clear London will need a new world-class hub airport if it wants to maintain world-class aviation links in a future in which global economic power is more widely distributed and which will be essential for the UK to continue to prosper as a leading country..

Chapter 8: Aviation’s role in meeting the growth agenda

This report demonstrates the central role of hub airport capacity in driving economic growth, including exports, and how it can contribute to a regional rebalancing of the economy by sharing the benefits of London’s global connectivity

with regions beyond the South East. Accordingly it is important that it is integrated into the Government’s growth strategy. There are a number of processes which need to reflect this.

A sustainable framework for UK aviation

The Government’s draft aviation framework is due to be published in March 2012. It should acknowledge that the shortage of hub airport capacity is the key challenge facing UK aviation and that the only sustainable long-term response is a new hub airport for London.

The Government's growth plan

The Government has made an overriding resolution to 'drive growth and create jobs right across our country'. The key role an efficient hub airport plays in generating strong, sustainable growth and supporting a bigger and better balanced economy should be recognised as an important essential of this.

At a time of fiscal restraint, aviation growth can offer high economic returns, particularly since the private sector can play an important part in funding the necessary infrastructure. Investing in a new hub airport offers a genuine opportunity to generate substantial additional revenue and jobs while also yielding a positive return. With clear and strong Government commitment, a new hub airport could be substantially funded by the private sector and boost public sector revenues at the same time.

The National Infrastructure Plan

In October 2010 the Treasury published the National Infrastructure Plan. This established the following goals for national infrastructure:

- To be integrated, reliable, secure and resilient
- To support sustainable and balanced economic growth and competitiveness
- To ensure that the overall programme supports the delivery of reduced UK greenhouse gas emissions and wider environmental objectives
- To achieve an affordable mix of public and private investment

The UK's current and planned airport provision does not meet the first three of these goals. The lack of available capacity at London's hub, in particular, compromises the ability of the whole aviation

system to facilitate economic growth as well as its reliability and resilience. Congestion at Heathrow increases emissions on the ground and in the air and as demand grows and Heathrow remains unable to expand, this situation will worsen.

The Government has identified a hierarchy for investment decision-making: (i) maintenance and smarter use of assets; (ii) targeted action to tackle network stress points and develop networks; and (iii) transformational large scale capital projects. In applying this to the question of hub airport capacity, the Government should bear in mind the length of time needed to plan what would amount to an integrated series of major capital projects and the fact that the longer a new hub takes to implement, the greater will be the negative economic and social consequences.

The Government's Committee on Climate Change

It is essential that the UK meets its climate change and environmental requirements and aviation must play its part in this. The Committee on Climate Change reported in 2009 that a growth in passenger demand of 60 per cent on 2005 levels to 2050 could be compatible with commitments to keep carbon dioxide emissions in 2050 no higher than in 2005, as a result of technological improvements. The Government's response to these recommendations is expected in March 2012 and is expected to reflect further research and stakeholder responses to the DfT's 2011 scoping document. The Mayor believes a new hub airport could be compatible with the committee's recommendations and that it should be viewed in the context of the uniquely valuable benefits it can deliver.

The National Planning Policy Framework

The National Planning Policy Framework is subject to review. It should ensure a transparent, balanced, expedient process for developing new infrastructure projects. Medium and long-term growth ambitions should be facilitated by a clear statement of where and in what circumstances the development of a hub airport is encouraged.

Actors and outcomes

It is essential that industry actors, stakeholders and the Government now work together on a long-term strategy in a timely manner to ensure the benefits of aviation for London and the whole of the UK are maximised and the harmful impacts of doing so are minimised.

Key findings

- 1: The economic dynamism of London's economy, which is vital to the whole UK, is closely linked to a number of highly internationally-oriented sectors.
- 2: While all sub-sectors of commercial aviation deliver benefits, business, inbound tourism and cargo generate the most potential for export-led economic growth.
- 3: A comprehensive network of direct long-haul routes is particularly important for the economy and can only be provided at a hub airport, where demand from all sub-sectors is consolidated.
4. A hub airport needs to serve London and be in the South East. Any lack of capacity there will benefit hub airports on the Continent and their local economies rather than other regions in the UK.
- 5: High speed rail is mainly a complement rather than a substitute for hub airport capacity. It can provide an alternative for around 10% of Heathrow's flights.
- 6: An efficient and sustainable hub airport requires adequate take off and landing slot capacity, excellent surface access links and must be appropriately located to minimise adverse local impacts.
- 7: Heathrow cannot serve the UK's hub airport needs effectively.
- 8: A fundamental shift to the Far East in the global economy is under way. This will bring tougher competition for resources and in markets for goods and services, as well as great opportunities. London must face the challenge by providing excellent connections to the emerging megacities of Asia and elsewhere if it is to continue to prosper as a global city.
- 9: If no new runway capacity is created, Heathrow's connectivity will deteriorate by 20 per cent by 2050. A new hub airport could provide world class connectivity in terms of destinations and frequencies to all key business locations as well as meet the other requirements.
- 10: A new hub airport should become a pillar of the Government's plan for growth and should be integrated into its policies and plans.

Introduction

1.1. Background

1. This report is the second in a series to be published by the Mayor of London in relation to the planning of London's future airport capacity. *A new airport for London - Part 1*, which set out the broad case for new airport capacity in London, was published in January 2011, helping to start an open and prominent debate on the subject.
2. In March 2011 the Government published *Developing a sustainable framework for UK aviation: Scoping document*. This invited stakeholders to present evidence in response to 49 questions, addressing themes and issues associated with the benefits and impacts of aviation. The Mayor's response is available on the GLA website². The Government has stated that responses to the scoping document will help inform a draft sustainable framework for UK aviation which is due to be published for consultation in March 2012.
3. In August 2011, the Government published new aviation forecasts. These anticipate that London's airports will be at full capacity by 2030 and that demand growth beyond then will be partly met at regional airports, partly rerouted and partly suppressed.
4. This report aims to move the debate to the next stage by demonstrating what is needed if aviation is to play a leading rather than a limiting role in the drive for much needed export-led economic growth. Further reports are planned to assess a number of other

aspects, including commercial, environmental and location issues in more detail.

1.2. Issues and aims

5. It is abundantly clear that commercial aviation brings benefits in many ways to the UK today. Around half the population takes at least one leisure flight each year; three-quarters of the UK's 30 million annual inbound visitors arrive by air; and a quarter of the UK's visible trade by value is transported by air. In London, where one-third of the population was born overseas and many other residents have family roots outside the UK, aviation performs an important social function by enabling people to maintain links with family and social networks overseas.
6. Above all, however, hitherto excellent aviation connections have allowed London to transform itself into one of the handful of leading cities in the world which host a large concentration of globally oriented financial and business services. There are enormous benefits associated with this and they are felt not just in London but also throughout the UK. It is a central concern of the Mayor that London is able to retain this role in the long term and it is this which has motivated him to take a lead in the debate over future airport capacity for London.
7. Nevertheless, it is important to recognise that aircraft generate environmental and social problems. An approach to growth is needed which maximises the benefits derived from aviation, yet keeps emissions related to climate change within acceptable limits and

minimises the numbers of people affected by noise and poor air quality.

8. To achieve this balance, it is important to be clear about the different ways in which aviation generates benefit. It is the Mayor's view that if the UK is to develop an aviation policy which is both environmentally acceptable and consistent with the Government's ambitious economic growth agenda there needs to be a recognition that:
 - Some types of air travel are particularly important for the wider economy
 - Sufficient capacity needs to be available at a hub airport for these benefits to be fully realised
 - The scale of the negative impacts of new hub airport capacity is dependent on its location
9. It is the aim of this report to examine these issues in some detail.

- Chapter 3: airport usage patterns and the role of transfer passengers in supporting airlines' direct long-haul route networks; the case for a hub serving London
- Chapter 4: the requirements of an efficient hub airport
- Chapter 5: expected changes in aviation demand in the period to 2050
- Chapter 6: Heathrow's limitations
- Chapter 7: future airport development scenarios
- Chapter 8: relationship between future aviation policy and the Government's growth agenda
- Key findings
- Appendices

1.3. Structure of report

10. The report covers the following:
 - Chapter 1: an outline of the value and structure of the London economy and its importance to the UK, including its fiscal contribution
 - Chapter 2: the different types of benefit which arise from the main sub-sectors of commercial aviation, including business travel, inbound and outbound leisure travel and freight; the implications for economic growth

Chapter 1.

The London economy

1.1. Introduction

11. This chapter briefly examines some key attributes of the London economy as a background to the discussion of the aviation benefits in the following chapters. The intention is to demonstrate that, while it is now desirable for Government to facilitate the rebalancing of the economy in favour of a fuller productive role in the regions, the size and nature of London's economy is such that its continuing success will be vital for the UK as a whole for a long time into the future. The chapter covers:
- London's global city status
 - The value and structure of London's economy
 - London's fiscal contribution
 - Key messages

1.2. London's global city status

12. London has succeeded in placing itself at the heart of a global network of 'world cities'. Being part of this 'super-network' lifts London to a different level of competition from others, sustaining and reinforcing a virtuous circle of productivity, competitiveness and cultural innovation. A.T. Kearney's report *The Urban Elite* puts it as follows:
- '[Global cities] are the ports of the global age, the places that both run the global economy and influence its direction. The cities where decisions are made, where the world's movers and shakers come to exchange the latest news and information... In a word, they have clout³.'

13. In the rankings which formed the basis of the A.T. Kearney report, London was second only to New York and, time and again, London holds a similar position when cities are ranked. It is this position in the global elite that the Mayor wishes to safeguard through appropriate aviation and other policies.

1.3. Value and structure of London's economy

14. While London's population is approximately one-eighth of the UK total, its £265bn-a-year economy accounts for more than one-fifth of the UK's Gross Value Added (GVA)⁴. A comparison of total GVA and GVA per capita between the UK regions is shown in Table 1. This demonstrates the extent to which London is the powerhouse of the UK economy. If London were a country, its GVA per capita would make it the third wealthiest in the world. In fact its lead within the UK has increased over the last decade, as it has seen significantly faster growth than the economy as a whole.
15. Approximately 4.3 million people are employed in London, 200,000 of whom are self-employed⁵. The last three decades have seen a significant shift from manufacturing employment in London, which has fallen by around three-quarters of a million jobs since 1971, and a similar increase in employment in business services.

Table 1 Regional GVA, 2009

Region	Per head £	Total GVA £(millions)
UK	19,977	1,234,445
North East	15,621	40,369
North West	17,263	119,079
Yorks & Humber	16,569	87,123
East Midlands	17,349	77,223
West Midlands	16,788	91,178
East of England	18,591	107,209
London	34,200	265,171
South East	20,923	176,500
South West	18,211	95,268
England	20,442	1,059,120

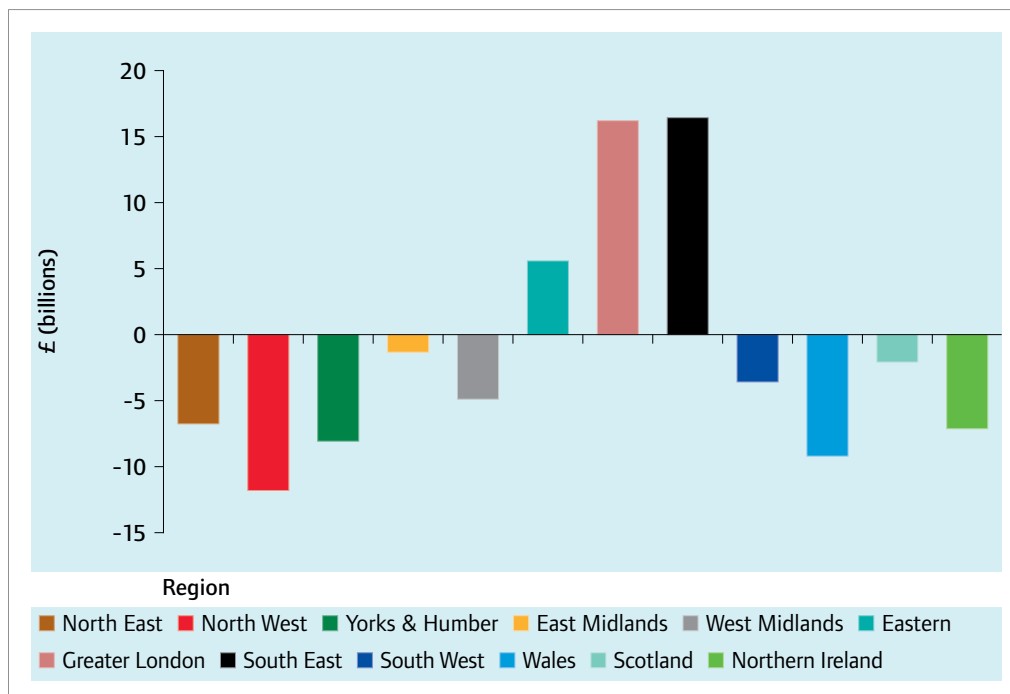
Source: ONS, *Regional GVA, 2010*

16. Not only is London's service sector bigger and more productive, it is also far more export-oriented than those in other parts of the UK. While London employment accounts for approximately one-seventh of the UK total, the city's service sector exports account for a third of the UK's total⁶. GLA Economics estimated that London's total exports of goods and services in 2008 totalled £66.4bn⁷. Key service exports included: advertising and market research, computer and information services, engineering and other technical services, fund management and securities broking, insurance, legal services, telecommunications, management consulting, finance and other business services.

1.4. London's fiscal contribution

17. For many years there has been a fiscal deficit in most regions of England and the other parts of the United Kingdom. London and the South East, and to a much lesser extent the east of England, have been the only regions generating a fiscal surplus. The strong dependence of the rest of the UK on net contributions by London and the South East is shown in Figure 1.

Figure 1: Regional fiscal contributions, 2006 – 2007



Source: Innovacion, *UK's engine for growth and prosperity: The Greater South East, 2010*

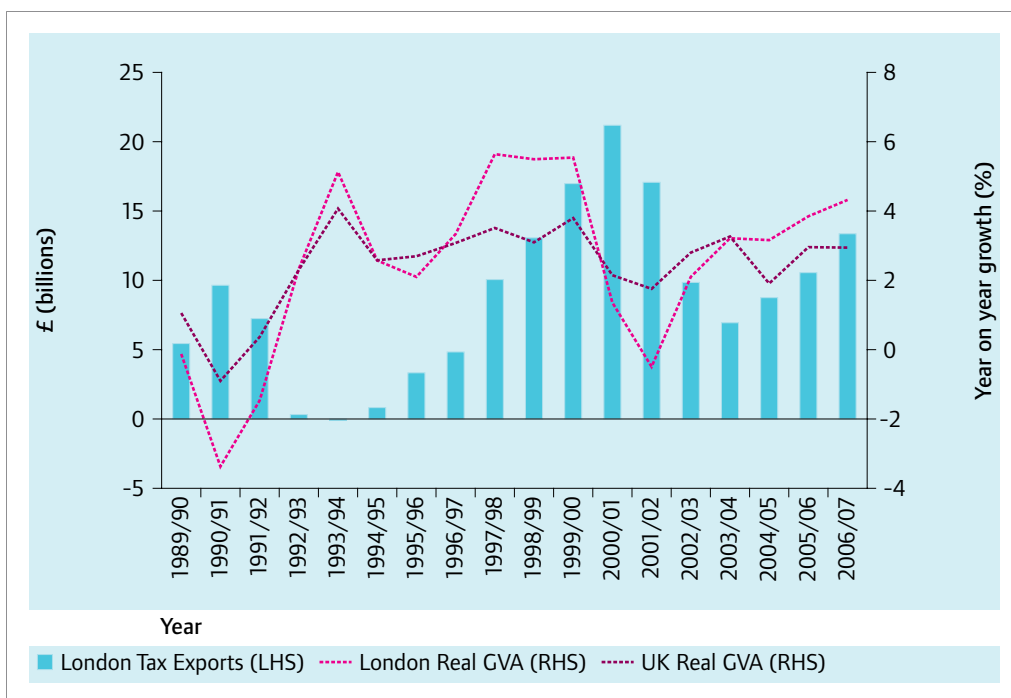
18. GLA Economics estimates that London generated a tax export in 2006/07 of between £8.4bn and £18.4bn. This represents between 9.5 per cent and 19.1 per cent of all tax revenues generated in London⁸. In fact, London has made a substantial ‘tax export’ in most years since 1990, as shown in Figure 2.

1.5. Key messages

- London’s £265bn-per-year economy accounts for more than one-fifth of the UK’s GVA

- London’s service sector is not only bigger and more productive, it is also far more export-oriented than those in other parts of the UK
- Much of London’s economic success can be attributed to its position at the heart of a global network of ‘world cities’
- There is a long-standing tax deficit in all regions of the UK other than in London, the South East and east of England. Between 9.5 per cent and 19.1 per cent of all tax revenues generated in London are ‘exported’ to other regions of the UK

Figure 2: London and UK real GVA growth and London’s ‘tax export’, 2006/07 prices



Source: GLA Economics calculations, Experian Business Strategies, 2009

Chapter 2.

The benefits of aviation

2.1. Introduction

19. The aviation sector plays a variety of important roles across the UK. For instance, the aerospace industry, which is the second largest in the world, directly employs around 100,000 people in skilled, high productivity work⁹. In the South East, commercial aviation is a major employer. The region's airports employ around 130,000 people directly – this is approximately one job per thousand annual passengers. There are also thousands of jobs in the supply chain and arising from the induced demand which the sector generates.
20. Most of the benefits which the aviation industry generates arise, however, through the activities enabled by each of commercial aviation's main sub-sectors: business travel, leisure travel and air freight. For example business travel enables flows of people, goods and capital which support London's role as a world city, outlined in the previous chapter. Outbound leisure travel enables half of all UK residents to take holidays and visit relatives and friends overseas at least once a year, while inbound leisure travel enables the UK to flourish as the world's sixth most popular tourist destination. Commercial passenger services also enable air freight flows, which are important to many industries in which speed adds value.
21. This chapter provides an examination of the benefits associated with the main sub-sectors. There are also important differences between airports in the roles played in serving these markets and these are also discussed.

22. The chapter covers:

- Business travel
 - The main economic sectors in which these benefits arise
 - The location of key functions
 - Foreign direct investment, including a spotlight comparing recent performance of main European competitors
 - Alternatives to business travel
- Leisure travel
 - Outbound tourism
 - Visiting relatives and friends
 - Inbound tourism
 - Travel alternatives
- Air freight
 - Role of air freight
 - Freight and commercial passenger services
- Summary of benefits to economic growth
- Key messages

2.2. Business travel

23. Ready access to business travel is one of the essential factors which allow London to play its leading role in the UK and the world economy, enabling it to generate far more wealth than it otherwise would have been able. The connectivity that aviation provides is central to many international firms' location decisions. As a result London and the South East have been very successful in attracting a high concentration of aviation-reliant businesses. Think London (now London and Partners), an organisation which helps overseas companies to set up in London, identifies 'easy access to other markets and cities' as one of the three main

strategic benefits which attract firms to locate in London¹⁰.

24. Easy access to business travel enables companies to share human resources and knowledge across divisions. Face-to-face contact strengthens collaboration and produces social network effects which improve firm performance and productivity. Sales and profit are also improved through easy access to external customers¹¹.
25. Moreover, there are strong agglomeration effects. These arise through the mutual benefits which firms in supporting industries can enjoy by locating near one another, for example between office headquarters and finance and business services.

2.2.1. Key aviation-reliant sectors in the UK

26. Sectors in which aviation accounts for more than 20 per cent of total expenditure on transport or where expenditure per employee on air transport is more than £1,000 are shown in Table 2¹².
27. The banking and finance and insurance and pension funds sectors are notable for the high proportion of aviation in their transport expenditure and their high expenditure per employee.

Table 2: Air intensive sectors of the UK economy and spend per employee on air transport, 2008

Sector	% of transport spend	Spend per employee £
Air transport	91.7	10,161
Banking and finance	66.6	2,178
Membership organisations	63.8	183
Other business services	60.8	235
Owning and dealing in real estate	59.6	395
Market research, management consultancy	57.5	371
Insurance and pension funds	56.1	4,852
Recreational services	53.1	338
Aircraft and spacecraft	52.9	981
Letting of dwellings	43.8	190
Advertising	43.7	969
Postal and courier services	41.7	1,761
Auxiliary financial services	39.6	207
Other transport equipment	37.8	1,727
Accountancy services	36.8	319
Legal activities	35.8	296
Research and development	34.4	197
Computer services	33.8	175
Other service activities	31.8	145
Ancillary transport services	31.0	1,247
Shipbuilding and repair	27.8	143
Telecommunications	26.9	419
Oil and gas extraction	25.1	4,948
Sugar	24.7	14,035
Hotels, catering, pubs etc	22.9	100
Weapons and ammunition	22.2	272
Estate agent activities	21.3	42
Architectural activities & tech. Consult	21.1	168
Oils and fats processing	13.6	1,972
Tobacco products	10.8	1,220
Inorganic chemicals, organic chemicals	17.8	2,412
Water transport	3.0	3,540

Source: York Aviation, 2011

28. Table 3 shows, for the main air transport-using sectors, both total expenditure on air transport and the share of all air transport expenditure. Banking and finance, with £1.3bn in 2008, was the highest spending sector. This accounted for 15.6 per cent of all expenditure on air transport by business.

Table 3: Sectors spending the most on air transport, 2008

Sector	Spend on air transport £ (millions)	% of total air transport spend
Banking and finance	1,284	15.6
Air transport	901	10.9
Insurance and pension funds	724	8.8
Ancillary transport services	578	7.0
Other business services	459	5.6
Postal and courier services	447	5.4
Wholesale distribution	423	5.1
Recreational services	254	3.1
Motor vehicle distribution & repair, fuel	248	3.0
Public administration & defence	238	2.9
Market research, management consultancy	192	2.3
Hotels, catering, pubs etc	181	2.2

Source: Office for National Statistics (ONS), input-output tables, 2010

29. Many of the service sector activities found in London are highly concentrated there, ie operate mainly in London rather than other areas of the UK.
30. A means of measuring geographic concentration is to calculate the location quotient. This is the number of people employed in a particular location in a given employment sector set against the number that would be employed were the jobs to be distributed nationally in proportion to each location's total employment base. Table 4 shows those economic sectors that have a 'location quotient' which is greater than 1.5¹³. These are principally in business and financial services. The sectors listed account for a quarter of London's total employment. Although the categories do not match precisely, it is clear that there is a high degree of overlap between the sectors highlighted in this table and those in Table 2 and Table 3. For example, financial and business services and leisure-related activities feature strongly in each set of data.

Table 4: Sectors with a London location quotient greater than 1.5

Economic sector	Location quotient
Programming and broadcasting activities	4.8
Motion picture, video and television programme production, sound recording and music publishing activities	3.3
Air transport	3.2
Publishing activities	2.5
Advertising and market research	2.4
Activities auxiliary to financial services and insurance activities	2.3
Activities of head offices; management consultancy activities	2.1
Legal and accounting activities	2.1
Financial service activities, except insurance and pension funding	1.9
Security and investigation activities	1.9
Other professional, scientific and technical activities	1.7
Activities of membership organisations	1.7
Computer programming, consultancy and related activities	1.6
Creative, arts and entertainment activities	1.6
Remediation activities and other waste management services	1.6

Source: NOMIS, Business register and employment survey, 2009

31. This analysis shows there are a number of sectors which make considerable use of air transport and coincide to a significant degree with those sectors geographically concentrated in London. This supports the proposition that much of London's highly valuable service sector is highly reliant on access to air services.

2.2.2. Location of key functions

32. Evidence about location decisions regarding head office functions is also instructive. According to Ernst & Young's Inward Investment Monitor, reported by UK Trade & Investment, the UK has been chosen as the location for the vast majority of European headquarters, as shown in Table 5¹⁴. These decisions are made partly on the basis that London has good links to international networks of company facilities, access to highly skilled staff and specialised business services, all of which are part of the interconnected system which links international aviation to London's economic attributes.

Table 5: Location of European Headquarters 1998–2009

Country of investment	Number	% of Total
UK	469	49.7
Germany	86	9.1
Switzerland	80	8.5
Netherlands	78	8.3
France	77	8.2
Ireland	44	4.7
Belgium	38	4.0
Denmark	22	2.3
Others	49	5.2
Total	945	100.0

Source: Ernst & Young, *Inward Investment Monitor*, 2010

33. The importance of international air links is further demonstrated by the fact that offices are heavily concentrated in areas within easy reach of an airport. While there is evidence of a concentration of head offices around Heathrow¹⁵, the main centre of gravity remains London's Central Activity Zone, as shown in Table 6.
34. There are also links between firms' decisions to locate in a particular place and the availability of leisure travel as well as business travel. In particular, firms' location strategies take into account the connection between the quality of aviation links and the willingness of highly skilled international workers to locate in a city.

Table 6: Head office locations in the South East, with location quotient above two

District	Location quotient
Hillingdon	6.0
Westminster	4.6
Windsor & Maidenhead	4.5
Milton Keynes	4.3
Hounslow	3.8
Slough	3.3
Kensington & Chelsea	2.6
Surrey	2.5
Lambeth	2.2
Reading	2.1

Source: NOMIS, Business Register and Employment Survey, 2009

2.2.3. Foreign direct investment

35. The benefit of London's perceived accessibility in allowing investors to oversee and monitor their investment personally is a vital factor in the UK's traditional success as both a recipient and source of overseas direct investment. Over the last decade the UK has been both the second largest recipient of FDI and the second largest source after the USA¹⁶. In 2010/11, over 94,000 jobs were created and safeguarded in the UK by foreign companies' investments¹⁷. Data from the European Investment Monitor suggests London's share of all UK FDI projects between 1999 and 2009 averaged 33 per cent¹⁸.
36. FDI can be in new projects, expansions of existing projects, or mergers and acquisitions activity. FDI benefits the UK economy in many ways. For example, an investment in a new factory or business creates new jobs directly, as well as further supply chain jobs, while knowledge transfers and innovation can have a further positive impact on productivity. In 2010, FDI-generated jobs represented 13 per cent of all jobs in London¹⁹. The sectors in which FDI employment is predominantly focused generally result in the generation of higher value jobs. Employees in foreign-owned companies are paid 37 per cent more than those in domestically-owned ones and even after adjusting for the different job types, a 12 per cent discrepancy in favour of those employed in foreign-owned firms remains²⁰.
37. FDI contributed £52bn to London's economy in 2008 and foreign-owned firms created 42 per cent of London's economic growth between 1998 and 2004²¹. The higher productivity of foreign-owned companies than domestic ones is important in this performance, although this may also be partly explained by the technological characteristics of those sectors with high levels of foreign ownership. This is also reflected in the relatively limited development of trade and inbound tourism with China in comparison with other major European countries. A significant factor is the limited capacity available at the UK's hub airport which is examined in further detail in Chapter 4 and Appendix A.

Spotlight

The competition for FDI and trade

The UK faces strong competition from neighbouring European countries for overseas trade and investment.

With Europe's metropolitan business districts competing in an increasingly fast-paced, networked economy, a large breadth of global links is crucial in attracting investment from overseas and maintaining successful trading relationships.

These forces have led some to cite a new economic geography, with major hub airports now driving and shaping business location and urban development.

Germany is widely perceived to be the UK's main rival in terms of general investment attractiveness and one of its relative strengths lies in the perception that it has high quality transport infrastructure, including its airports.

Germany has capitalised on the strength of its manufacturing sector to become China's largest trading partner in the European Union (EU) with bilateral receipts of €130bn, a third of total trade between China and the EU²². It is notable that more routes are offered between German

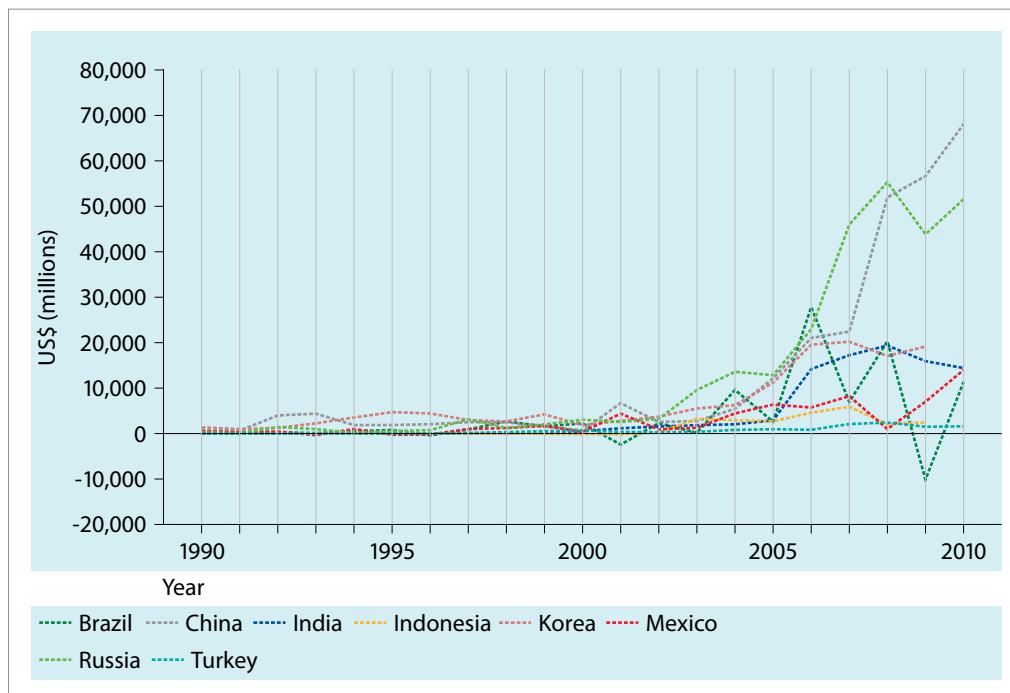
and Chinese cities than elsewhere in Europe - six compared with two in the UK. On the other hand, France seems to have increasing success in attracting inward investment from Brazil, which totalled \$800m in 2009. In comparison, the Brazilian investment in the UK amounted to just \$1.7m over the same period²³. France's hub airport, Paris Charles de Gaulle, has the best connections to Brazil of any of the four major European hub airports

There has been a recent decline in the UK's FDI performance compared to other countries, particularly in relation to growth markets. Heathrow, the UK's hub airport, currently trails continental hubs in serving growth markets. The only major exception is India, to which the UK has unrivalled air connections from Europe, in part owing to the historic links between the two countries.

The lack of direct flights to growth markets may already be costing the economy £1.2bn a year as trade goes to better-connected competitors. The value of this missed opportunity to the UK economy over the next 10 years could total £14bn²⁴.

38. The UK's continued ability to attract large-scale foreign investment is vital, particularly as emerging economies such as China become increasingly important potential sources of capital (and also locations for UK overseas investment), as shown in Figure 3. Good aviation links are considered essential by overseas investors, and the UK has very good links with those countries with which it has long-standing major investment flows, such as the US. However, the UK has performed significantly less well than other European countries in developing new aviation connections to emerging countries such as China.
39. Two emerging groups of nations with rising income levels are (i) Brazil, Russia, India and China (the so-called 'BRICs') and (ii) Colombia, Indonesia, Vietnam, Egypt, Thailand and South Africa (the 'CIVETS'). Of these countries the UK has high frequency services only to Russia, India and, to a lesser extent, Thailand. The number of direct services to South Africa is declining; Brazil and Egypt have a relatively limited number of services; and Colombia and Indonesia have no direct connection with the UK at all.

Figure 3: Rise in outward FDI from growth markets, 1990-2010



Source: UNCTAD Stat, 2011

2.2.4. Alternatives to business travel

40. The question arises as to whether aviation links are genuinely indispensable to business or whether for some trips the same benefits could be realised by other means, such as conference calls and other forms of remote electronic communication. Many people have argued that much business travel could be eliminated through the use of electronic communication. This has not, however, occurred to any great extent to date, as Denstadli states:

‘Since its introduction in the 1970s, it has been suggested that virtual intra-company meetings via video conferencing would reduce the demand for business passenger travel. However, studies have had only inconclusive evidence regarding the actual impact, indicating that the substitution effect has been rather limited²⁵.’

41. This seems to suggest that despite the ‘information revolution’, face-to-face contact remains, and will remain, an essential element in conducting business. Indeed, given the low cost of electronic alternatives, it seems clear that the business travel which is undertaken cannot be easily substituted by other forms of communication.

2.3. Leisure travel

42. Leisure travel by UK residents brings individual benefits but, at least as far as tourism is concerned, little in the way of wider competitiveness benefits. (There are, nevertheless, important network benefits which all passengers bring to the hub airport,

including outbound tourists - see Chapter 3.) On the other hand, visiting relatives and friends is an important social benefit of aviation, and one increasingly important to London’s growing international population.

43. Leisure travel to the UK by overseas residents is a vital source of export revenues. While London remains globally attractive, the UK is lagging its continental rivals in attracting visitors from emerging countries such as China.

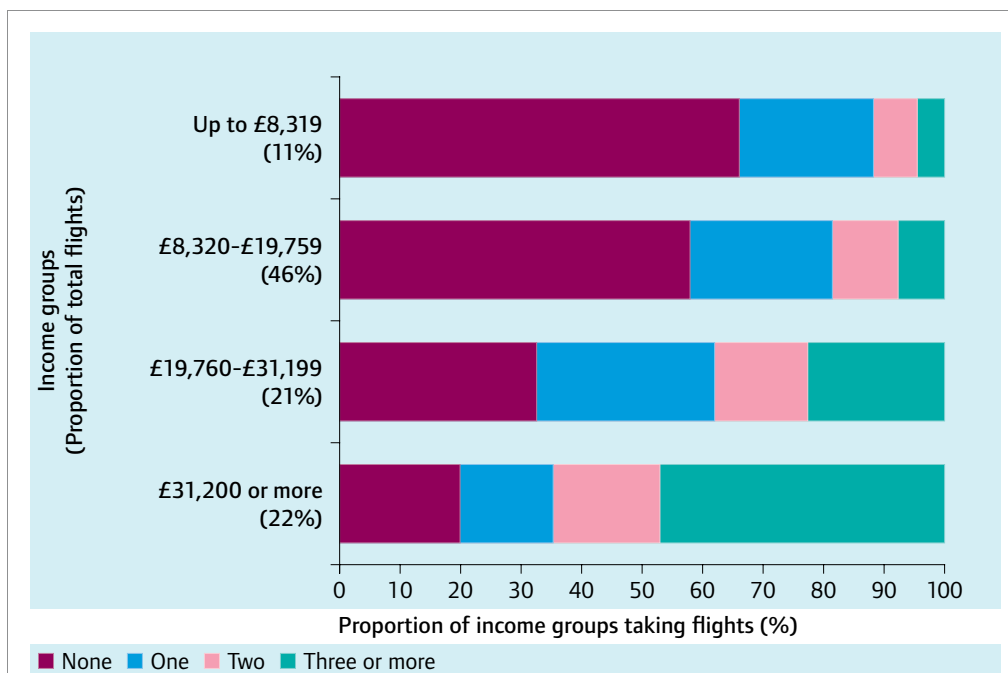
2.3.1. Outbound tourism

44. This is by far the largest sub-sector of aviation, and until the recent recession, growth had been almost continuous for several decades. This has vastly broadened the range of locations available to people for holidays. Large numbers of people choose to exercise this freedom by travelling farther afield for holidays and more often than they have done previously. While this is a valuable benefit to the individuals concerned, and it undoubtedly supports some business activity in the UK, for example in tourism and travel services, it is mainly a form of consumption which effectively adds to the UK’s flows of imports from overseas²⁶.

45. Nevertheless, there may be some other wider economic benefits. The availability of personal travel opportunities helps make the UK attractive for internationally footloose workers who benefit the economy by offering skills and know-how, which in turn attracts certain businesses to locate in the UK.

46. Approximately 50 per cent of the UK adult population travels by plane at least once in a given year but in recent years participation in this market has stopped growing. There has been some growth in demand in the past decade, much of it associated with the increased penetration of the market by low cost carriers. Growth has been mainly within a relatively fixed pool of people, who have increased the number of flights they take in a year. The composition of the pool of commercial aviation users is strongly associated with income group, as Figure 4 shows²⁷. It is not clear to what extent aviation fares determine this
47. Furthermore, data produced by the British Air Transport Association (BATA) shows that during the 10 years from 1999 the relative share of commercial aviation use by each socio-economic group remained broadly constant²⁸.
48. This analysis shows it can no longer be supposed that as aviation use increases there is an accompanying increase in the number of individual users. There appears to be a relatively fixed section of the population which does not participate in the aviation economy. In the last ten years or so a relatively fixed group of people in middle and higher income brackets has accounted for almost all the growth in aviation use.

Figure 4: UK air travel by annual income group



Source: Committee on Climate Change, *Meeting the UK's Aviation Target*, 2009

49. Aviation policy needs to recognise the importance of outbound tourism to the roughly 50 per cent of the population which makes use of aviation services for this purpose. This analysis, however, indicates that there are not strong economic or social grounds for aviation policy to prioritise

2.3.2. Visiting friends and relatives

50. Visiting friends and relatives (VFR) is a distinct sub-sector within broader leisure travel. It differs from more general leisure travel in that there is little or no flexibility about destination. London is home to a large number of overseas migrants and many more people with family and social ties overseas. For this reason VFR travel is a particularly important element of aviation demand in the capital. VFR trips are less easily substituted than holiday destinations. There is more flexibility with holidays, which can be taken in different locations and by different modes etc.
51. VFR trips have grown more rapidly than the aviation market overall, reflecting the increasing proportion of UK residents born abroad, particularly in London and other large cities, as well as the growing internationalisation of the labour market. VFR travel often has very high utility to those who make it, allowing ties to be maintained with family and friends overseas. Given the importance of such travel, which for many may only be affordable infrequently, it should be distinguished from other sorts of travel.
52. Londoners attach a great importance to VFR trips. They have a high social utility to minority ethnic people in particular, where they carry a special family and social value. This also includes many Londoners that are economically disadvantaged. Any general loss in connectivity should be treated as more serious where it affects travel for VFR. In short, although leisure travel by air may be a rarity among economically disadvantaged people, it is greatly prized by them, and policies that make it more difficult would not be supported by the Mayor.

2.3.3. Inbound tourism

53. Overseas tourists to the UK support jobs and investment by generating valuable export revenues. While the UK overall has a large trade deficit in international tourism, London remains a significant generator of inbound trips. London has a strong global image, and remains far more attractive as an international leisure location than most other regions of the UK. VisitBritain has long found that perceptions of Britain are dominated by London. The capital receives half of all the UK's 30 million annual overseas visitors, compared with the nine per cent who visit Scotland and the four per cent visiting Wales. London had 11 times as many visitors as Edinburgh, 18 times as many as Manchester, 20 times as many as Birmingham and 23 times as many as Glasgow²⁹.

Spotlight

Inbound tourism from China

While France, Germany and Italy each managed to attract between 500,000 and 700,000 visitors from China in 2010, the UK had only 127,000³⁰.

There are at least twice as many seats from Germany and France to China per head of population than there are from the UK. In total, France earns £1.3bn per year from Chinese tourist spending on visits in the country, compared to the UK's Chinese tourist spending receipts of £115m³¹.

It is clear that by failing to attract a comparable number of Chinese visitors to its main European competitors, the UK is missing out on a rapidly growing and highly valuable potential source of overseas earnings.

Main reasons for the UK falling behind are:

- (i) The UK's separation from the Schengen area
- (ii) A lack of direct flights to mainland Chinese cities
- (iii) Difficulties in the UK with the primary Chinese payment system

Chinese tourists tend to visit multiple countries on package tours of Europe. These only require a single visa provided visitors remain within the Schengen area. The UK's decision to remain outside the treaty area means visitors from China must obtain a separate visa to enter the UK and the extra time and cost involved results in the UK being left off many schedules.

The relative lack of flights between the UK and China is also a deterrent. The UK has fewer flights to fewer destinations in China than France, Germany and the Netherlands. China's biggest airline, China Southern, does not serve the UK, citing limited access to Heathrow as the reason for their absence. This is discussed in more detail later in the report.

A further issue to be resolved is the limited integration of the China Union payment system in contrast to a number of other European countries.



Photograph © BAA Limited

54. London and the UK seem to be developing much more slowly as a destination for the potentially huge emerging tourism markets of Asia than other countries in Europe. This is reflected in the concern that VisitBritain has expressed about relatively slow growth in overall UK airline seat capacity. Recent figures show that between 2006 and 2010 airline seat capacity from international origin markets to the UK increased by 2.9 per cent. By comparison, the equivalent figures for France and Germany were 6.3 per cent and five per cent respectively³².

2.3.4. Travel alternatives

55. The destination is fixed for many types of trip, including most business trips, as well as many leisure trips, notably VFR travel and travel for health and education reasons. Tourism trips, however, can be considered more flexible, since holiday destinations are to a degree good substitutes for one another, although clearly individual preferences will vary. It is important to note the implications of this for the economic benefits of inbound tourism in the event of deterioration in international connectivity. In particular, if the UK wants to receive more international tourists it should consider the quality of aviation connections which are needed to attract them.

2.4. Air freight

56. In 2005, while 0.5 per cent of the UK's international goods movements by weight travelled by air and 95 per cent by sea,

air accounted for around 25 per cent of movement by value³³ and 55 per cent of the value of UK manufactured exports to non-EU countries³⁴. In 2007 the value of UK air freight exports to non-EU countries was £31.3bn³⁵. It is clearly therefore of fundamental importance to the UK's trading economy.

2.4.1. Role of air freight

57. Air freight enables access to markets. It can help grow demand for goods to which speed adds value and it is valuable in enabling more efficient production practices. It is commonly used for transporting high-value equipment, machinery and spare parts. Its speed and reliability give it a vital role in reducing inventory needs as part of just-in-time production practices through allowing the routine transportation of high-value components between remote locations within integrated supply chains as well as emergency deliveries. It allows businesses to obtain the benefits of low-cost production overseas while satisfying and stimulating the demand of affluent consumers in domestic markets. Air freight imports of components for just-in-time manufacturing in the UK were valued at £19.5bn a year in 2005³⁶. The products and practices associated with air freight are likely to become increasingly important for the future of UK manufacturing.

58. Air freight is also used for fast delivery of high value-to-weight manufactured goods with short product life cycles, such as perishable foods and pharmaceuticals – 71.3 per cent of the UK’s pharmaceutical exports to countries outside the EU travelled by air in 2005³⁷.

2.4.2. Freight and commercial passenger services

59. Air cargo either travels in dedicated aircraft or as belly hold freight sharing aircraft with commercial passenger operators. Both methods are acceptable for most types of freight, although the express logistics industry tends to rely on cargo-only aircraft³⁸. In fact, belly hold freight is more important to the UK than other countries. Approximately 67 per cent of the weight of all UK air freight is carried in the belly hold of passenger flights, which compares with a global average of 50 to 60 per cent³⁹.
60. Airlines have found that yields from the carriage of freight on passenger services are around five to 10 per cent higher than the yields achieved on dedicated cargo flights⁴⁰. The combination with passenger services, where ticket sales cover most of the cost of the flight, allows for flexible pricing structures and therefore often cheaper prices for exporters. Belly hold cargo typically returns a 60 per cent profit, while freighter operations struggle to break even⁴¹. Furthermore, freight is vulnerable to fluctuations in demand and a strategy based on belly hold freight is less of a financial risk than leasing or investing in a standalone fleet of additional specialist freight aircraft. By example, following the recent recession, Air France-KLM decided to orient its freight strategy more around its passenger services, which has resulted in an increase in the share of belly hold freight from 50 to 70 per cent of the total freight carried⁴².
61. Based on analysis of airline financial data, the CAA has calculated that belly hold freight typically contributes between five and ten per cent of total revenue on long-haul services⁴³. This contribution is not insignificant, particularly on lower volume ‘thinner’ routes, where such revenues can help maintain the route’s viability and/or help increase frequencies. At the same time, by piggybacking on passenger services, a direct freight connection can be provided to many more destinations than could be viably supported by a dedicated freighter flight.



Table 7: Summary of the economic and social impacts from aviation sub sectors

	Consumption	Investment	Exports / Imports	Tax revenue	Regional impacts / Inclusiveness	No effective substitutes?
Business	N/A	Business flights facilitate investment flows. ●	Business travel facilitates UK exports of goods and services. ●	Business travel generates Air Passenger Duty (APD). Corporation taxes on enabled activities (especially in London and SE) make a vital contribution to Government revenues, alongside income tax on employment income. ●	London's economy is reliant on a comprehensive network of direct air connections. It plays a vital role as the main aviation gateway to the rest of the UK. A well connected hub airport could serve the whole UK allowing regional economies to benefit from the global connections it offers. ●	Many London based firms place a premium on the availability of a wide range of direct, frequent air connections. Electronic means have not proved an effective substitute. ●
Outbound leisure	Outbound leisure flights facilitate overseas holidays by UK consumers. This is final consumption expenditure which contributes to economic growth but that part of it which flows overseas is netted off as imports. It is not the case that all of this expenditure flows out of the UK. (Inter alia it also supports investment in UK aviation equipment and facilities etc.) Nevertheless the opportunity cost is likely to be lower consumption and investment in UK based tourism than would otherwise have taken place. ●	N/A	Spending overseas by UK tourists represents imports to the UK, a negative item in national accounts for the purposes of calculating economic growth. ●	Outbound leisure passengers generate revenue through APD but other indirect taxes are foregone on expenditure made overseas which would otherwise have been made in the UK. ●	Leisure trips and education trips are important to people, helping to improve well being and quality of life. However, about 50 per cent of the population do not regularly fly. Most recent aviation growth is accounted for by better off groups making more trips rather than previous non users starting to fly. ● VFR trips are very important in London in particular since there are many people with family ties overseas. The destination is usually fixed. ●	People value the freedom to choose where they go on holiday, although in fact alternative destinations, mode of travel and aviation routes are available in many cases. In practice prices will adjust to allocate resources and determine where, when and how people travel on holiday. ●
Inbound leisure	N/A	N/A	Expenditure by overseas visitors in the UK (net of tax) represents export revenues which contribute to economic growth. Inter alia, this supports investment in aviation services, tourist facilities, infrastructure etc. ●	Incoming tourists generate indirect tax such as VAT on expenditure in the UK and also direct revenues through APD. ●	London plays a vital role as the main aviation entry point to the UK. Many tourist visits will include travel beyond London and will generate regional benefits, which will help economic rebalancing. ●	If the UK wants to maximise the benefits for UK tourism from emerging economies there are few effective substitutes for direct flights. Other barriers, notably restrictive visa arrangements will also need to be addressed. ●
Cargo	Incoming cargo facilitates the production of finished goods in the UK, although it is not measured as a separate component of GDP. Those elements which are imported are netted off. ●	Air cargo is part of the supply chain for imported investment goods such as machine tools, which contribute to the economy's productive capacity (and economic growth). ●	Air cargo enables UK goods to be sold to overseas customers. Air cargo also enables imports of goods for consumption. UK based air cargo services used by overseas firms are a source of export revenue. ●	Customs duties are levied on goods produced outside the EU. Excise duties are levied on imported alcohol and tobacco products. Also, indirect taxes (VAT) are raised on final consumption of most imported goods. ●	Cargo services facilitate operation in overseas markets by regional manufacturing businesses and can play an important role in economic rebalancing. ●	Many international goods markets would not exist without the availability of air transport. It is used where speed adds value. It is essential in pharmaceutical and perishable goods markets and vital for just in time (JIT) production processes. ●
All sub sectors and transfer passengers at UK hub	See above.	All sub sectors and transfer passengers support the network of direct routes for business which facilitate investment flows. ●	Transfer passengers generate export revenues through their use of UK based airlines and expenditure in UK airports. All sub sectors and transfer passengers contribute to higher export potential through allowing more direct routes and higher frequencies to operate, benefiting UK businesses and consumers. ●	Transfer passengers do not pay APD. However there is a positive contribution to UK revenues through taxation of UK airline profits and also any VAT paid on items bought during transfer. See above for other passengers and cargo. ●	See above.	See above.

Economic/social impact: ● Positive ● Mixed ● Negative

2.5. Summary of benefits

62. The foregoing analysis has demonstrated that commercial aviation generates a range of important benefits for the UK. It facilitates overseas travel for approximately 50 per cent of the population, allowing them to take holidays and visit friends and relatives overseas. It plays a hugely positive role in facilitating economic growth and it raises substantial revenue for Government, both directly and through the additional economic activities which it enables. It can be a powerful means of promoting London's and the UK's regional economies by providing opportunities for international trade, tourism and investment, and air freight also plays a vital role in supplying the needs of industry and consumers, particularly of goods for which speed adds value.
63. Different types of benefit will be more or less important to the achievement of particular policy priorities. It is clear that UK economic policy has recently moved towards encouraging a more vigorous productive sector, with a strong emphasis on export-led growth. This analysis shows which sub-sectors of aviation should be treated more importantly if aviation policy is to respond to this.
64. A summary of the contributions of the various sub-sectors to economic growth, and regional rebalancing appears in Table 7⁴⁴. The intention is to identify where there are positive and negative influences

for policy purposes⁴⁵. It includes both direct and secondary effects. Direct effects include, for example, revenues generated by aviation services themselves while an example of secondary effects is the attraction of investment to London which business travel enables.

Key messages

- The benefits of business, inbound leisure, and transfer passengers as well as cargo accrue largely to the wider economy. The activities these sub-sectors enable are able to make a major contribution to export led economic growth
- While some of the benefits associated with outbound tourism will accrue to UK businesses supplying travel and tourism services, they are less relevant to the current economic priorities of generating higher export-led economic growth than the benefits associated with the other sub-sectors. Most of the benefits are in the form of 'consumption' by individuals taking holidays abroad⁴⁶
- There are, however, significant social benefits associated with travel for VFR, much of which is long-haul. This market is heavily concentrated in London, where over a third of the population was born overseas and there are many others with strong familial and social ties overseas

Chapter 3.

The implications for airport capacity requirements

3.1. Introduction

65. The previous chapter concluded that there appears to be a strong case for ensuring growth can take place in certain sub-sectors of commercial aviation as part of the Government's efforts to promote export-led economic growth. It is important to recognise that different types of airport capacity will have an influence on the ability of different sub-sectors to grow. Most outbound tourist needs can be adequately met by point-to-point airports⁴⁷. The same cannot be said for the other sub-sectors, which deliver greater economic and social benefits. For these, spare point-to-point capacity is unlikely to meet growth needs fully. Only sufficient capacity at a hub airport will address this challenge and this is examined in detail below.

66. This chapter covers:

- Patterns of aviation use within the different sub-sectors, including a spotlight on freight at Heathrow
- The need for transfer passengers to sustain long-haul routes
- The route network benefits at a hub airport
- London's need for a hub airport in the South East
- The extent to which regional airports can

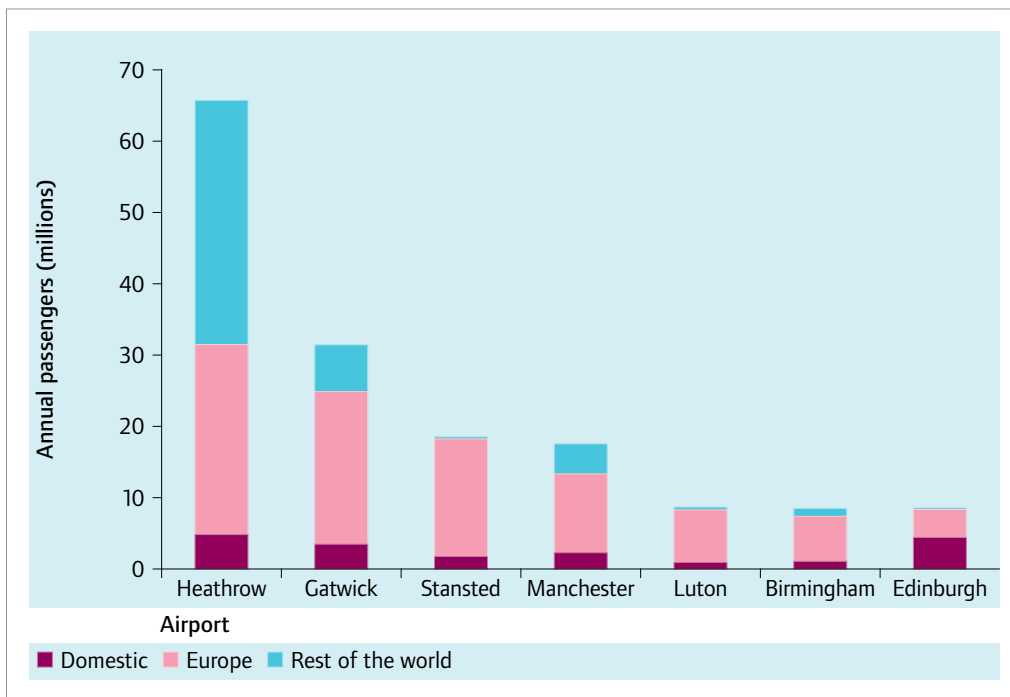
offer an alternative to hub capacity in the South East

- The scope for high-speed rail to provide a substitute
- Whether or not a hub airport in the regions could work
- The risk of loss of benefits to overseas competitors
- Further benefits from transfer passengers
- Key messages

3.2. Patterns of airport use

67. London's principal airports accounted for approximately 60 per cent of all passengers using UK airports in 2010. Heathrow was by far the largest, with around 65.7 million passengers, about 36 per cent of whom were transfer passengers⁴⁸. As Figure 5 shows, Heathrow dominates the provision of direct long-haul routes to destinations beyond Europe, representing more than two-thirds of all UK scheduled long-haul traffic. The only other airports with any substantial long-haul business are Gatwick and Manchester, although this is on a much smaller scale than at Heathrow. It is clear that Heathrow plays a unique role in connecting the UK to locations outside Europe.

Figure 5: Annual passengers by route type at UK's largest seven airports

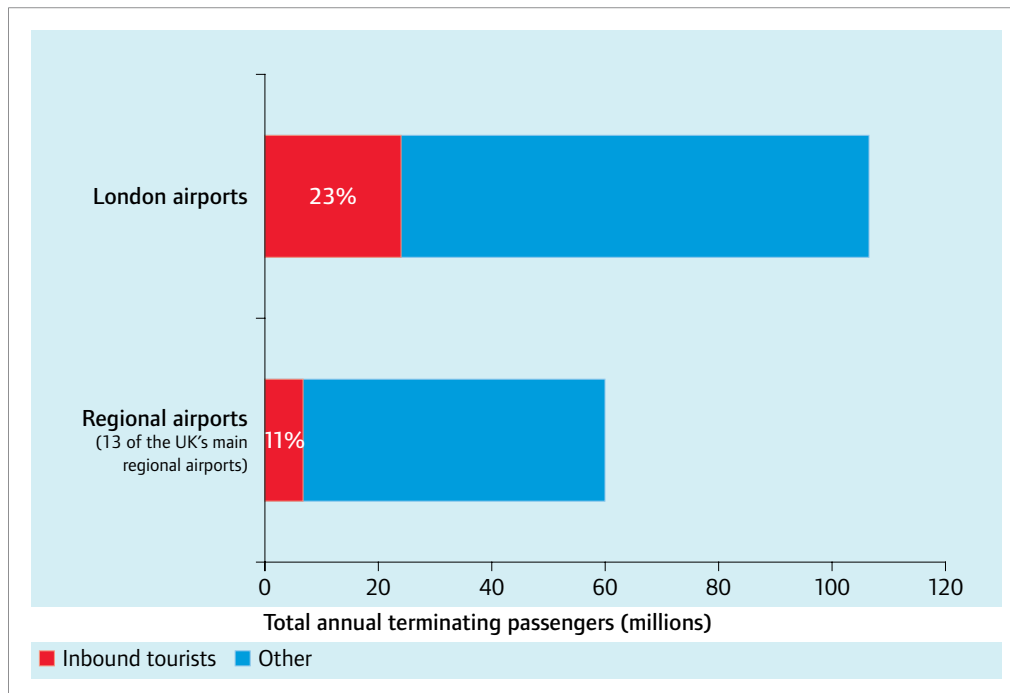


Source: CAA, UK Airport Annual Statistics for 2010, 2011

68. There is variation in the share of the different sub-sectors by airport. It is notable that 34 per cent of passengers are travelling for business at Heathrow. There are also high business travel shares at London City (56 per cent), and the five main Scottish airports (an average of 30.6 per cent). However at the remaining London airports and eight main regional airports in England the share of business travel is significantly lower, averaging 17.7 per cent⁴⁹.
69. There are significant differences between the proportions of outbound and inbound leisure travellers across airports. In particular, outbound passengers are distributed much more evenly across the country's airports than inbound passengers, who are concentrated at the London airports - especially Heathrow. (Outbound tourism is nevertheless an important element of demand at Heathrow.)

70. It is estimated that London's airports handle just under three quarters of all inbound tourist arrivals by air. Heathrow plays a special role as an entry point for relatively high spending long-haul visitors. Many of these tourists visit a variety of regions of the UK, often during longer stays in the UK than short-haul visitors make. The relative importance of inbound tourism in terms of overall airport passengers is illustrated in Figure 6. This shows that the proportion of all passengers who are inbound tourists is twice as high at the London airports than at 13 main regional airports.

Figure 6: Share of all arrivals who are inbound tourists at London airports and the main regional airports



Source: CAA, Passenger Survey Report, 2007/08, 2008, 2009 (The regional airports sample represents approximately three quarters of total regional demand.)

71 There is a marked variation between London and regional airports with regards to the purpose of UK residents' international leisure trips. As Table 8 shows, the proportion of travel to visit relatives and friends (VFR) for all London airports is significantly higher than that for the country's leading regional airport, Manchester, and approximately 10 times as great in volume terms⁵⁰. This may reflect both the higher proportion of London's population with overseas families and social ties than in other regions and possibly a higher proportion falling into higher income groups amongst those living in London.

Table 8: VFR and other leisure as a proportion of UK residents' international leisure trips, per cent and 000s

Airport	VFR (%)	Other leisure (%)	VFR (thousands)	Other leisure (thousands)
Heathrow	53.2	46.8	9,384	8,250
Gatwick	23.5	76.5	4,421	14,421
Stansted	52.4	47.6	4,417	4,010
Luton	47.8	52.2	2,230	2,434
All London	41.4	58.6	20,452	29,115
Manchester	17.8	82.2	2,084	9,616

Source: BATA, *Characteristics of Passengers, 2009* [from CAA data], 2009

72. There are also major differences between the London airports, likely reflecting the types of destinations served. It is noteworthy that while Heathrow has a lower overall number of leisure passengers than Gatwick, it has by far the highest number of VFR trips of any airport in the country.
73. As the main airport for long-haul passenger services, Heathrow is also the most important freight airport in the UK, accounting for 82 per cent of UK belly hold air freight. In fact, this constitutes 63 per cent of all UK air freight, and as such Heathrow's network plays a vital role in supporting freight connectivity for the UK economy, as the spotlight on freight at Heathrow describes in more detail.

Spotlight

Freight at Heathrow

The majority of the UK's air freight is lifted from London's airports with Heathrow handling the largest share of goods. In 2010 nearly 1.5 million tonnes of freight passed through Heathrow (about 63 per cent of the UK total)⁵¹. This is six times as much as handled at East Midlands airport, the second ranked airport.

Despite this leading position in freight handling, only about five per cent of the tonnage lifted from Heathrow in 2010 was carried on cargo planes⁵² (these accounted for 0.5 per cent of Heathrow's slots – seven per day on average)⁵³; the other 95 per cent of freight was carried in the

belly hold of passenger aircraft. The revenues it produces contribute to the viability of Heathrow's passenger route network. Statistics for 2010 show 93.7 per cent of freight tonnes at Heathrow were transported to international destinations outside the EU, 6.1 per cent in the EU and 0.2 per cent domestically.

This pattern is partly driven by the relative sizes of the belly holds of aircraft flying domestically, within the EU and to other international destinations. For example the belly hold capacity of a Boeing 747 is approximately 30 tonnes compared to a Boeing 737's two tonnes.

3.3. The need for transfer passengers

74. It is clear that Heathrow plays a special role, particularly in the provision of long-haul services, and that it is particularly important for the sub-sectors which offer the most economic and social benefits – business travel, inbound tourism, VFR travel and cargo. Heathrow is able to play this role because it is the UK's hub airport. It therefore handles the vast majority of transfer traffic as shown in Table 9.

75. There are high fixed costs associated with operating commercial aircraft and this is particularly the case on long-haul routes. Individual sub-sectors do not generate sufficient demand to justify the comprehensive network of flights, many at high frequencies, which Heathrow offers. Heathrow's route network is only viable because sufficient demand is consolidated there, allowing the fixed costs to be shared by passengers and cargo across a large total market.

Table 9: Passengers who are connecting at selected UK airports, 2009/10

Airport	Proportion connecting (%)	Number of connecting passengers (millions)
Heathrow	35.8	23.5
Gatwick	8.4	2.6
Stansted	6.4	1.2
Manchester	2.2	0.4
Luton	2.4	0.2
Aberdeen*	8.5	0.2
Birmingham	1.9	0.2
Glasgow*	2.2	0.2
Edinburgh*	1.7	0.2
Liverpool	2.1	0.1

Source: CAA, Annual Passenger Survey Report, 2010 and 2009*

76. Each passenger generates benefits for all the others using the route by supporting its viability. In effect the viability of routes depends on the combined revenues of 'high yield' business passengers, 'volume' leisure travellers and to an extent belly hold cargo to make them viable. There is therefore a considerable degree of interdependence between the various sources of revenue. This includes all the sub-sectors and transfer passengers who use Heathrow as a hub.
77. This process creates connectivity benefits to both the hub airport's catchment area and those of its feeder airports. This model works because leisure passengers are generally more willing to fly indirectly than business passengers, particularly since airlines price indirect flights more attractively. Leisure demand for long-haul destinations can therefore be consolidated at hub airports such as Heathrow. In economic terms this means that each passenger effectively generates 'positive externalities' to all the others, including business passengers. This effect is magnified in hub operations, which are necessary to the ability of the market to serve many long-haul commercial air routes.
78. The reliance of Heathrow's route network on transfer passengers is demonstrated by the fact that in 2010 on 39 routes at the airport they accounted for more than 50 per cent of passengers, as shown in Figure 7. There were a further 92 routes on which they accounted for more than 25 per cent of passengers⁵⁴. Further details about how hubbing at Heathrow works in practice are provided in Appendix A.

Figure 7: The importance of transfer passengers in supporting use of Heathrow, by route



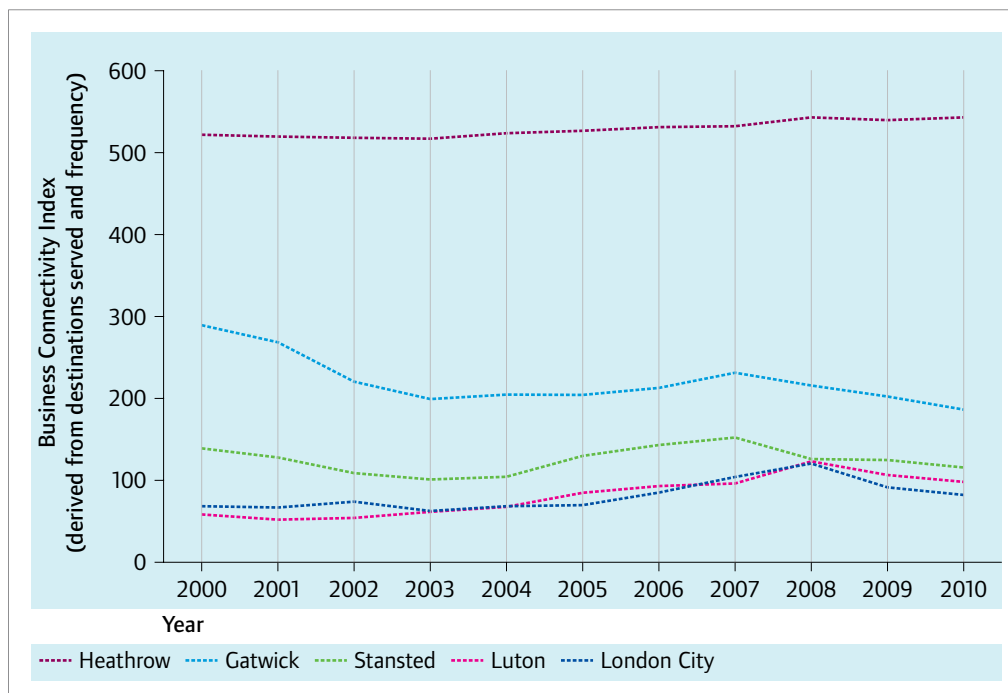
Source: York Aviation, 2011

3.4. Route network benefits

79. Heathrow's hub status allows it to offer direct services to a broader network of destinations than it would otherwise be able to. The ability to attract transfer passengers allows an airport to grow its market and establish a virtuous circle between demand and connectivity. Furthermore, the connectivity on offer starts to enable new economic activity which in turn generates more aviation demand. This can continue until the hub airport is at full capacity. Heathrow has historically followed this positive pattern of development, and this explains why its

network is so superior to other UK airports. There is a huge gap between the overall quality of Heathrow's direct business connectivity and that of the other London airports. This is illustrated in Figure 8 which shows the number of direct routes offered to cities in the Global World Cities Index at the five principal London airports.

Figure 8: Business connectivity at London's principal airports (derived from destinations served and frequency)



Source: York Aviation, 2011

80. Even where routes would be viable without the need to consolidate demand, a hub offers additional benefits since airlines can operate higher frequencies than would otherwise be possible, making the route more attractive to passengers. With the exception of London City Airport, the frequency of flights available at Heathrow is more than twice that provided at the other London airports.
81. For these reasons the Mayor believes aviation at London's hub should be considered a national priority for growth. All sub-sectors and transfer passengers at the hub will be important in this.

3.5. The importance of a hub airport for London

82. Point-to-point airports are highly effective at meeting most passengers' needs for outbound tourism, which are mainly for short-haul travel. Moreover people value the convenience of regional airports which are relatively close to home where they meet their needs. Overall there are few runway capacity constraints at point-to-point airports.
83. The case has been made, however, for recognising the particular value to economic and social policy objectives of accommodating growth in demand in the other sub-sectors – business travel, VFR travel, inbound tourism and cargo.
- It has been shown that in fact a relatively high proportion of travel associated with these is long-haul and that a hub airport is needed to maximise the quality of the route network needed to serve them.
84. The question arises, however, as to whether it would matter if some of these trips which currently use direct long-haul services at Heathrow could be made indirectly, by transferring at another hub airport, without any significant loss of economic or social benefit.
85. People travelling for certain purposes, such as visiting friends and relatives, appear to some extent to be willing to trade off the journey time and degree of convenience associated with direct travel for other attributes such as lower prices. Business travellers, however, are generally far less willing to sacrifice journey time, convenience and frequency and are significantly less willing to take indirect flights, as shown in Table 10 overleaf. The variation in the differences from route to route is largely due to available capacity and the range of alternative indirect hub options available.

Table 10: Split of direct and indirect passengers by selected routes, 2010

Origin/destination	All passengers		Business passengers	
	Direct	Indirect	Direct	Indirect
Accra	71%	29%	82%	18%
Auckland	25%	75%	72%	28%
Bangkok	53%	47%	88%	12%
Beijing	71%	29%	86%	14%
Delhi	79%	21%	73%	27%
Hong Kong	91%	9%	92%	8%
Hyderabad	23%	77%	26%	74%
Islamabad	78%	22%	70%	30%
Johannesburg	58%	42%	80%	20%
Karachi	63%	37%	66%	34%
Kingston	96%	4%	95%	5%
Lagos	84%	16%	89%	11%
Los Angeles	88%	12%	96%	4%
Melbourne	26%	74%	63%	37%
Mumbai	72%	28%	70%	30%
Nairobi	86%	14%	80%	20%
New York (JFK)	97%	3%	95%	5%
San Francisco	91%	9%	88%	12%
Shanghai	92%	8%	99%	1%
Sydney	41%	59%	66%	34%
Average of sampled routes	76%	24%	87%	13%

Source: CAA, Annual Passenger Survey, 2010

86. While leisure passengers will tend to be more price-driven, business passengers will pay a premium if necessary to enable them to take the most direct option, valuing the time and convenience this adds. This shows that many business travellers value highly the international connectivity brought by the provision of the widest possible range of direct flights a

hub airport offers and this is an important aspect of London's attractiveness as a business location to them.

87. If London ceased to offer a leading global aviation network it could lose the highly valuable, aviation reliant activities it has won over many decades.

3.6. Can regional airports offer an alternative?

88. In August 2011 the DfT published a new set of aviation demand and carbon emissions forecasts for ten year periods to 2050⁵⁵. They offer an insight into the implications of failing to expand airport capacity in the southeast of England.
89. The DfT foresee that, with UK current policy, all growth will be at the UK's regional airports beyond 2030, since London's existing airports will have reached their full capacity. This implies that by 2050, 42 million people a year will travel from the South East to airports in other regions, while millions of others will be deterred from flying altogether.
90. Not only would this result in millions of people travelling further by road and rail to fly but also in a probable deterioration in overall connectivity. At best regional airports could be expected to offer a small range of the most popular long-haul destinations – most likely to overseas hubs – diluting the UK's range of direct long-haul connections. In short they would not be able to replicate the benefits of a hub airport.
91. This indicates that a chronically capacity-constrained South East airport system poses dangers to the UK's economy. Not only would the nation's airport capacity be regionally imbalanced, but there is a strong likelihood that the most socially

and economically beneficial sub-sectors of demand would suffer because of their reliance on hub capacity to be able to grow. In particular, London would lose its vital business connectivity which is as strong as it is because of the enormous volume and mixture of demand which feeds through Heathrow.

3.7. The role of high-speed rail

92. High-speed rail could in principle offer an effective alternative to flying for some domestic trips and other short-haul trips, particularly for business travellers who can make productive use of the uninterrupted journey experience train travel offers in comparison with flying. It should be noted, however, that the DfT demand forecasts already take account of abstraction from air by HS2 – and as noted above these anticipate that London's airports will be at full capacity by 2030.
93. In fact, high-speed rail does not represent an effective alternative for more than 10 per cent of journeys taken to or from Heathrow, in terms of journey time. Moreover, by increasing the catchment area of the hub airport, high-speed rail has the potential to exacerbate Heathrow's shortage of capacity.

3.8. Could a hub in the regions work?

94. Developing a hub airport outside the South East would not be workable, even assuming that a site with the capability to meet the requirements could be found (see Chapter 4). London's economy has developed over several decades, and through massive investment, to be heavily dependent on the availability of a comprehensive network of direct flights at good frequencies – and this requires that the airport offering this connectivity is conveniently located. The key sectors are internationally footloose and, rather than migrating to other parts of the UK, would be far more likely to move to established competitors overseas than to other UK regions.
95. A comprehensive long-haul network can only be viably offered in the UK if there is a major hub airport, in the southeast of England. If such an airport were a well-connected hub airport it would nevertheless promote regional economic rebalancing by allowing London's high level of connectivity to be enjoyed more widely across the UK's regions.
96. The argument is ultimately a national one because hub capacity serving London is the only effective option for improving access to global markets for the whole UK. It would not only encourage growth in London but also encourage regional growth in international trade, tourism and investment, making a strong

contribution to the rebalancing of the national economy. For these reasons the Mayor believes hub airport capacity in the southeast of England should be treated as national strategic infrastructure.

3.9. Risk of loss of benefits to overseas competitors

97. If, due to capacity constraints, London ceased to have a hub airport capable of attracting large numbers of transfer passengers, it is highly likely that the loss of revenue would lead to the disappearance of a significant number of direct routes which were previously viable, most of which would no longer be served from the UK. On routes to a number of emerging markets there is evidence that this process is already happening. Those transfer passengers would instead use one of a number of hub airports overseas, including unconstrained continental rivals such as Paris Charles de Gaulle, Frankfurt and Amsterdam Schiphol. These airports would gain the connectivity and revenue benefits that the UK lost, as they attracted increased transfer flows and the possibility of a virtuous circle of improving connectivity so long as their capacity remained unconstrained.

Spotlight

High-speed rail and aviation

High Speed 1 (HS1), currently the UK's sole high speed link, offers rail access from the centre of London to Paris, Lille and Brussels, as well as regional services to Kent. Services to other Continental locations, including Amsterdam, Cologne and Frankfurt are expected to commence within the next few years. Traditionally there have been strong air markets between the UK and most of these cities.

The Government's proposed High Speed 2 (HS2) scheme will provide a new fast link between London and Birmingham. The current plans for the first phase of HS2 do not serve Heathrow directly, although access is planned via an interchange with Crossrail at Old Oak Common. It is planned to include a direct connection to Heathrow in a second phase, along with extension of the network to the north of England and Scotland.

Rail can only compete effectively with air for the bulk of an inter-city travel market when it offers a total journey time which is no more than about three and a half hours⁵⁶.

HS2 should therefore allow rail to take substantial market share from air on routes between London and Scotland (and Newcastle) since it will allow the rail offer to cross this threshold. Rail already has a dominant share on routes to other cities in the north. The expansion of HS1 services to a wider range of near Continental destinations will have only a modest effect on air demand since journey times will be close to or above the maximum for rail to effectively compete.

3.10. A national hub

98. Connecting London's future hub airport to the high-speed rail system is important if regions outside the South East are to share fully in its global connectivity benefits. If the future hub airport is to be Heathrow, these benefits may be limited because of the inherent capacity constraints of the airport. In any event, it is important that the Government ensures that the high-speed rail strategy and strategy for future hub airport capacity are integrated.
99. An efficient hub airport in the South East, which is well-connected to the UK regions, mainly by rail, could serve as a truly national airport, with a particular national role. For this reason the Mayor believes hub airport capacity in the South East should be given priority as strategic national infrastructure. It is clearly also important that decisions about high-speed rail and future hub airport capacity are fully integrated.

3.11. Further benefits from transfer passengers

3.11.1. Support for UK-based airlines

101. Most transfer passengers fly with an airline based at the hub airport, so in the case of Heathrow, a UK-based airline. For example, Virgin Atlantic Airways, which controls four per cent of slots at Heathrow, sells 40 per cent of its tickets outside the UK, generating receipts of £1.5bn a year. Thirty per cent of Virgin Atlantic passengers at Heathrow connect to other flights⁵⁷. Not

only does this support the route network, but it also supports airline jobs and those in firms which support them, such as catering and provisioning businesses.

102. By helping UK airlines offer more attractive services, transfer passengers also help them compete against overseas airlines. Given that addressing the persistent balance of payments deficit is a Government priority, this is beneficial. Other things being equal, UK-based passengers who choose to use a UK-based airline effectively generate fewer import flows than those who choose an overseas-based airline.
103. It should also be noted that since airlines tend to operate hubs only in their home countries, or together with their alliance partners in their home countries, the presence of an efficient UK hub airport is essential for the UK to play a leading role in one of the three global airline alliances.

3.11.2. Airports and other services

104. When overseas passengers transfer between aircraft at a UK airport, export revenue is generated in airport fees and from goods and services they purchase⁵⁸. An indication of the importance of this can be seen at Heathrow where retail generated revenue of £350m in 2009, representing a fifth of its total income⁵⁹.

105. Stopovers at airport hotels are a source of income from overseas. This is particularly important for a number of outer London boroughs, including Hillingdon and Hounslow. Hillingdon has between 15,000 and 25,000 hotel rooms and Hounslow between 1,000 and 2,500⁶⁰. Furthermore, some transfer passengers take advantage of travelling through London to visit the city, and this generates additional valuable tourism receipts.

Key messages

- Heathrow plays a special role as the main long-haul airport for the UK. It is particularly important for the sub-sectors which offer the most wider economic and social benefits – business travel, inbound tourism, VFR travel, cargo
- It plays this role because it is the UK's hub airport. On 39 routes, more than 50 per cent of passengers are transferring. The revenues transfer passengers generate for airlines are vital for maintaining the quality of Heathrow's route network
- This gives UK travellers an unrivalled offer in terms of business connectivity and flight frequencies. London's economy is reliant on this since business travellers place a premium on direct, frequent connections to a wide range of global destinations
- The Mayor believes aviation at London's hub should be considered as a national priority for growth. By focusing growth (in all sub-sectors and including transfer passengers) at the hub, the UK would gain vital aviation network benefits for future prosperity
- The Government's forecasts envisage regional airports to an extent replacing Heathrow's current role. They cannot, however, replicate the benefits of London's hub airport. Aviation-reliant businesses are generally internationally footloose and could migrate to competing cities overseas if London's air links deteriorated in comparison. If Heathrow loses its ability to attract large numbers of transfer passengers the benefits associated with it will migrate to cities with less constrained hub airports, including Frankfurt, Paris and Amsterdam
- A hub airport outside the South East would also fail to provide the convenience needed by business travellers in London
- High-speed rail can at best reduce demand at Heathrow by 10 per cent so does not offer an alternative to hub airport capacity
- An efficient, well-connected hub airport for London would serve as a national hub airport

Chapter 4.

Requirements of an efficient national hub airport

4.1. Introduction

106. The Mayor has set out the case for London's hub capacity to be treated as strategic national infrastructure. This chapter identifies and details the key requirements of an efficient hub airport, namely:

- Sufficient take off and landing slot capacity for:
 - meeting the long-term demand associated with a comprehensive international and domestic route network
 - efficient and resilient operations
 - 'hub wave' operations
- Sustainable and high quality surface access
- A world-class passenger experience
- Minimisation of harmful local impacts

4.2. Slot capacity to meet long-term hub demand

107. It has been demonstrated that slot capacity enables London's hub to serve the widest range of international destinations with frequencies that can meet the expectations of UK passengers and the UK economy's trade and investment needs. Slot capacity also facilitates a competitive offer for the transfer traffic which is essential for supporting the viability of a comprehensive network.

108. Sufficient slot capacity is necessary to ensure regions across the UK can connect into the hub and share its connectivity benefits. This is especially true where other modes such as rail are insufficient

for this purpose. Improved access to global markets will increase trade and investment opportunities for the UK regions.

109. European aviation trends towards increasing liberalisation and consolidation suggest there will be fewer, bigger hubs in the future. The development of the US market over the last 30 years shows how this may occur. If London does not have an airport with sufficient slot capacity, hub operations are likely to consolidate at established Continental European competitors. A severely constrained Heathrow will cease to be a hub airport over time.

4.3. Efficient and resilient operations

110. For a hub to be attractive to both airlines and passengers, it needs to be able to function smoothly, even when placed under strain. This means the runways, aprons and terminals must all be of sufficient capacity to minimise delays in everyday operation and to maximise resilience in the face of major disruption, for instance that caused by adverse weather.

111. Airport delays and disruption are costly to the UK economy and reflect poorly on the international image of London and the UK, possibly hampering their attractiveness as a location for business. Additionally, the emissions resulting from increased taxi times and stacking, as planes wait to takeoff or land, are an environmental cost.

112. In an open, competitive aviation market, congested airport capacity which impacts the reliability and efficiency of operations,

including aircraft utilisation, has a direct bearing on an airline's ability to compete, both in terms of cost and of its passenger service offering. Over time, this will encourage a shift of hub operations from capacity-constrained hubs towards rival airports better able to support the operational needs of airlines in an efficient, reliable, cost-effective manner.

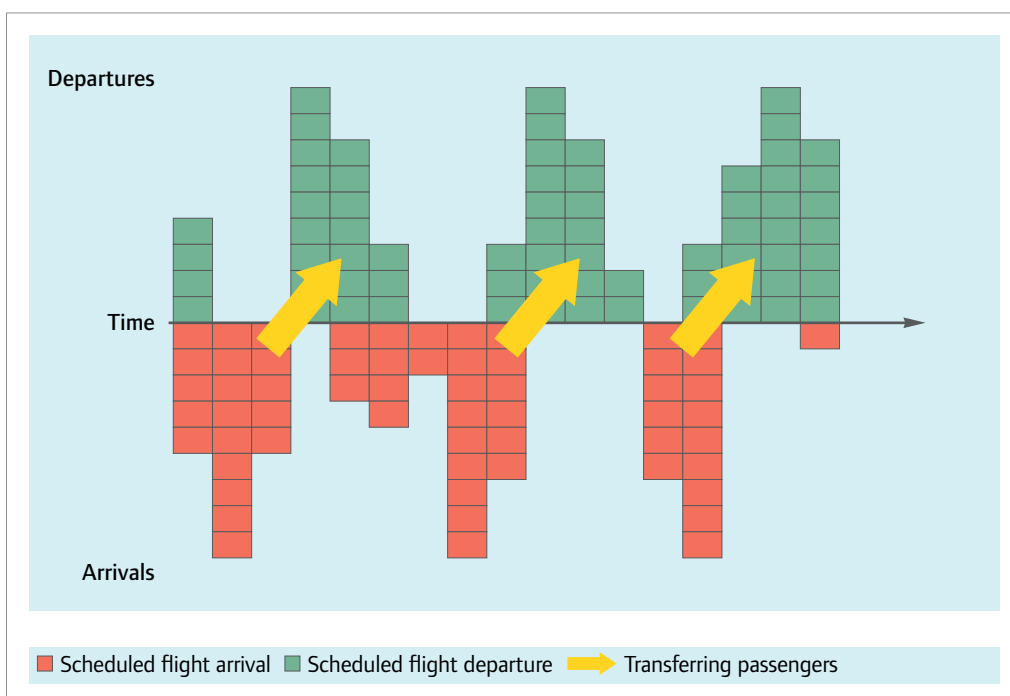
4.4. Supporting hub 'wave' operations

113. An optimised hub airport does not simply provide a wide range of routes and frequencies. It optimises the hub's potential by supporting the organisation of flights in a series of incoming and outgoing waves in defined banks throughout the day as illustrated in Figure 9.

114. Operating such banks of flights maximises the number of connections that can be made in a short space of time, increasing the attractiveness of the airport to transfer passengers and supporting the airport's hub potential.

115. However, an optimised approach requires sufficient slot capacity to support bursts of arrivals and departures. A number of the world's largest hubs, such as Atlanta and Paris Charles de Gaulle have at least four full-length parallel (and independently operable) runways to ensure they can support waves of arrivals and departures and maximise their global connection opportunities.

Figure 9: 'Wave' departure and arrival pattern at an efficient hub airport



116. To take full advantage of an optimised wave operation, it is also important that the hub airport can minimise connecting time required between flights. This reduces a transfer passenger's total journey time while maximising an airline's fleet utilisation by reducing the time the planes spend on the ground. This requires the hub airport to be able to handle large volumes of connecting passengers and baggage in a short space of time. A number of major airports have demonstrated that substantial improvements in minimum connecting times (MCTs) are achievable. For example, Munich Airport's Terminal 2 claims to be the world's first terminal building specifically tailored to the needs of hub traffic, and boasts a MCT of just 30 minutes⁶¹.

4.5. Sustainable and high-quality surface access

117. For a hub airport to succeed and support its wide range of routes and frequencies, it needs to draw on a substantial passenger catchment. This includes not only transfer traffic from a variety of markets across the globe, but also strong transport links to its immediate region, to maximise the demand potential of its hinterland. Airport access is an important element of aviation's environmental impacts.

118. For London, such links need to provide fast access to key destinations for business, particularly central London locations such as the West End, the City and Canary Wharf. The importance of being integrated into

a high-speed rail network was outlined in Chapter 3. This will help ensure the UK regions can tap into the benefits of the global connectivity offered while maximising the catchment of the hub airport. A further requirement is a rail journey time to central London of no more than 45 minutes.

119. Central London, although the most important origin/destination for business passengers, is not the only destination; a new London airport's potential to maximise its catchment area will depend on its ability to offer strong, sustainable transport connections to points across the South East and beyond.
120. It is important to note that such surface access links need to support access not only for passengers but also for freight, airport-related businesses and airport workers. Each plays a key role in the functioning and potential of the hub airport. New surface access infrastructure associated with an airport development can also benefit local communities if it is constructed with non-airport users in mind as well.
121. Chep Lap Kok Airport in Hong Kong demonstrates what can be achieved when excellent sustainable public transport provision is placed at the heart of airport planning. Its Airport Express train covers the 35km journey to central Hong Kong in 20 minutes, achieving a public transport access mode share of 66 per cent (and 96 per cent for staff)⁶².

4.6. A world-class experience for passengers

122. Overall, for the hub to be competitive and attract the direct and transfer traffic it needs to sustain itself, it must provide passengers with the quality of experience they expect from a world-class hub in their journey to, through and from the airport. This includes the above elements, namely an efficient, resilient airport with the slot capacity to support an extensive domestic and international route network, supported by excellent surface access. It also means state-of-the-art facilities on a spacious site, offering a comfortable, hassle-free experience that appeals to travellers.

4.7. Minimising harmful local impacts

123. Given the enormous local, regional and national benefits of aviation, ways must be found to address its impact on local communities while not unduly constraining air travel.

124. Noise in the vicinity of airports generated from aircraft operations has an adverse impact on a community's quality of life. At the very least, aircraft noise is distracting and can be unhealthy. Noise is measured as sound pressure levels in decibels (dB). In 2006, more than 750,000 people were within the 55dB noise contour at Heathrow alone⁶³. New aircraft technologies will help ease the impacts but cannot eliminate them.

125. If a hub airport is to be sustainable in terms of its impacts on local communities, it must be located so that, to the greatest extent possible, its flight approach paths do not overfly residential areas.

Key messages

- Sufficient slot capacity ensures the hub airport can serve a wide range of domestic and international routes while minimising delays in its everyday operation and maximising resilience in the face of major disruption
- Unconstrained capacity and operational efficiency can help deliver an optimised hub which offers a world-class experience for passengers
- A hub airport requires substantial sustainable surface access links to central London, the wider South East and, via the high-speed rail network, the rest of the UK
- Noise is major concern and one that can only realistically be addressed by a hub airport location which minimises overflying of residential areas
- These requirements are key to ensuring the viability of the hub airport by enabling it to maintain its attractiveness to passengers and airlines alike

Chapter 5.

The limitations of Heathrow

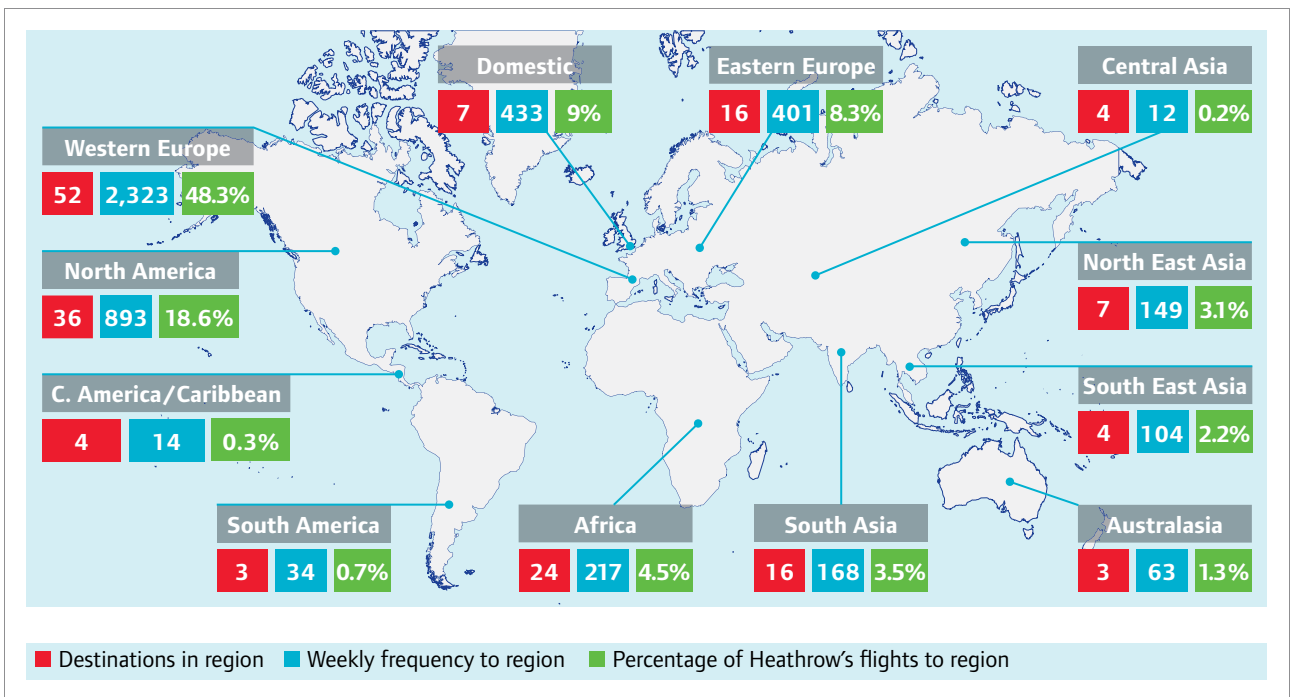
5.1. Introduction

126. Historically, Heathrow has been very successful in allowing London to be one of the best connected cities in the world. To understand the extent to which it is able to meet the UK's future hub airport needs, a good starting point is to examine how it currently performs.
127. There is evidence that in recent years Heathrow has been less successful than its main rivals in developing new routes. It is already lagging behind some of its competitors in terms of serving important emerging countries. The fundamental reason for this is the shortage of spare landing and take-off slots. Whereas there are between three and six runways at the main continental hubs, with runway utilisation of less than 75 per cent in all cases, Heathrow only has two runways and is operating at 98.5 per cent of its regulated capacity.
128. There are very few slots at Heathrow that could be made available from the relocation of non-core flights. In the summer 2011 period, cargo-only flights only accounted for 0.5 per cent of slots at the airport⁶⁴. Most of these are at times when slots are less sought after, such as evening departures and late afternoon and evening arrivals.
129. There are other aspects of Heathrow's operational performance, in some cases linked to slot capacity, which also need to be considered. These include efficiency in relation to aircraft movements, resilience to disruption and MCTs for transfer passengers.
130. Finally there are a number of issues relating to Heathrow's location and the quality of its surface access. In particular it is important to be clear about the numbers of residents who are, or will be, susceptible to noise disturbance and poor air quality. An important aspect of this is the impact of surface access as well as aviation.
131. This chapter covers:
- Heathrow's route network
 - Developing routes with emerging economies
 - Heathrow's efficiency and resilience
 - Noise and air quality
 - Surface access networks
 - Key messages

5.2. Heathrow's route network

132. At present the distribution of flights serving Heathrow is centred on the world's established economies. North America and Western Europe account for nearly three-quarters of total weekly flights, as shown in Figure 10⁶⁵.

Figure 10: Global distribution of weekly flights from Heathrow, June 2011

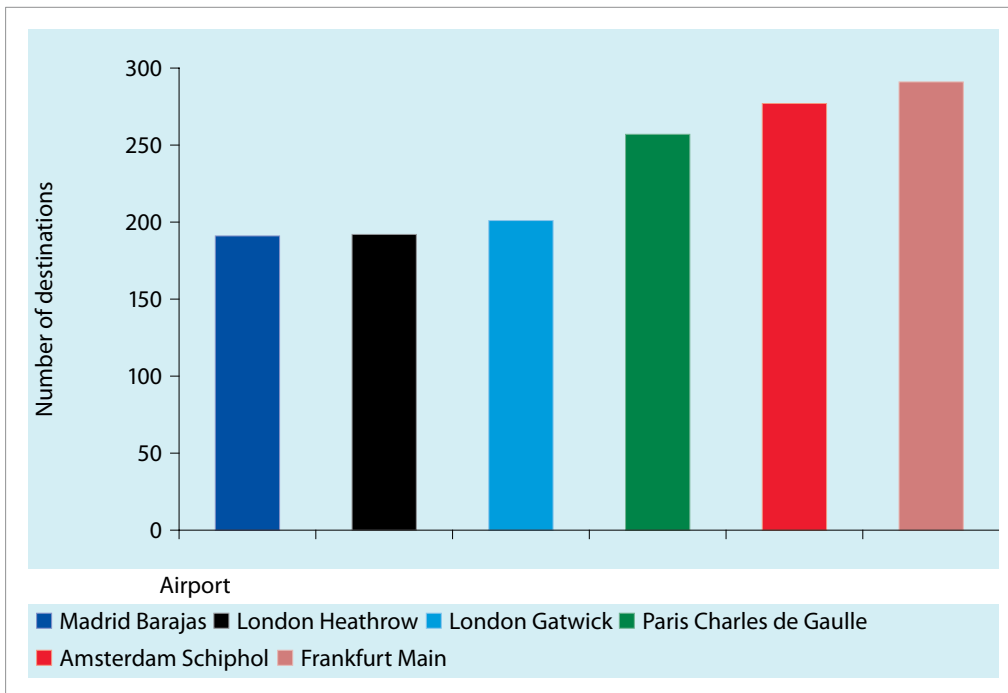


Source: OAG, OAG Schedules Data, June 2011

133. Heathrow remains very effective as a hub airport in many markets. For example, London-North America and London-India have strong UK markets which are supplemented at Heathrow by substantial numbers of transfer passengers travelling North America-India. Details about Heathrow's hub workings are provided in Appendix A.

134. The problem for Heathrow is that it does not have sufficient capacity to perform consistently well on all routes. It is consequently becoming increasingly focused on its core markets and is allowing other European airports to take the lead elsewhere. Already Heathrow has slipped to fifth in Europe in terms of the number of destinations it serves, as Figure 11 shows.

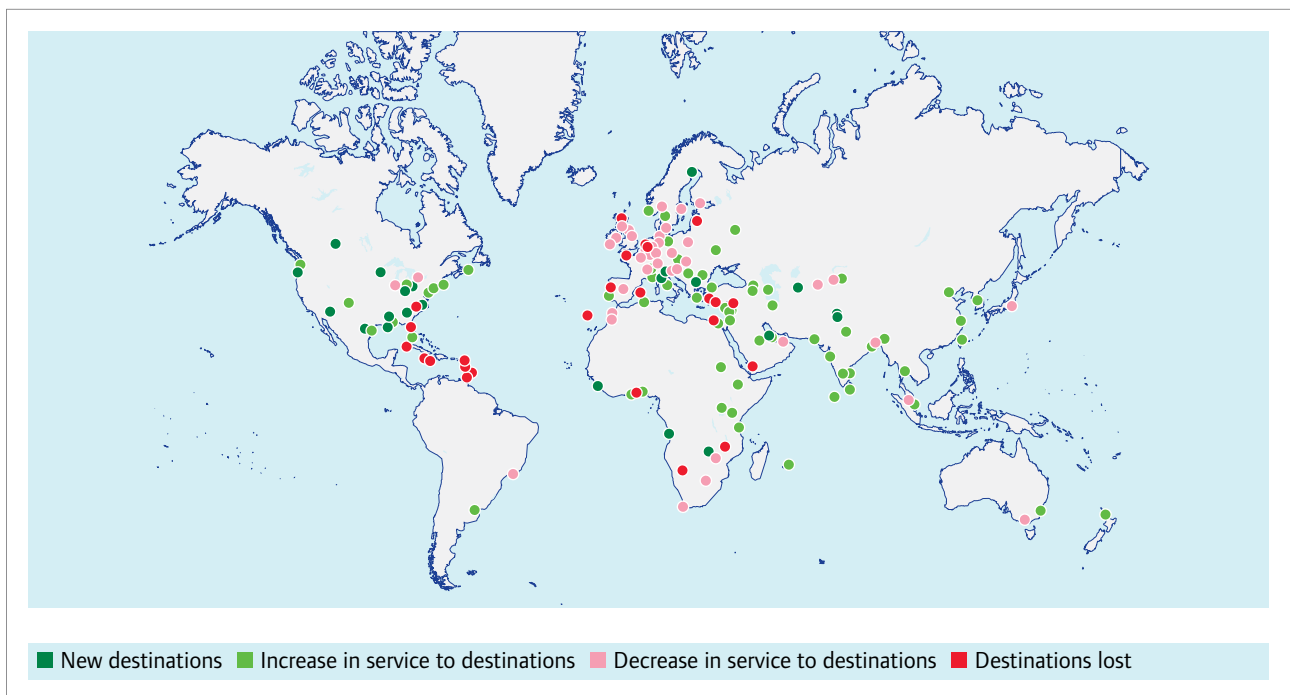
Figure 11: Number of destinations served from selected European airports, 2011



Source: OAG, OAG Schedules Data, June 2011

135. While new routes have opened and frequencies have improved on certain routes in recent years, this has been accompanied by a significant reduction in frequencies on other routes and the withdrawal of others altogether. Figure 12 below provides a summary of routes at Heathrow that have changed between 2002 and 2011.

Figure 12: Changes in connectivity to destinations served at Heathrow, 2002-2011



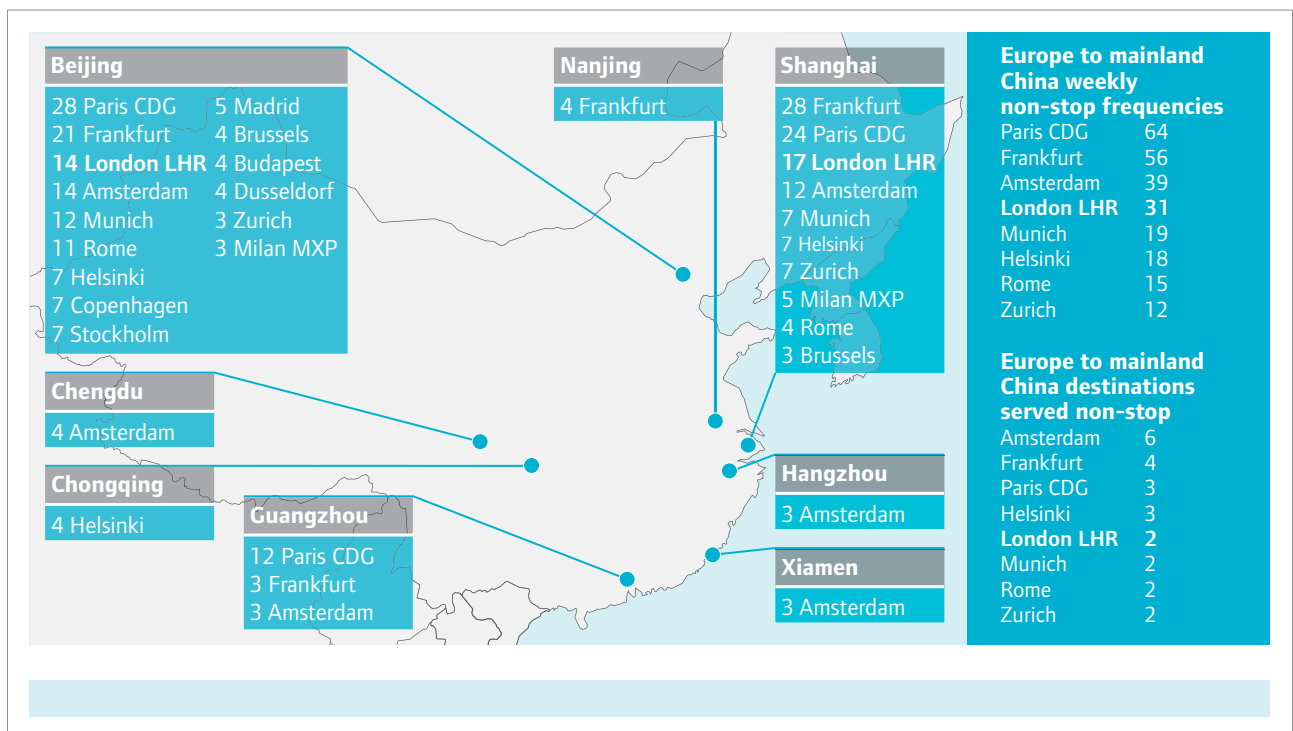
Source: OAG, OAG Schedules Data, 2002 and June 2011

136. There is also evidence that a lack of slot capacity at Heathrow is undermining access to foreign markets for UK carriers. A number of governments, when negotiating aviation bilateral treaties with the UK, are mindful of the slot constraints at Heathrow which act as an effective constraint on their airlines to enter Heathrow or increase their frequencies. This can be reflected in the willingness to allow UK airlines access to their airports. For example, industry sources indicate that this is partly why China is unwilling to liberalise the bilateral UK-China agreement. Indeed, China's biggest airline, China Southern, does not serve the UK, citing access to Heathrow as the reason⁶⁶. Similarly, the Nigerian authorities have announced they will cut British Airways' flights to Lagos from seven to three, as well as rescheduling its slots to less convenient times. This was deemed to be in retaliation for Arik Air's inability to secure affordable well-timed slots at Heathrow for continuation of its Abuja service⁶⁷. Rival European hubs will be the main beneficiaries of capacity constraints at the UK's hub.

5.3. Developing routes with emerging economies

137. Four-fifths of UK firms are satisfied with links to EU markets. However, just 59 per cent of the respondents think the UK's links with the Far East and South America are satisfactory while the remaining 41 per cent are dissatisfied⁶⁸.
138. When there are high opportunity costs associated with landing slots, as is the case at Heathrow, there is little incentive for established airlines to take risks with new and untested routes. For example, British Airways has a relatively conservative approach to starting new international routes.
139. This means it is more difficult for airlines to act as a first-mover in serving emerging markets from Heathrow. As a result, although in recent years Heathrow's network has developed through the substitution of routes, as described above, London has fallen behind others in its connections with some emerging economies. Heathrow's position relative to that of other European hubs in relation to serving mainland China is shown in Figure 13.

Figure 13: Current and planned weekly non-stop frequencies to mainland China



Source: Various airline / airport timetables, June 2011

140. This picture is reinforced when the number of weekly seats is considered. While Frankfurt, Paris Charles de Gaulle and Amsterdam Schiphol offer approximately 17,500, 15,000 and 11,000 seats a week to mainland Chinese airports respectively, Heathrow only offers 9,000⁶⁹. With these airports operating at around 70 per cent runway utilisation, and Heathrow at 98.5 per cent, it is likely that Heathrow will play a diminishing role in providing access to this and other rapidly expanding parts of the world in the absence of new capacity.
141. Further detail about the development of Heathrow's direct connections with India and China is provided in Appendix A. This provides a useful case study of the important role of transfer passengers in making such routes successful.

5.4. Heathrow's efficiency and resilience

142. Heathrow's lack of spare capacity results in peak-time delays and poor resilience when disruption occurs. At busy times, aircraft can spend 30-40 minutes in stacks awaiting a landing slot. There can be on-ground delays owing to constrained runway and terminal capacity. Taxi-out times (time between push back and take-off) at Heathrow are on average 18 per cent longer than at Paris Charles de Gaulle, 31 per cent longer than at Amsterdam and 40 per cent longer than at Frankfurt⁷⁰. Despite current efforts to improve its infrastructure, these issues are likely to remain.
143. At Heathrow, the maximum number of flights per hour is 87⁷¹ (see Table 11). With each runway operated in single mode this limits the arrival or departure wave capacity to approximately half of this. As such, Heathrow's ability to operate as a hub is compromised.

Table 11: Capacity, utilisation and destinations served at Europe's principal hub airports

Airport	Runways	Current max flights/hour	Future max flights/hour	Current runway utilisation	Destinations served, June 2011
Heathrow	2	87	87	98.5%	192
Amsterdam	6	110	120	70%	277
Paris	4	114	120 (2015)	73.5%	257
Frankfurt	4	83	126 (2015)	74.5%	291
Madrid	4	98	120	n/a	191

Source: Various operators, compiled by TfL

Table 12: Minimum connect times at selected European airports

Airport	Minimum connecting time (minutes)	Connection type	Source
Heathrow	60	Intra-terminal	BAA
	75	T1-T3	BAA
	105	T5-T4	BAA
	90	Other terminal	BAA
Paris CDG	45		AdP
Frankfurt	45		United
Amsterdam	50	Intercontinental	KLM
	40	Europe	KLM
Munich	30	T2-T2 (LH/Star Alliance hub)	MUC
Zurich	35	Europe	Swiss

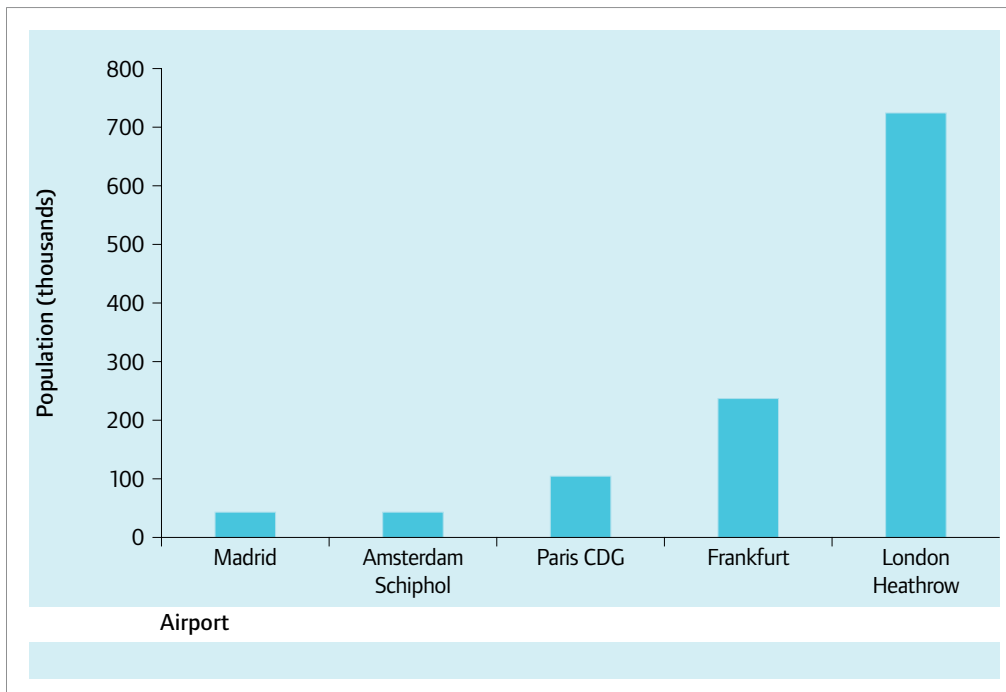
Source: Various airport operators and airlines, compiled by TfL

5.5. Noise and air quality

144. Built in the 1940s before the era of the jet engine and when the area was still a relatively rural outpost, Heathrow is now surrounded by residential areas. Aircraft noise and poor air quality negatively affect too many Londoners for Heathrow to remain the UK's aviation hub in the long term. Many areas are blighted by noise and other local impacts.

145. Heathrow's location is such that in 2006 more than 756,000 people were significantly affected by noise in excess of 55dB Lden⁷² (this compared with 11,900 at Gatwick⁷³ and 9,400 at Stansted⁷⁴). Other European hubs – Amsterdam, Frankfurt, Paris Charles de Gaulle and Madrid – also affect a fraction of the population that Heathrow does⁷⁵.

Figure 14: Number of people exposed to noise exceeding 55dB Lden from Europe's principal hub airports



Source: Compiled by ERM from various sources

*Most data for 2006 and self reported to the EC under Directive EC2002/49

146. The aircraft emissions around the airport are typically added to by emissions from road vehicles. Road traffic attracted by the airport is a significant contributor to air pollution around Heathrow. BAA reports that airport-related traffic represents up to 30 per cent of all traffic on major routes around Heathrow⁷⁶. This is estimated to contribute around 11 per cent towards the average nitrogen dioxide (NO₂) concentration across all of Heathrow's monitoring sites.

147. There are huge variations in the negative impacts of airport operations depending on the location. A quarter of the nitrogen oxide monitoring sites at Heathrow exceed the EU limit value, with poor health impacts for some living near the airport. The carbon dioxide (CO₂) emissions of aircraft waiting in the stacks created by runway capacity constraints represent an amount equivalent to around 10 per cent of the total CO₂ emitted during the landing and take-off cycle of aircraft that arrive and depart at Heathrow⁷⁷.

5.6. Surface access networks

148. While Heathrow has good public transport links with central London, the majority of passengers are travelling from other areas to the airport and most are using private transport. There is severe road congestion around Heathrow owing to the high numbers of private vehicles and taxis used to access the airport and its related activities. Around 25 per cent of vehicles on

the M4 and at least 15 per cent on the M25 in the vicinity of Heathrow are travelling to and from the airport⁷⁸. These roads have the worst delays and reliability record in the UK. Even if demand management tools were implemented to discourage vehicle use, with increasing passenger numbers, congestion would be likely to continue or worsen. If Heathrow were to grow, it is clear that its fundamental shortcomings as a location for a major hub airport would only become more pronounced.

5.7. Key messages

- Heathrow's shortage of take-off and landing slots is resulting in a narrowing of its route coverage, with a concentration on core established markets and a relatively slow development of connections serving most emerging ones
- Competing continental airports are taking a lead in serving many emerging destinations
- Lack of spare runway capacity at Heathrow also results in peak-time delays and very poor resilience when disruption occurs
- Minimum connect times are poor for transfer passengers at Heathrow
- Heathrow causes excessive congestion on road routes used for surface access and is not sufficiently integrated into sustainable surface access networks
- Heathrow's location is such that many residents are affected by noise and poor air quality

Chapter 6.

Future hub airport demand

6.1. Introduction

149. In assessing the UK's likely future hub capacity needs it is important to consider how demand is likely to be affected by change all around the world. The interaction between global economic change, aviation use and the development of technology likely to have a bearing on the relative economics of hub and other airports is examined.

150. This chapter covers:

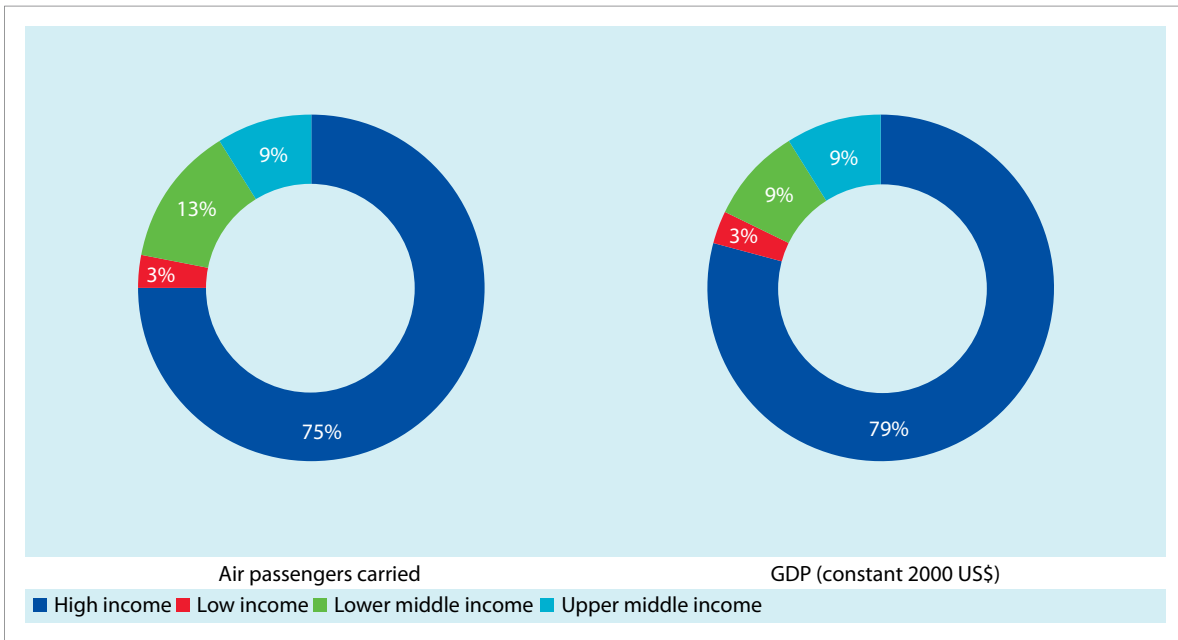
- The relationship between gross domestic product (GDP) and aviation use
- World GDP forecasts
- Europe's changing world role
- Emerging global cities
- Aviation industry forecasts
- Airline fleet technology
- Key messages

6.2. The relationship between aviation and GDP

151. There is a very strong relationship between GDP and aviation use at the aggregate level. Historical analysis across many countries shows that time and income shares allocated to travel are stable over time and geography⁷⁹. On average, a person spends 1.1 hours a day travelling and devotes a predictable fraction of income to travel. Wealthier people devote resources to using faster modes of travel, which allow them to travel further within the same travel time budget.

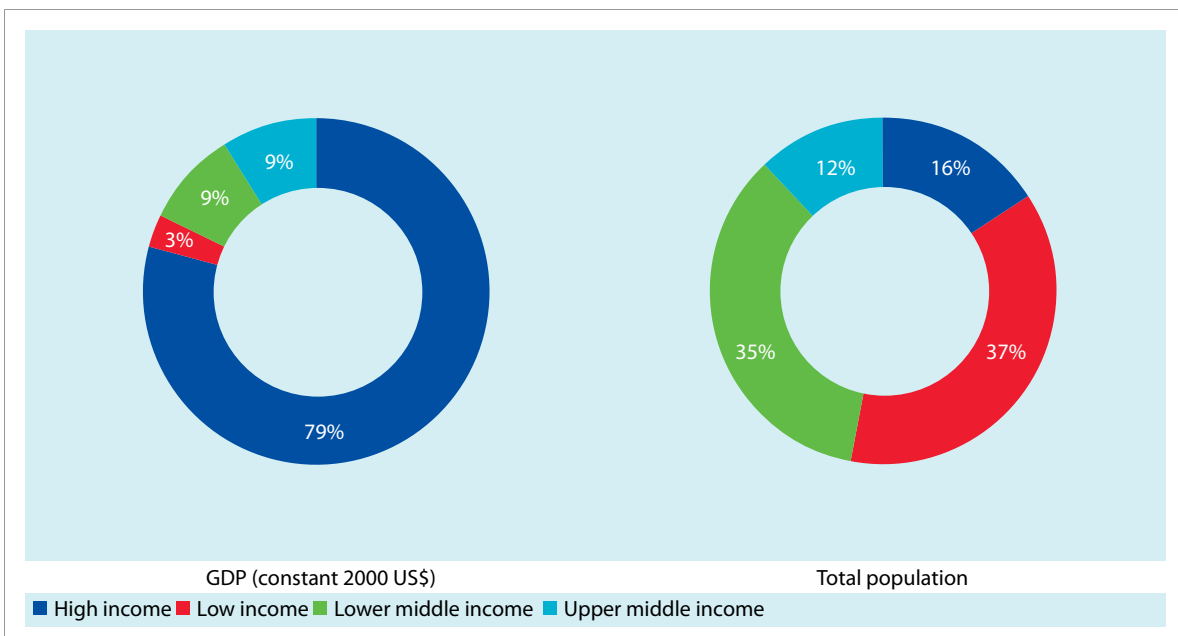
152. Figure 15 and Figure 16 aggregate countries into different income categories, using 2005 data. The contribution of these country groups to the total number of world air passengers, world GDP and world population are shown in Figure 15. There is a striking correlation between each group's share of air passengers and share of GDP. In contrast the shares of total population are very different. For example, high-income countries account for almost 80 per cent of all airpassengers and total world GDP while accounting for only 16 per cent of the world's population. This indicates that the inequality in access to aviation in the world is highly correlated to development and that as regions of the world develop, aviation use can be expected to follow closely.

Figure 15: Passenger and income shares when countries are aggregated into different income categories



Source: Mariya A. Ishutkina and R. John Hansman, MIT International Center for Air Transportation, 2009

Figure 16: Income and population shares when countries are aggregated into different income categories



Source: Mariya A. Ishutkina and R. John Hansman, MIT International Center for Air Transportation, 2009

153. The relationship between GDP growth and aviation demand growth between 1970 and the present is illustrated in Figure 17. Aviation demand exhibits significantly more variation than GDP growth, with periods of accelerating and decelerating GDP growth corresponding to more pronounced changes in aviation use.

154. While there will be differences in the relationship between aviation use and GDP between different countries, it is clear that in the absence of global-level constraints on aviation growth, the forecast development

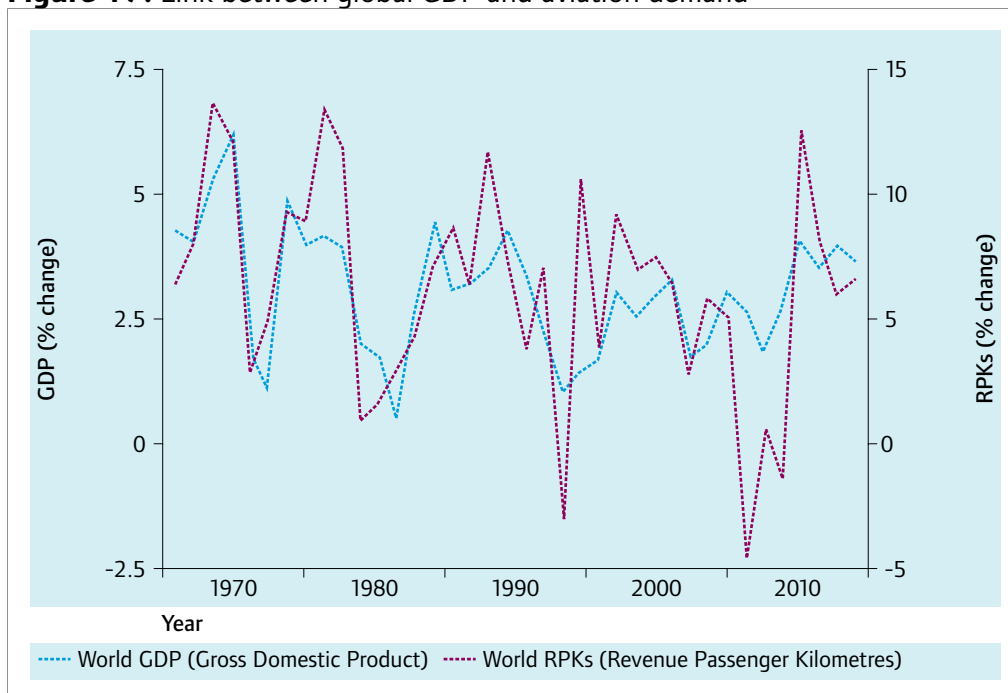
of world GDP offers a useful guide to how global aviation demand is likely to develop.

6.3. World GDP forecasts

155. A report by PwC⁸⁰ has set out the potential for GDP growth to 2050 in a number of key countries, including the G20 group, the E7 emerging economies⁸¹, as well as Spain, South Africa, Argentina, Saudi Arabia, Nigeria and Vietnam. The report forecasts GDP growth on the basis of the following factors:

- Growth in labour force of working age
- Change in average education levels in the adult population

Figure 17: Link between global GDP and aviation demand



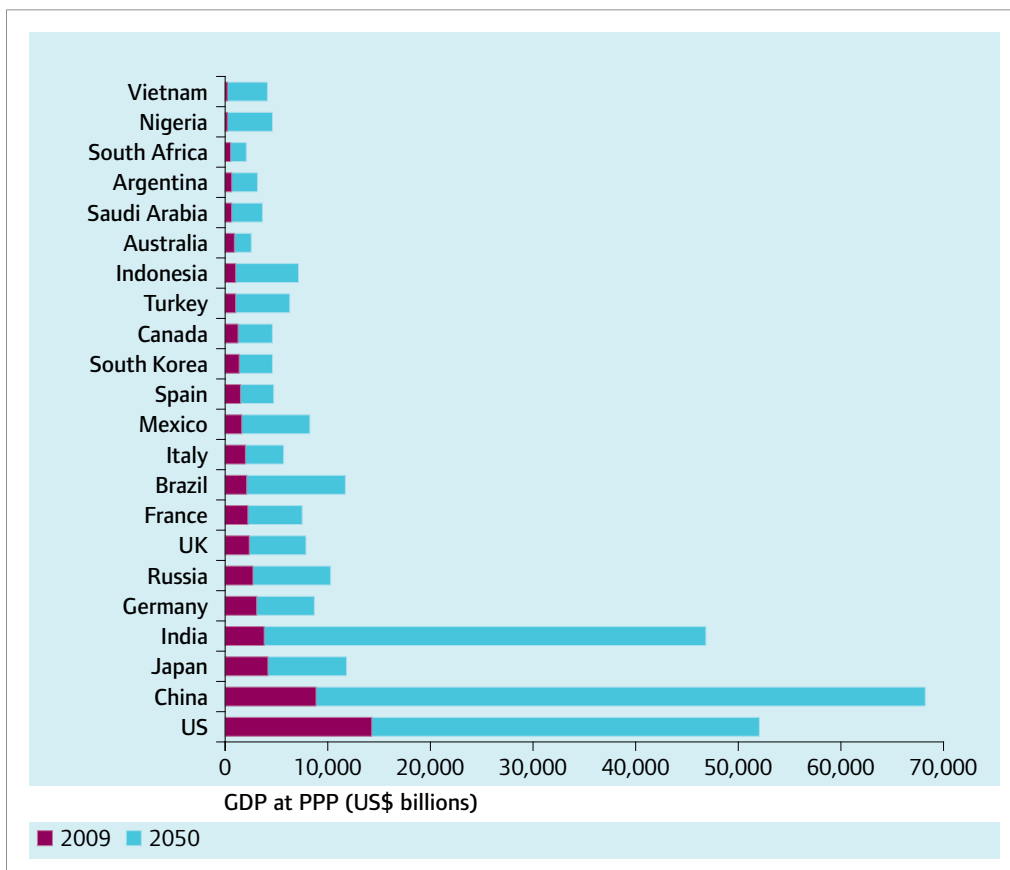
Source: Boeing, *Current Market Outlook, 2010-2030, 2011*

- Growth in capital investment
- Total productivity growth, accounting for catching up by lower income countries with richer ones

156. The forecasts are a measure of the potential for GDP growth and, as the report makes clear, are dependent on the countries following growth-friendly policies. Some emerging countries may therefore not be able to live up to their potential.

157. Figure 18 shows how the top 20 economies in terms of GDP at purchasing power parity (PPP) could change between now and 2050. China is expected to overtake the USA, and the top three economies in 2050 make up a larger share of total global GDP than the top three today. The country ranked 20th in 2050, Argentina, will have an economy larger than the UK's today (although the UK economy is forecast to more than double in the same period).

Figure 18: Growth in GDP of leading world economies, 2009-2050



Source: PricewaterhouseCoopers, *The accelerating shift of global economic power: challenges and opportunities*, 2011

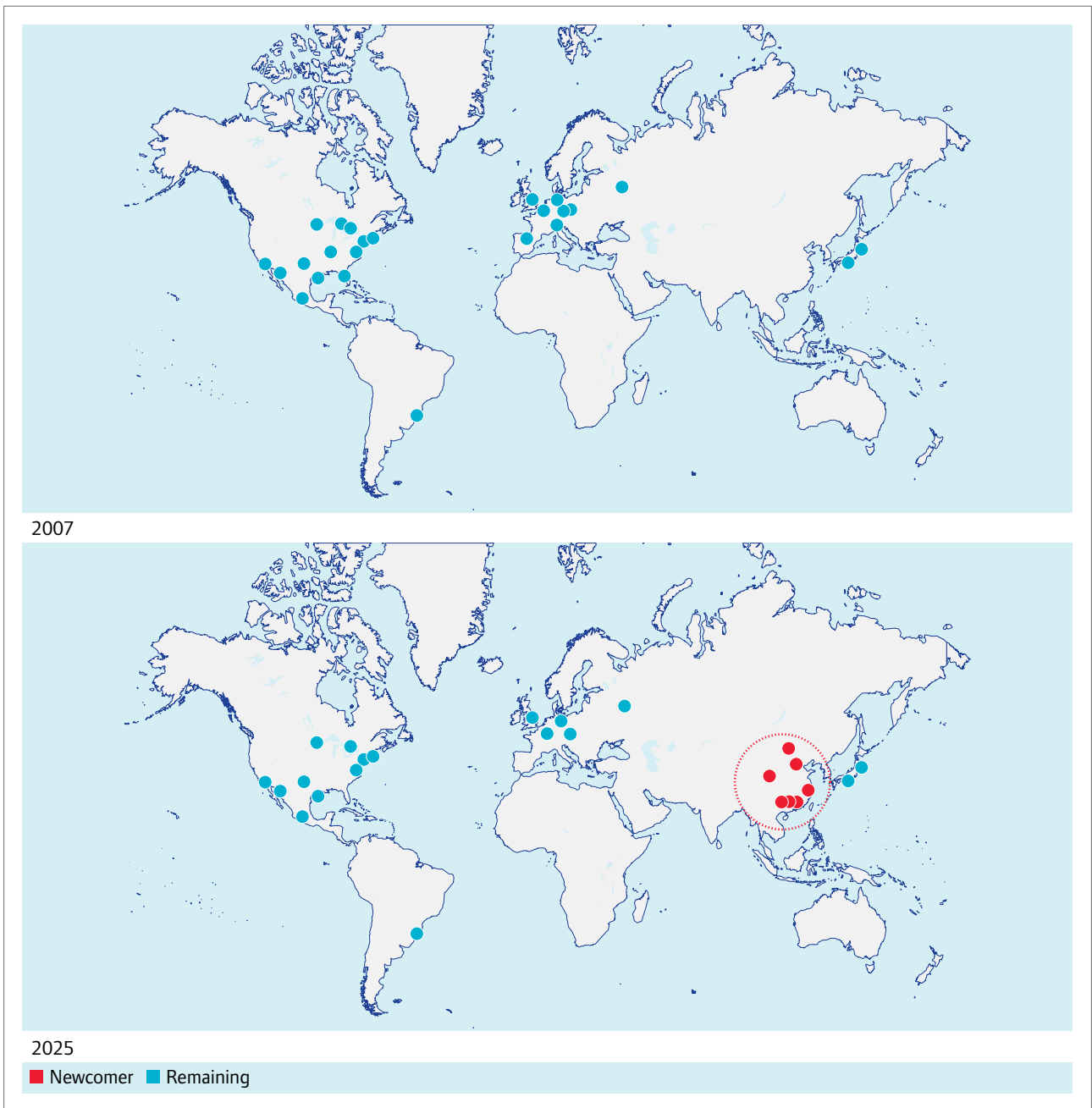
6.4. Europe's changing world role

158. While major European countries will move down the GDP rankings, they are all still forecast to grow significantly – GDP in both France and Germany in 2050 is estimated to be higher than Japan's GDP today – and so international connections to these European destinations will remain important and need to be improved from their current levels to keep up with future growth.
159. The world's GDP will be more dispersed, with less concentration in Europe and North America and a higher share in Asia and Latin America. In terms of annual growth rates averaged over the period, the biggest growth is forecast in Vietnam (8.8 per cent), followed by India (8.1 per cent), Nigeria (7.9 per cent), China (5.9 per cent) and Indonesia (5.8 per cent)⁸².

6.5. Emerging global cities

160. A recent study by the McKinsey Global Institute (MGI)⁸³ looked at the potential performance of global cities in 2025. It compared the top 600 cities today, measured in terms of contribution to global GDP growth, with the top 600 cities in 2025. In both scenarios, the 600 cities will contribute about 60 per cent of global GDP. However, the cities making up the 600 will change, encompassing more in Asia and fewer in North America and Europe. MGI expects 136 new cities to enter the top 600, all from the developing world. One hundred of the 600 cities will be in China. Over the next 10 years approximately 75 million Chinese households will enter the 'consuming classes' with disposable incomes of more than \$20,000 .
161. A comparison between the leading 25 cities by total GDP in 2007 and those expected in 2025 is shown in Figure 19. Seven cities in China, including Hong Kong, are expected to replace cities in North America and Europe. The 25 cities with the fastest rate of GDP growth between 2007 and 2025 are shown in Figure 20 overleaf. While a small number of cities in western countries are included, such as London, New York, Los Angeles and Tokyo, the vast majority of the remainder are in China and India.

Figure 19: Expected change in leading 25 megacities by total GDP between 2007 and 2025



Source: McKinsey Global Institute, *Urban world: mapping the economic power of cities, 2011*

Figure 20: Fastest growing cities in terms of total GDP growth between 2007 and 2025



Source: McKinsey Global Institute, *Urban world: mapping the economic power of cities, 2011*

162. These emerging ‘megacities’ (those leading either in terms of total GDP or growth in GDP) are expected to be the locus of a disproportionate volume of future international business activity. These cities are expected to experience very high growth in the number of people with incomes more than \$20,000 a year, which is considered a threshold for aviation usage⁸⁴.

163. Table 13 shows the top 25 cities in terms of GDP growth between 2007 and 2025⁸⁵. Emerging cities which are ‘underserved’ from Heathrow are shown in bold. This list is dominated by Chinese cities, but of the 12 identified, Heathrow currently serves only Shanghai and Beijing. It is worth noting that the number of airports handling more than 30mppa is expected to increase from three in 2008 to 13 in 2020⁸⁶. Shanghai and Beijing are significantly less well served than other cities much further down the list including Singapore (18th), Tokyo (20th), Mumbai (24th) and Hong Kong (25th).

Table 13: Current weekly frequencies from London to 25 cities with forecast highest GDP growth between 2007 and 2025

City	2011 weekly frequency from London
Shanghai	17
Beijing	14
New York	191
Tianjin	0
Chongqing	0
Shenzhen	0
Guangzhou	0
Nanjing	0
Hangzhou	0
Chengdu	0
Wuhan	0
London	-
Los Angeles	70
Foshan	0
Taipei	8
Delhi	49
Moscow	72
Singapore	49
Sao Paulo	14
Tokyo	34
Shenyang	0
Xi'an	0
Dongguan	0
Mumbai	42
Hong Kong	61

Source: OAG, OAG Schedules Data, June 2011 & McKinsey Global Institute, *Urban world: mapping the economic power of cities, 2011*

164. Similarly the frequency of flights between Heathrow and the UK's fastest-growing export markets, both in terms of goods and services, varies greatly as Table 14 sets out.

Table 14: UK's fastest growing export markets in goods and services

Services	2011 weekly frequency from Heathrow	Goods	2011 weekly frequency from Heathrow
Russia	77	Russia	77
Singapore	49	Chile	0
India	129	Pakistan	11
China & Hong Kong	31 & 63	China & Hong Kong	31 & 63
South Korea	12	Brazil	27
Taiwan	8	India	129
Turkey	52	South Korea	12
Thailand	34	Turkey	52
Chile	0	Singapore	49
Iran	10	Colombia	0

Source: ONS, United Kingdom Balance of Payments: The Pink Book, 2010 and OAG, OAG Schedules Data, June 2011

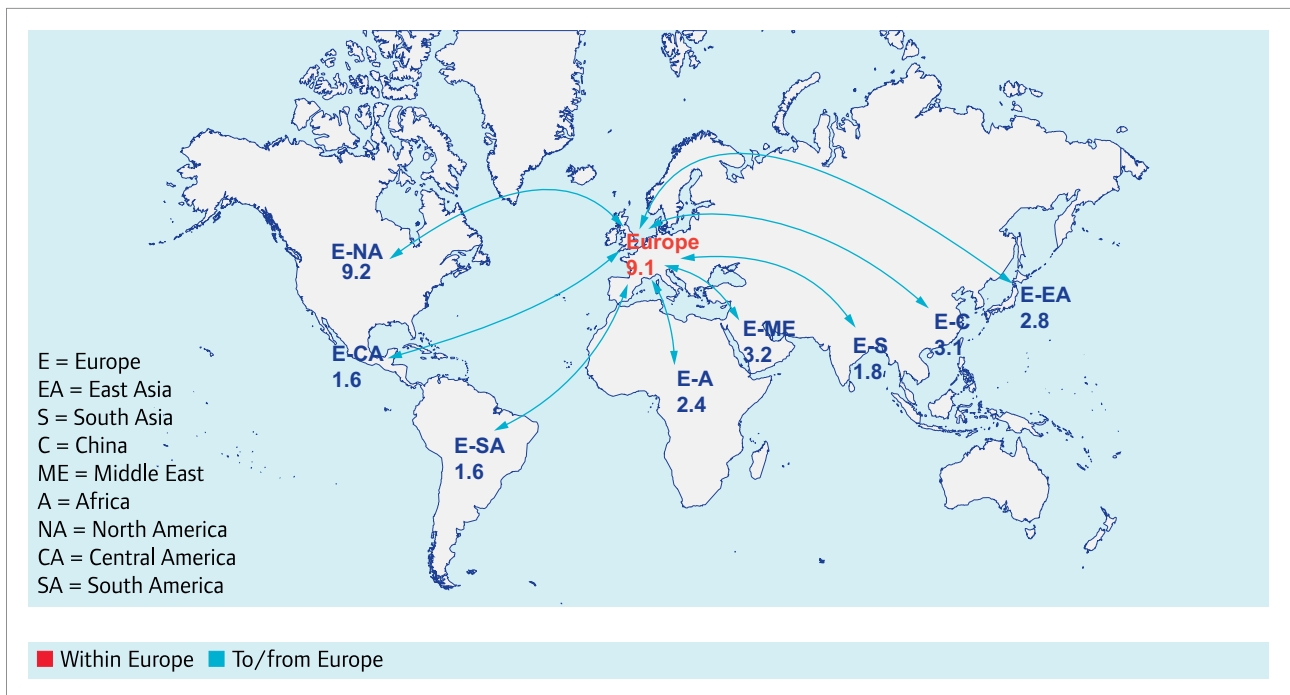
6.6. Aviation industry forecasts

165. Forecasts from aircraft manufacturers Airbus and Boeing suggest that global aviation demand is likely to more than double in the 20 years to 2030⁸⁷.

166. Figure 21 shows the distribution of expected global aviation growth between 2010 and 2030. Over a third of all aviation growth is forecast to be within Europe or between Europe and other regional blocs.

167. Growth rates in intra-European and North American routes are not as high as for other world regions. However, the substantial starting demand base means that in absolute terms this element generates a higher number of additional flights.

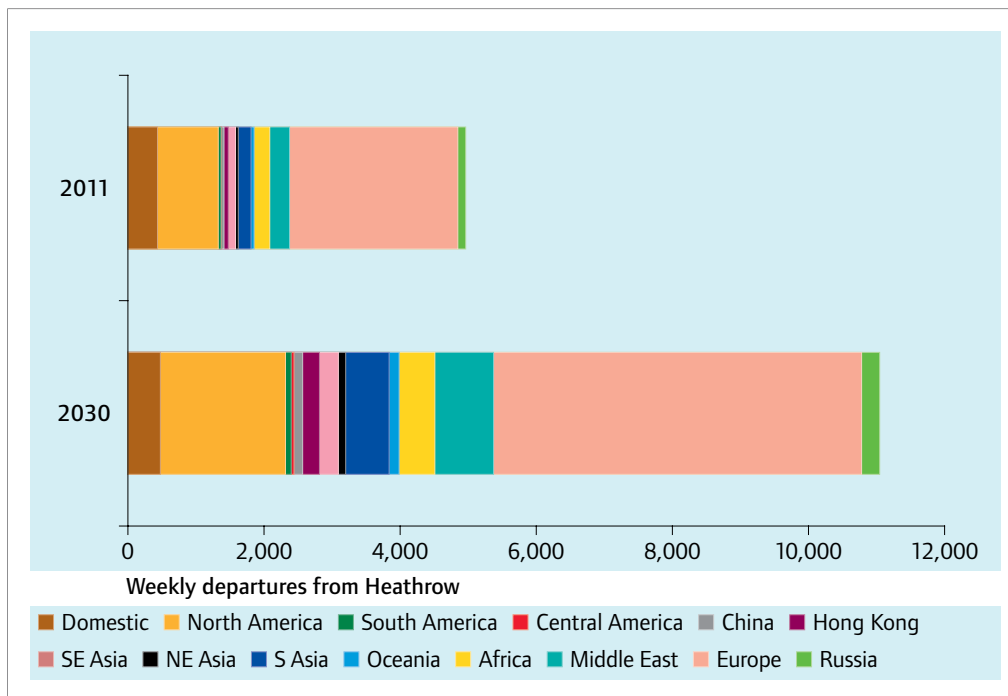
Figure 21: Forecast percentages of overall global aviation growth by world region flow, 2010-2030



Source: Boeing, *Current Market Outlook 2011-2030*, 2011

168. This means that in addition to attempting to cater for new demand from emerging destinations and fast growing routes, the UK will need to be able to accommodate an even greater quantum of growth on well-established routes.

Figure 22: Projected change in flights at Heathrow if forecast world region growth occurs, 2011–2030.



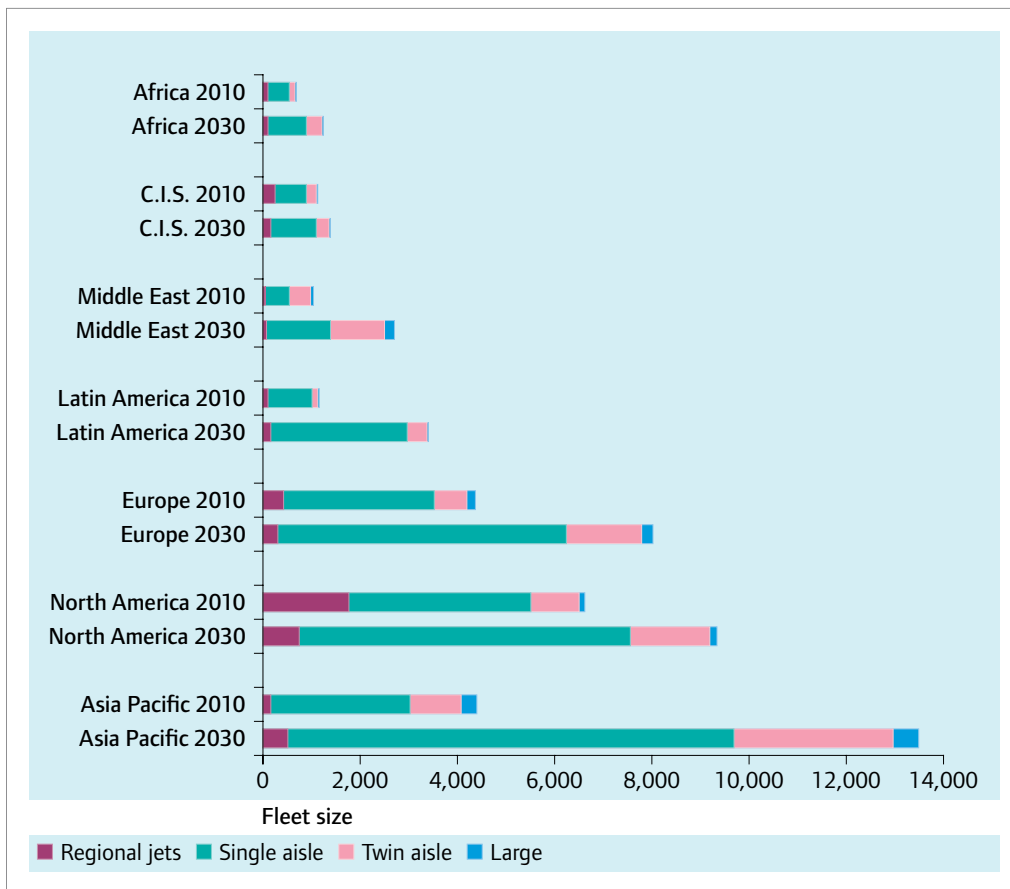
Source: OAG, OAG Schedules Data, June 2011 & Boeing, Current Market Outlook 2011–2030, 2011

169. Figure 22 illustrates how growth would occur on routes to and from Heathrow if capacity were available there. This shows that weekly frequencies would need to double just on its current network on the basis of the growth rates implicit in the Airbus and Boeing forecasts. Additional services would then be required to connect emerging routes.

6.7. Airline fleet technology

170. Airlines are responding to growth by ordering more aircraft, chiefly from the two main manufacturers, Airbus and Boeing, and also replacing older aircraft with more fuel-efficient models. American Airlines recently placed the biggest single order for new aircraft and will take delivery of 260 new Boeing 737s and Airbus A320s, including 130 A320neos, that promise lower emissions and fuel savings of as much as 15 per cent over aircraft employing existing engine technologies. Asian airlines are among others committed to similar orders.

Figure 23: Changing aircraft fleet sizes by world bloc, 2010-2030



Source: Boeing, *Current Market Outlook 2011-2030*, 2011

171. Figure 23 shows the expected increase and regional distribution of different sized aircraft in 2030 compared with today. It is worth noting developments in the types of aircraft and their likely impacts on the shaping of the sector. In particular, a number of new long-haul aircraft have been (or are soon to be) introduced, which are expected to have a profound impact on the industry.

172. The launch of the Airbus A380, the biggest passenger plane ever built (carrying as many as 840 passengers in an all-economy configuration) and the Boeing 747-8 will provide additional capacity between some of the world's biggest airports. The A380 is currently deployed both on the busiest long-haul trunk routes, such as London Heathrow-Singapore, and key domestic and regional routes (eg Beijing-Guangzhou). This offers a means of increasing the effective number of passengers which can be accommodated in a given landing slot. However, it is not clear to what extent such aircraft are able to increase overall capacity at runway-constrained airports such as Heathrow. Demand to all destinations is not always conveniently 'parcelled' into units that lend themselves to the operation of very large aircraft at high frequencies. Also, while larger aircraft will increase the utilisation of scarce runway slots this is partially offset by the greater separation that is required from the plane behind, on both take-off and landing, due to stronger wake turbulence. Their greater wing span will place more pressure on space for taxiways and stands, which is also highly constrained at airports such as Heathrow.
173. Other developments in aircraft technology will facilitate a broadening of the route network and enable viable operation of new long-haul routes. This will have the effect of reducing the average number of passengers on aeroplanes on long-haul routes, with corresponding changes in the

'efficiency' of landing slots. In particular, the Boeing 787 and the Airbus A350 will match the range of existing long-haul aircraft but carry as few as 250 passengers at a cost per seat kilometre comparable to existing aircraft. They therefore have the potential to open up new long-haul routes between city pairs which do not have the demand to support the higher-capacity long-haul aircraft currently available. This development could enable more direct services to major long-haul destinations from secondary European gateways, such as the main airports in the UK regions, by-passing European hubs like Heathrow. Nonetheless, it also offers an opportunity to unconstrained European hubs to launch new long-haul routes, in particular to secondary gateways in emerging market economies that are currently not viable.

Key messages

- Growth in aviation demand strongly correlates to GDP. So GDP forecasts can shed light on demand growth at a global level as well as on which countries, regions and cities are most likely to take on the largest share of that demand growth
- Analysis of GDP growth trends suggests an ongoing rebalancing towards the major emerging economies, particularly in East Asia, and that many of these markets are substantially underserved from Heathrow (and the UK)
- Worldwide aviation demand is forecast to double between now and 2030. There will also be significant growth in demand

on well-established routes to the major economic centres of Europe and North America, which though proportionally lower than the growth on routes to emerging economies, is higher in absolute terms

- Aircraft technology trends towards both larger and smaller long-haul aircraft suggest that the pressure on airport slot capacity is unlikely to reduce and could increase as many more long-haul routes become viable for the first time

Chapter 7.

Hub airport benefits

7.1. Introduction

174. This chapter identifies the scale of aviation benefits associated with building a new hub airport in comparison with a do-minimum of the existing level of runway capacity at the UK's major airports. It does not consider the benefits and disbenefits of building an airport in any particular location. In both cases, the potential quality of route networks that could be offered is examined.

7.2. Demand forecasts

175. The Government's recent aviation demand forecasts⁸⁸ set out the implications of not expanding airport capacity, which is implicit in the Government's current stance, in which no new runways are envisaged. UK-wide demand is forecast at 520mppa and 470mppa respectively for capacity unconstrained and capacity constrained central cases. The DfT's forecasts include an assumption that aviation is part of an EU emissions trading scheme and that aviation is able to purchase carbon credits from other sectors. The DfT's 2011 aviation forecasts are calculated independently of the cap recommended by the Government's Committee on Climate Change.

176. These demand forecasts set out the implications of current Government policy. This assumes that no new runways are built and future demand is allocated across the UK's airports. In this scenario, London's airports are full by 2030 and all further growth occurs at regional airports. Table 15 illustrates the allocation of demand

today and in 2050, in the event of current Government policy.

177. Furthermore, hub capacity remains constrained to the capacity of Heathrow which is assumed to be 86mppa (approximately 30 per cent growth over 2010). This is calculated on the assumption that existing operational arrangements are maintained, and the cap of 480,000 flights per year remains in place. The other London airports grow from 61 to 96mppa (approximately 60 per cent growth over 2010) and regional airports grow from 83 to 287mppa (approximately 250 per cent growth over 2010). Clearly, available growth at point-to-point airports far outstrips growth at London's hub. The forecasts appear to be neutral about the consequences of this imbalance, and allow 'maximal use' of existing airports. In the light of the essential role of hub capacity in facilitating certain key aviation sub-sectors (as set out in Chapter 3), it is not clear that this is either commercially viable or desirable in terms of economic and social outcomes.

178. In order to address this, an alternative scenario is examined in which a new hub airport serving London is built. This would allow a range and frequency of services to be offered consistent with meeting the comprehensive needs of key sub-sectors of the economy. This includes short and long-haul business travel, inbound tourism and cargo together with the transfer passengers that are essential to make such a network

viable. This airport is assumed to be capable of accommodating up to 180mppa.

179. 180mppa is broadly equivalent to the size of Heathrow in the DfT's capacity unconstrained central case forecasts. While 180mppa could not be accommodated within the Committee on Climate Change's 2009 limits if London's existing airports operate as is currently envisaged, there are a number of circumstances in which a new 180mppa hub airport serving London could be compatible with environmental commitments. These are identified in Appendix B.

180. Since 'priority growth' is at the hub, it is assumed that passenger numbers at other London and regional airports would adjust to be consistent with the requirements of reducing emissions in line with meeting climate change targets, rather than at the hub.

Table 15: The allocation of aviation demand today and in 2050 (million passengers per annum)

	London's hub	Other London airports	UK Regional airports
2010 (as observed, CAA figures)	66	61	83
2050 – No new runways (as per DfT capacity constrained central case)	86	96	287
2050 A new hub airport	up to 180	Demand to be allocated in accordance with climate change commitments	

7.3. Potential route networks

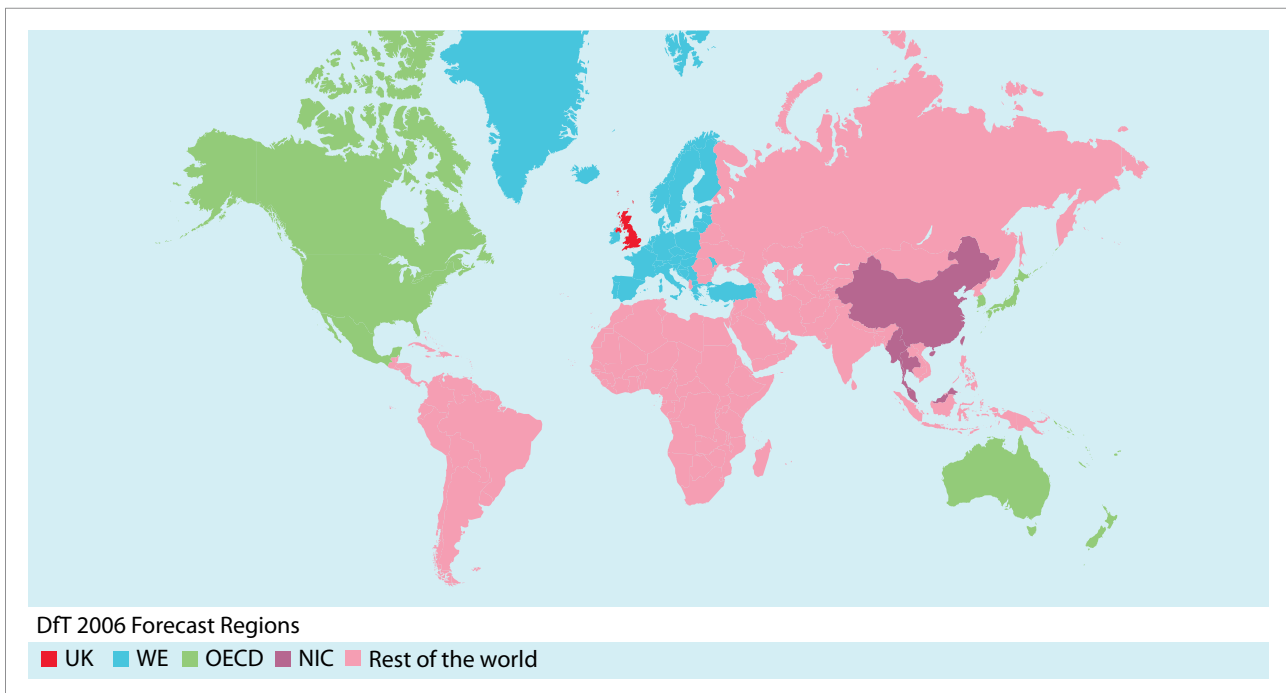
7.3.1. Number of destinations served

181. In order to assess the route network benefit of the new hub, its potential route network is compared to that which is expected at Heathrow and Manchester⁸⁹ in 2050.

182. Destinations are aggregated into five global categories following the classification of countries used in the DfT's forecasting model, as shown in Figure 24. These categories are:

- The UK (domestic)
- Western Europe (WE)
- Members of the Organisation for Economic Co-operation and Development (OECD) region excluding those in the WE region⁹⁰
- Newly Industrialised Countries (NIC)
- Rest of the world

Figure 24: DfT classification of global regions



7.3.2. Destinations served at a good frequency

183. A key feature of hub benefit is the ability to operate routes at more attractive frequencies than point-to-point airports can sustain. In order to assess the benefit of a new hub airport, we have examined the number of routes that could be expected to be served at a 'good' frequency at each airport in the two scenarios. To do this, a simple frequency threshold has been calculated for destinations in each of the five world

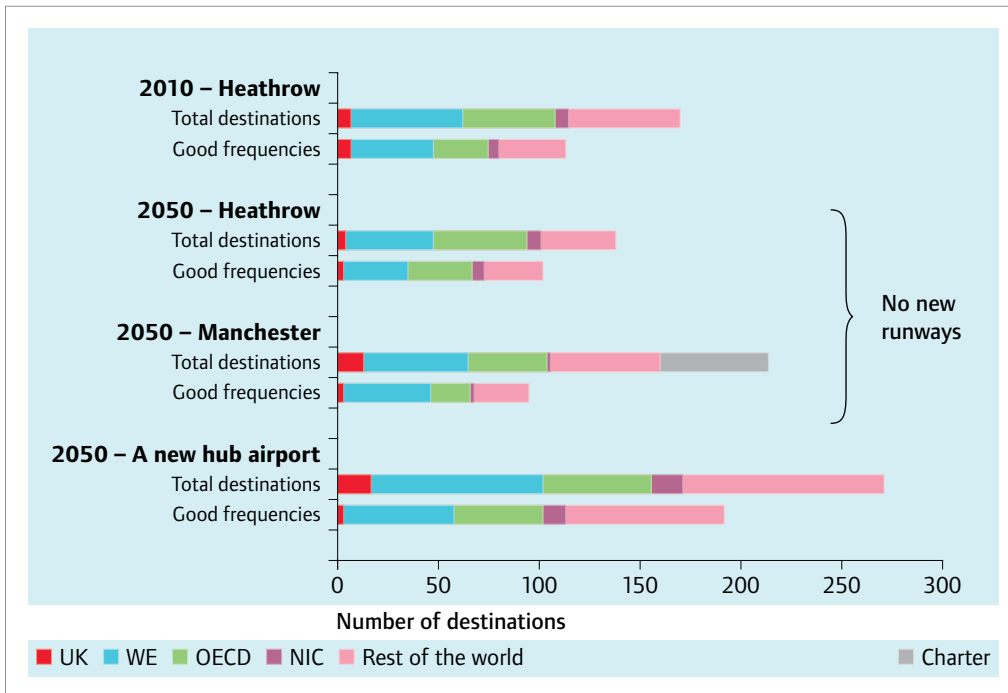
regions, as set out in Table 16. These thresholds represent the approximate frequency at which flights per week (two-way) could be expected to develop and sustain strong business links. They have been calculated following discussion with industry experts using conservative assumptions about changes in the global economy, and take into account the differences in aircraft sizes that are likely to be used according to the length of route.

Table 16: Service frequency threshold above which a service is deemed to be good, by global region

Region	Threshold frequency deemed 'good'
UK (domestic)	40
WE	30
OECD region (excluding WE)	20
NIC	10
Rest of the world	10

184. Figure 25 combines the results to show the number of unique destinations served by world region, and the number of these destinations served at a good frequency.

Figure 25: Connectivity in 2050 with no new runways and with a new hub, by global region



7.4. Results

185. The impact of no new runways in the South East is that the total number of destinations served at London's hub diminishes, continuing a trend which is in fact already under way. In fact, compared to 2010, it is expected to be around 20 per cent lower. The greatest reduction is seen in the long-haul markets to countries in the rest of the world category – which contains many of the world's fastest growing economies. The main reason for this is the airlines responding to capacity constraints by concentrating services on more profitable 'thick' routes such as London - New York and London – Hong Kong at the expense of lower yielding routes – many of which are strategically vital to the UK economy.
186. A second result is that the UK's regional airports will not adequately address the loss of connectivity associated with London's constrained hub capacity (in terms of both total destinations served and those served at good frequencies). In 2050, despite being the UK's foremost regional airport, Manchester has a far inferior destination mix compared to Heathrow in both 2010 and 2050.
187. A new London hub offers by far the largest range of destinations and number of routes served at a good frequency. Crucially, substantial growth is able to occur to many new destinations in both NICs and the rest of the world which will be crucial for best serving the UK economies productive needs in the future.
188. The above analysis shows that London will need a world-class hub if it wants to maintain world-class aviation links in a future in which world economic power is more widely distributed.

Key messages

- Without a new hub airport, the UK will lose some of the benefits it currently enjoys as a result of Heathrow's current hub status
- Regional airports will grow as a result of the shortage of capacity in the South East, but this will not replicate the benefits of a hub
- There are likely to be severe consequences for the wider economy since the quality of links to emerging long-haul destinations in particular will not develop in the way they would if there were adequate hub capacity serving London
- As world economic power becomes increasingly diffuse, London will find it increasingly difficult to maintain its global city status without a new hub airport

Chapter 8:

Meeting the Government's growth agenda

8.1 Introduction

189. This report demonstrates the central role of hub airport capacity in driving economic growth, including exports, and how it can contribute to a regional rebalancing of the economy by sharing the benefits of London's global connectivity with regions beyond the South East. Accordingly it is important that it is integrated into the Government's growth strategy. There are a number of processes which need to reflect this.

8.2 A sustainable framework for UK aviation

190. The Government's draft aviation framework is due to be published in March 2012. It must acknowledge that the shortage of hub airport capacity is the key challenge facing UK aviation and that the only sustainable long-term response is a new hub airport for London.

8.3 The Government's growth plan

191. The Government has made an overriding resolution to 'drive growth and create jobs right across our country'⁹¹. It is essential that the key role of an efficient hub airport in generating strong, sustainable growth and supporting a bigger and better balanced economy is recognised as an important element of this.

192. At a time of fiscal restraint, aviation growth can offer high economic returns, particularly since the private sector can play an important part in its funding. Investing in a new hub airport offers a

genuine opportunity to generate substantial additional revenue and jobs while also yielding a positive return. With clear and strong Government commitment, a new hub airport could be substantially funded by the private sector and boost public sector revenues at the same time.

8.4 The National Infrastructure Plan

193. In October 2010 the Treasury published the National Infrastructure Plan. This established the following goals for national infrastructure:

- To be integrated, reliable, secure and resilient
- To support sustainable and balanced economic growth and competitiveness
- To ensure that the overall programme supports the delivery of reduced UK greenhouse gas emissions and wider environmental objectives
- To achieve an affordable mix of public and private investment

194. The UK's current and planned airport provision does not meet the first three of these goals. The lack of available capacity at London's hub, in particular, compromises the ability of the whole aviation system to facilitate economic growth as well as its reliability and resilience. Congestion at Heathrow increases emissions on the ground and in the air and as demand grows and Heathrow remains unable to expand, this situation will worsen.

195. The Government has identified a hierarchy for investment decision-making: (i) maintenance and smarter use of assets; (ii) targeted action to tackle network stress points and develop networks; and (iii) transformational large scale capital projects. In applying this to the question of hub airport capacity, the Government should bear in mind the length of time needed to plan what would amount to an integrated series of major capital projects and the fact that the longer a new hub takes to implement, the greater will be the negative economic and social consequences.

8.5 The Government's Committee on Climate Change

196. It is essential that the UK meets its climate change and environmental requirements and aviation must play its part in this. The Committee on Climate Change reported in 2009 that a growth in passenger demand of 60 per cent on 2005 levels to 2050 could be compatible with commitments to keep carbon dioxide emissions in 2050 no higher than in 2005, as a result of technological improvements. The Government's response to these recommendations is expected in March 2012 and is expected to reflect further research and stakeholder responses to the DfT's 2011 scoping document. The Mayor believes a new hub airport could be compatible with the committee's recommendations and that it should be viewed in the context of the uniquely valuable benefits it can deliver.

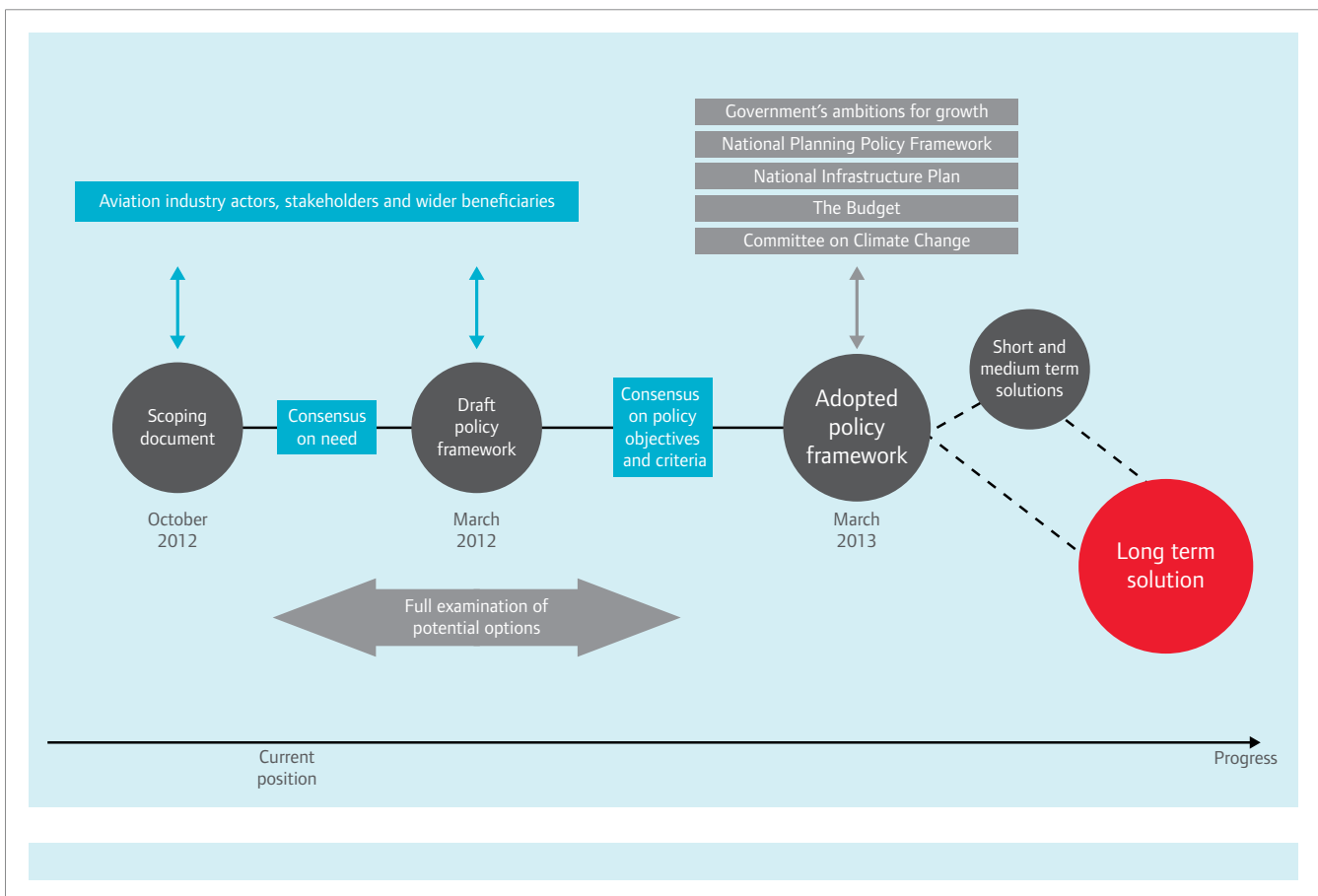
8.6 The National Planning Policy Framework

197. The National Planning Policy Framework is subject to review. It should ensure a transparent, balanced, expedient process for developing new infrastructure projects. Medium and long-term growth ambitions should be facilitated by a clear statement of where and in what circumstances the development of a hub airport is encouraged.

8.7 Actors and outcomes

198. It is essential that industry actors, stakeholders and the Government now work together on a long-term strategy in a timely manner to ensure the benefits of aviation for London and the whole of the UK are maximised and the harmful impacts of doing so are minimised.
199. A potential action plan which illustrates a possible strategy for bringing together these actors, requirements and outcomes is presented in Figure 26 overleaf.

Figure 26: Summary of the policy context to development of the DfT's sustainable aviation framework



Key finding 1: The economic dynamism of London's economy, which is vital to the whole UK, is closely linked to a number of highly internationally oriented sectors.

200. London is the powerhouse of the UK economy and it has a bigger, more productive and far more export-oriented service sector than other parts of the UK. London is important to the rest of the UK not only in providing specialised services, but in generating a substantial 'tax export' which along with that of the South East supports public expenditure in the whole country. The industries which allow London to play this role are highly internationally oriented.

Key finding 2: While all sub-sectors of commercial aviation deliver benefits, business, inbound tourism and cargo generate the most potential for export-led economic growth.

201. London's economy has become highly aviation-reliant. Foreign-owned firms created 42 per cent of London's economic growth between 1998 and 2004 and 94,000 jobs were created or safeguarded in the UK in 2010/11 by foreign direct investment. London is the destination for about half of the UK's 30 million annual overseas visitors and in particular for long-haul visitors who tend to stay longer, spend more and are more likely to travel to other points in the UK, generating vital export revenues for the economy. Around a quarter of the UK's international goods movements by value are made by air, with around

two-thirds transported in the belly hold of passengers flights, nearly all on long-haul routes.

Key finding 3: A comprehensive network of direct long-haul routes is particularly important for the economy and can only be provided at a hub airport.

202. Heathrow plays a special role as the UK's main airport, dominating the provision of direct long-haul routes to destinations beyond Europe, with more than two-thirds of all UK scheduled long-haul traffic. This is particularly important for the sub-sectors which offer the most economic and social benefits – business travel, inbound tourism, VFR travel and freight. Heathrow's route network is only viable because sufficient demand is consolidated there, crucially, including transfer passengers. This allows the high fixed costs associated with operating commercial aircraft, especially on long-haul routes, to be shared by enough passengers and freight.

Key finding 4: A hub airport needs to serve London and be in the South East. Any lack of capacity there will benefit hub airports on the Continent and their local economies rather than other regions in the UK.

203. The Government forecasts that London's airports will be full by 2030 and that by 2050, 42 million people a year will travel from the South East to airports in other regions, while millions of others will be deterred from flying altogether. In fact, the full social and economic consequences

of London being faced with a chronically capacity constrained airport system are unknown. Without an effective hub it is likely that there will be deterioration in the route network and that the aviation-reliant economy will be badly underserved. Since crucial elements of this are internationally footloose, it is highly likely that valuable activities will migrate overseas rather than to other UK regions.

Key finding 5: High-speed rail is mainly a complement rather than a substitute for hub airport capacity. It can provide an alternative for around 10 per cent of Heathrow's flights.

204. Rail can only compete effectively with air for the bulk of an inter-city travel market when it offers a total journey time which is no more than about three-and-a-half hours. HS2 should therefore allow rail to take substantial market share from air on routes between London and Scotland (also Newcastle) since it will allow the rail offer to cross this threshold. Rail already has a dominant share on routes to northern English cities. The expansion of HS1 services to a wider range of near Continental destinations will have only a modest effect on air demand since journey times will be close to or above the maximum for rail to effectively compete. On the other hand, a connection to a high-speed rail network will increase Heathrow's catchment area, potentially adding further pressure on its capacity. Connecting London's future hub airport to the high-speed rail system is

nevertheless important if regions outside the South East are to share fully in its global connectivity benefits.

Key finding 6: An efficient and sustainable hub airport requires adequate take off and landing slot capacity, excellent surface access links and must be appropriately located to minimise adverse local impacts.

205. A hub airport needs sufficient capacity to support the routes and frequencies which the consolidated demand from its own catchment and transfer passengers support. A number of the world's largest hubs, such as Atlanta and Paris Charles de Gaulle have at least four full-length parallel independent runways which can support waves of arrivals and departures to maximise the efficiency of connections. Strong transport links are essential to maximise the hub airport's catchment area. For London, such links need to provide fast access to key destinations for business, particularly central London locations. It is important to note that such surface access links need to support access not only for passengers but also for freight, and that airport access is an important element of aviation's environmental impacts. A hub should also be located so as to minimise the noise and local air quality impacts of aircraft operations on the local population.

Key finding 7: Heathrow cannot serve the UK's hub airport needs effectively.

206. Heathrow is operating at 98.5 per cent of its permitted capacity. The lack of spare capacity results in peak-time delays and poor resilience when disruption occurs. While Heathrow remains competitive on many of its established routes, there is evidence that access to foreign markets for UK carriers is being compromised by a shortage of take-off and landing slots. Other European airports are taking the lead on routes to many emerging economies. Its ability to operate as an efficient hub, with waves of arrivals and departures is also compromised by its capacity limits. In 2006 more than 756,000 people were significantly affected by noise in excess of 55dB Lden associated with Heathrow. The numbers affected at other European hubs was a fraction of this.

Key finding 8: A fundamental shift to the Far East in the global economy is under way. This will bring tougher competition for resources and in markets for goods and services, as well as great opportunities. London must face the challenge of providing excellent connections to the emerging megacities of Asia and elsewhere if it is to continue to prosper as a global city.

207. The fastest-growing world economies are to the east, with countries such as China, India, Indonesia and Vietnam experiencing GDP growth rates of up to nine per cent. The growth is such that by 2050 China's

total GDP is expected to have overtaken the USA's, with India not far behind. Thirteen of the top 25 cities in terms of GDP growth between 2007 and 2025 are expected to be in China, yet Heathrow currently serves only two of them and even these are not at high frequencies compared to more established markets. If the UK wants to prosper in the future it must recognise both the huge challenge of increasing competition for markets and resources and also the new opportunities which emerging markets bring. The UK is already lagging behind other European countries, notably Germany, in trade and investment with China. It is imperative that London greatly improves its connections with China, and other emerging markets if it is to meet the challenge.

Key finding 9: If no new runway capacity is created, Heathrow's connectivity will deteriorate by 20 per cent by 2050. A new hub airport could provide world-class connectivity in terms of destinations and frequencies to key business locations.

208. The DfT's 2011 demand forecasts set out the implications of current Government policy. This assumes that no new runways are built and future demand is allocated across the UK's airports. In this scenario, London's airports are full by 2030 and all further growth occurs at regional airports. In the light of the essential role of hub capacity in facilitating certain key aviation sub-sectors, it is not clear that this is either

commercially viable or desirable in terms of economic and social outcomes.

209. Nevertheless, the impact of no new runways in the South East is that the total number of destinations served at London's hub diminishes, continuing a trend which is in fact already under way. The greatest reduction is seen in the long-haul markets to countries in the rest of the world category – which contains many of the world's fastest growing economies. London will need a world-class hub if it wants to maintain world-class aviation links in a future in which world economic power is more widely distributed

Key finding 10: A new hub airport should become a pillar of the Government's plan for growth and should be integrated into a range of policies and plans.

210. The Government has made an overriding resolution to 'drive growth and create jobs right across our country'. It should recognise the importance of a new hub airport to this vision for growth and related policy initiatives. It is essential for industry actors, stakeholders and the Government to work together in a timely manner to ensure the benefits of aviation for London and the whole of the UK are maximised and the harmful impacts of doing so are minimised. This requires the actors to work together on a long-term strategy.

Appendix A – 'Hubbing' at Heathrow

Introduction

Transfer passengers are vital to the viability of Heathrow's comprehensive route network. The aim here is to provide additional details about the way Heathrow's hub model works and to illustrate its success and limitations through case studies of Heathrow's links with India and China. These show how hub activity can help increase connectivity with an emerging market and also how links can remain underdeveloped to the wider detriment of the economy.

This appendix provides:

- An illustration of the network benefits which transfer passengers generate for Heathrow's routes
- A comparison of the recent development of routes between Heathrow and India and China

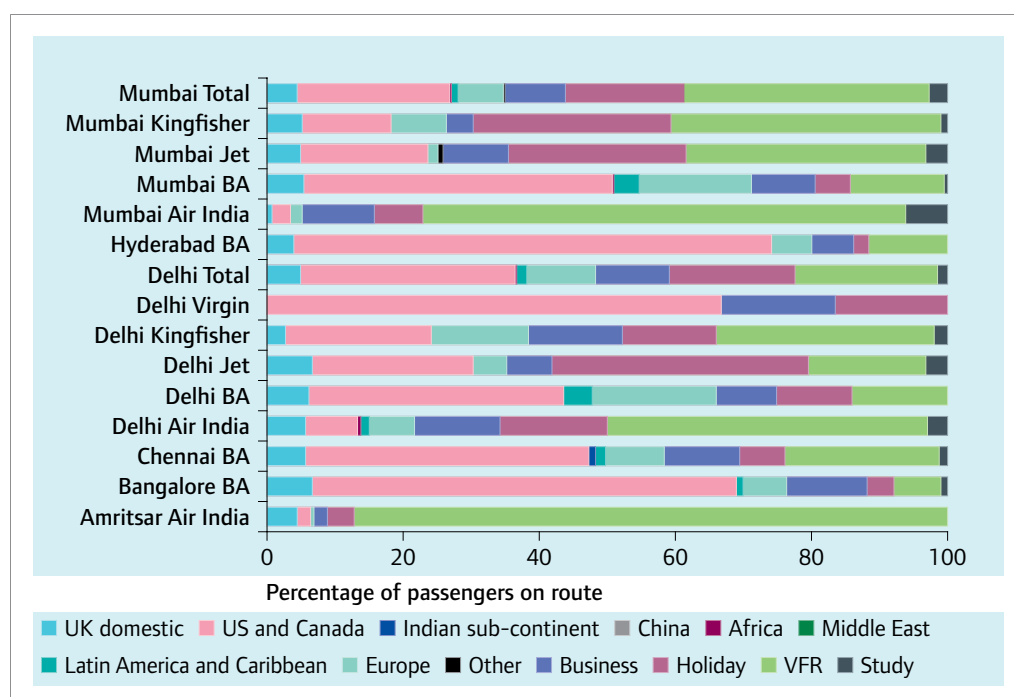
How hubbing works at Heathrow

The most frequent intercontinental route operated between any pair of airports in the world is London Heathrow to New York JFK. Of 121 flights a week in June 2011, 76 were operated by British Airways, Heathrow's main hub operator – an average of more than 10 a day. Approximately 39 per cent of all passengers on the route transfer at Heathrow, which is equivalent to 47 of the 121 weekly flights. In fact the high frequency of flights which the market can support on this route is highly valued by business users particularly in the business and financial services sectors and is dependent on the mix of transfer and direct passengers that a hub airport provides.

The mutually beneficial network effects generated by a hub airport are further illustrated in the role North American flights also play in supporting long-haul routes with thinner demand at Heathrow. There are many routes with high proportions of transfer passengers at Heathrow and most of these are international⁹². On approximately 70 per cent of Heathrow's routes transfer passengers account for more than 25 per cent of the total.

The pattern of services on routes between Heathrow and India illustrates the connectivity benefits of the UK hub. In Figure A1 the proportions of direct passengers by journey purpose (business, visiting friends and relatives, holiday, study) are shown in the four bars on the right of each row. Indirect passengers are shown to the left, with proportions by origin of passengers rather than journey purpose shown. This illustrates, for example, that on the Hyderabad route only around 20 per cent of passengers are travelling directly, with the majority visiting friends and relatives; of the 80 per cent of passengers travelling indirectly, the vast majority are travelling from the US and Canada.

Figure A1: Proportions of direct passengers (by journey purpose) and indirect passengers (by origin) on flights from Heathrow to India



Source: York Aviation from CAA survey data, 2010

A number of observations can be made about the data. First, there are significant differences in the share of transfer passengers across airlines. This reflects an apparent preference for airlines in each country to concentrate on consolidating demand at their own 'home' hubs. The proportion of indirect passengers using UK-based airlines (BA and Virgin) is generally significantly higher than that using the Indian airlines, which reflects the availability of transfer passengers at Heathrow. In contrast, the Indian-operated carriers rely far less on transfer passengers in the UK, and instead consolidate Indian domestic demand

at Mumbai and Delhi. It appears clear that the transfer business available at UK and Indian hubs together allows higher frequencies on these hub-to-hub routes than would otherwise be possible.

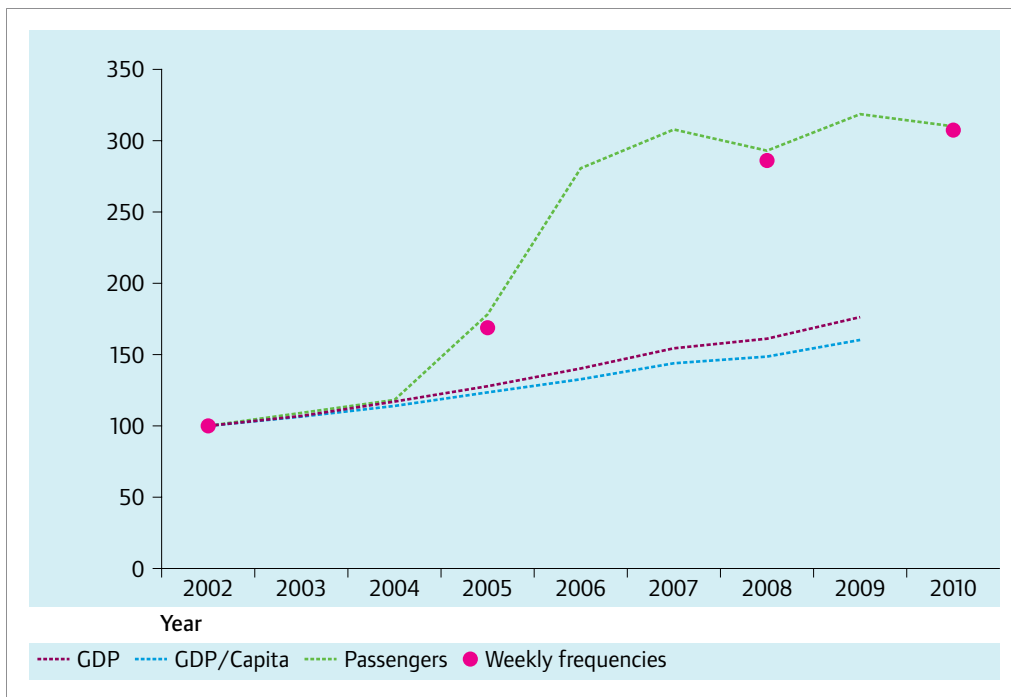
Second, a consequence of this is that direct flights to the second-tier Indian destinations of Bangalore and Hyderabad⁹³ can be operated by BA on the basis of consolidated demand at Heathrow. Transfer traffic on these routes accounts for over 75 per cent of demand and principally originates in North America. It seems clear that without the UK hub, direct flights to these destinations would not be available.

Case studies: India and China

A comparison of the pattern of Heathrow’s direct connections with India and China provides a useful illustration of its varying success in developing new links to important emerging markets. Although both India and China are rapidly growing economies and are increasingly important for UK trade and investment, they have seen very different patterns of aviation development in recent years. Figures A2 and A3 show the relationship between growth in GDP and GDP per capita and the development of weekly frequencies from Heathrow since 2002, in India and mainland China respectively.

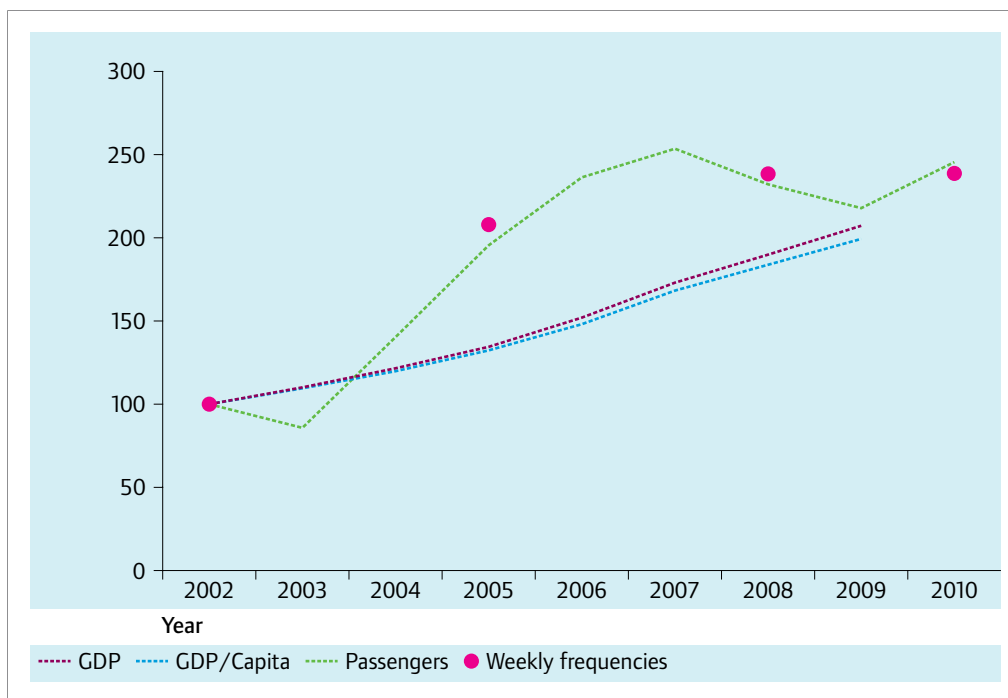
The development of services between the UK and China has broadly tracked GDP growth over the decade whereas the growth of services between the UK and India has been substantially faster than GDP or GDP per capita growth. It is noteworthy that while both China’s GDP and GDP per capita have grown at nearly twice the rate of India’s over the period, the weekly frequency of flights between Heathrow and India grew substantially faster than that between Heathrow and mainland China. The reasons for this are explored below.

Figure A2: Indexed growth of GDP and GDP per capita in India against aviation links with the UK



Source: World Bank Data, CAA Statistics, and OAG, OAG Schedules Data, June 2011

Figure A3: Indexed growth of GDP and GDP per capita in China against aviation links with the UK

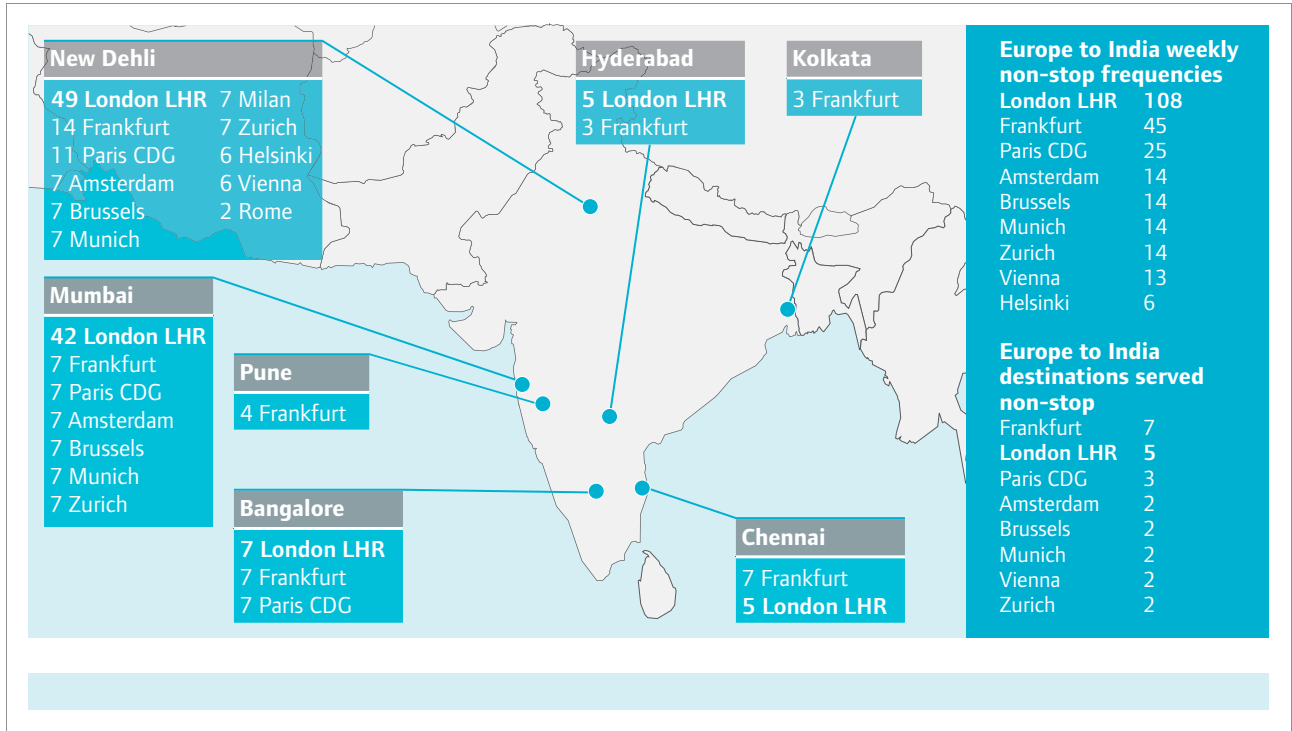


Source: World Bank Data, CAA Statistics, and OAG, OAG Schedules Data, June 2011

Further detail about the patterns of non-stop direct services to and from Heathrow are provided in Figures A4 and A5. This shows that in terms of weekly flight frequencies to India, Heathrow has a commanding lead among European airports and in terms of the number of destinations served is second behind Frankfurt. In contrast Heathrow lags well behind other European airports in the market between Europe and mainland China. Both Paris Charles de Gaulle and Frankfurt

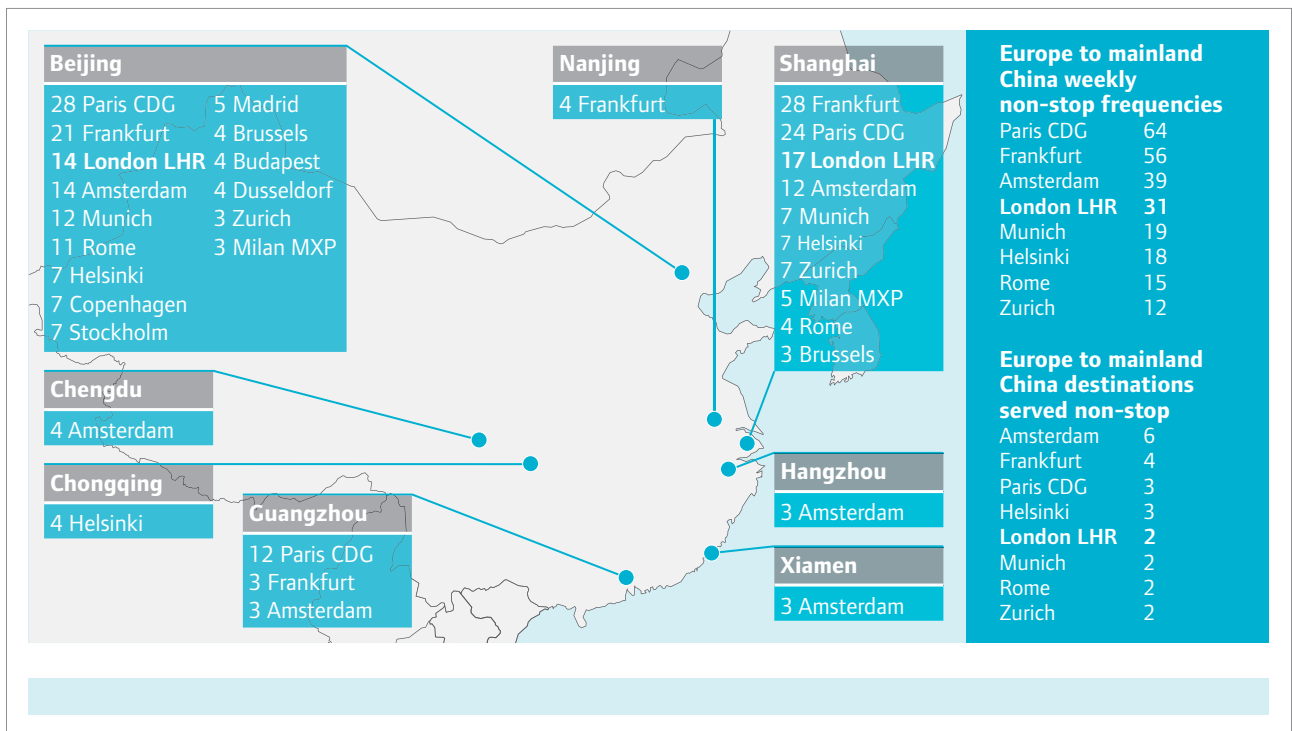
offer substantially higher frequencies to both Beijing and Shanghai. Heathrow is in fifth position in the number of destinations served (two compared with six at Amsterdam Schiphol), and fourth in terms of overall weekly flight frequencies, with less than half the frequency offered by Paris Charles de Gaulle, the leading European hub on this measure.

Figure A4: Current and planned weekly non-stop frequencies from Europe to India



Source: Various Airline/Airport timetables, compiled by TFL

Figure A5: Current and planned weekly non-stop frequencies from Europe to mainland China



Source: Various Airline/Airport timetables, compiled by TFL (Not including flights to and from EU 10 or European part of CIS)

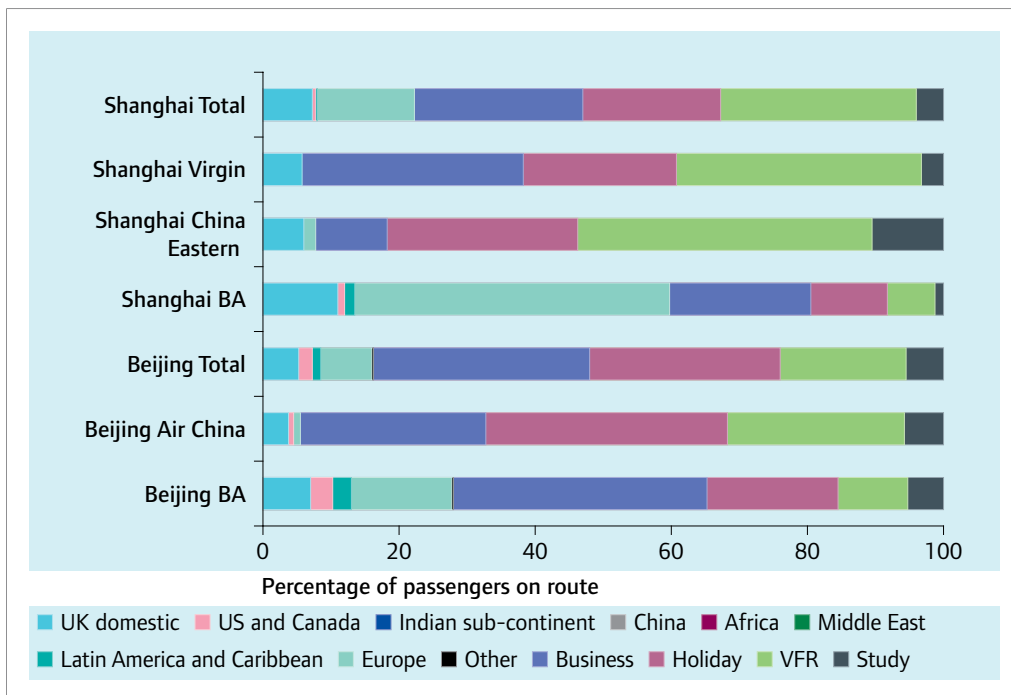
It is notable that alongside this large discrepancy between Heathrow's success in developing direct services to India and its relative failure with services to China, there are substantial differences in the respective roles of transfer traffic in the two markets. As Figure A6 shows, where there is significant transfer traffic on Chinese routes it is fed primarily by passengers originating in the UK and Europe rather than North America. The proportions of transfer traffic are in any case generally much lower on Chinese routes than Indian ones. While transfer passengers account for approximately 20 per cent of the total Shanghai market from Heathrow and 15 per cent of the Beijing market, they account for more than 30 per cent of Mumbai passengers and almost 50 per cent of Delhi passengers, as shown previously in Figure A1.

While it is clear that Heathrow is not an attractive hub for passengers travelling between North America and China since routes via the Pacific are shorter, this is also the case for Europe's other hub airports, which have been relatively successful in establishing direct links. Other explanations are needed for Heathrow's failure to establish a leading offer in serving mainland China. The restrictions inherent in the UK's bilateral agreement with China appear to be a decisive factor.

Industry sources indicate that China is unwilling to liberalise the bilateral UK-China agreement because of the inability of Chinese carriers to obtain the slots they desire. China's biggest airline, China Southern, does not serve the UK, citing access to Heathrow as the reason⁹⁴.

In contrast, the rapid growth in Heathrow's market to India followed the signing of a new bilateral UK-India treaty in 2005. Previously, as much as half of the market between the UK and India was indirect, with transfers at hubs in third countries. The new bilateral agreement has allowed direct flights to grow and replace this. While similar treaties were agreed between India and the other European countries with hub airports, none of these has been able to reach the frequencies now offered at Heathrow. This difference, shown in Table A1, is underpinned by both a strong home market and high feeder demand from the frequent North American flights into Heathrow.

Figure A6: Proportions of direct passengers (by journey purpose) and indirect passengers (by origin) on flights from Heathrow to China



Source: York Aviation from CAA survey data, 2010

Table A1: Utilisation of bilateral permitted weekly departure frequencies, Europe-India

Destination	Permitted weekly departures		Weekly departures		Utilisation	
	Indian carriers	European carriers	Indian carriers	European carriers	Indian carriers	European carriers
Germany*	50	50	14	52	28%	104%***
France*	35	35	14	21	40%	60%
Netherlands*	21	21	0	7	0%	33%
UK**	112	112	77	52	69%	46%

Notes

*2011 Departures only includes Amsterdam, Paris (CDG), Frankfurt and Munich

**UK Permitted is based solely on current operating routes, but the total could increase should services be launched on routes not currently served

***It is not clear how Lufthansa have exceeded their allowance as these are individual routes

Source: UK/India Bilateral Agreement and OAG, OAG Schedules Data, June 2011

On the other hand, the restrictive bilateral UK-mainland China agreement does not allow for much more traffic than that which is required to meet the needs of the UK market alone. And with the exception of BA's services on which there is a significant volume of transfer traffic originating in continental Europe, the mainland China market has many fewer passengers who transfer at Heathrow than most other major long-haul markets.

The importance of slot availability should not be underestimated. All of the bilateral agreements with India stipulate that the governments must make best endeavours to provide commercially acceptable slots at both ends of the routes. To some extent this has not been so challenging given the service pattern of operations from India, typically arriving in the late afternoon or early evening and departing mid to late evening, avoiding conflict with the busiest periods at the European hubs.

Appendix B-

Forecasting methodology

The DfT's demand model

The DfT's 2011 aviation forecasts explore patterns of demand in both capacity constrained and capacity unconstrained conditions. Underlying demand is first calculated and then allocated across the UK's airports, dependent on their assumed 'capacity'. Both capacity constrained and capacity unconstrained forecasts have high, central and low ranges to account for variation in the external factors that are driving demand.

For capacity unconstrained conditions, the airports have unlimited capacity. For capacity constrained conditions, existing infrastructure and planning conditions are assumed. However, the capacity constrained forecasts still allow for demand to increase, including through increasing average loadings and using spare capacity where it currently exists (such as at Stansted). For example, Heathrow's throughput increases from 65mppa today to 86mppa in 2050.

The DfT's forecasts are calculated independently of the cap recommended by the Government's Committee on Climate Change. The DfT's forecasts include an assumption that aviation is part of an EU emissions trading scheme and that aviation is able to purchase carbon credits from other sectors.

Potential route networks

The potential route networks have been calculated in accordance with the DfT's forecasting model. The DfT's demand model allocates a destination to a UK airport according to the demand to that destination from both the UK airport's local catchment and any hub traffic

it accommodates. Each airport constitutes a different destination, and there may be multiple destinations serving one city. The demand on each route is then assessed to see whether the route is viable according to a number of criteria. Airports compete for passengers if their catchment areas overlap and passengers are allocated as the model reaches equilibrium after many iterations.

Meeting environmental targets

While an airport accommodating 180mppa would be much larger than any airport in operation in the world today, there are a number of circumstances in which a new hub airport serving London accommodating 180mppa could be compatible with environmental commitments:

- If the UK does not adopt a unilateral cap and decides that aviation can purchase carbon credits from other industries following its entry into the EU Emissions Trading Scheme in 2012
- The proportion of the UK's total aviation demand that is accommodated in London and the South East is greater than it is currently (approximately 60 per cent). This could occur if growth at a hub airport serving London was prioritised
- Transfer passengers do not contribute to the UK's demand figures in the way they currently do. It is important to note that the Committee on Climate Change's methodology for a UK emissions cap could discriminate against the UK. Currently UK regional passengers transferring at Heathrow count as three air traffic movements and only as one if they transfer at a foreign hub

- If London's other airports do not continue to grow within their current constraints as per the DfT forecasts. For instance, Heathrow is predicted to grow to 86mppa under existing operating arrangements. This may be neither commercially viable nor desirable
- When the DfT reports in March 2012 on whether the Committee on Climate Change's 2009 recommendations remain appropriate, it concludes that a greater level of growth across the UK is permitted.

Appendix C-

Other cities' strategies

Introduction

This appendix identifies instructive examples of hub airports around the world. The purpose is to gain a brief insight into the context in which the airport was created, its complementary infrastructure, and long-term development strategy. A second objective is to explore the economic impacts associated with the airport's development, both for its immediate vicinity and the wider region.

The cities examined are:

- Atlanta
- Munich
- Seoul (Incheon)
- Hong Kong

Atlanta

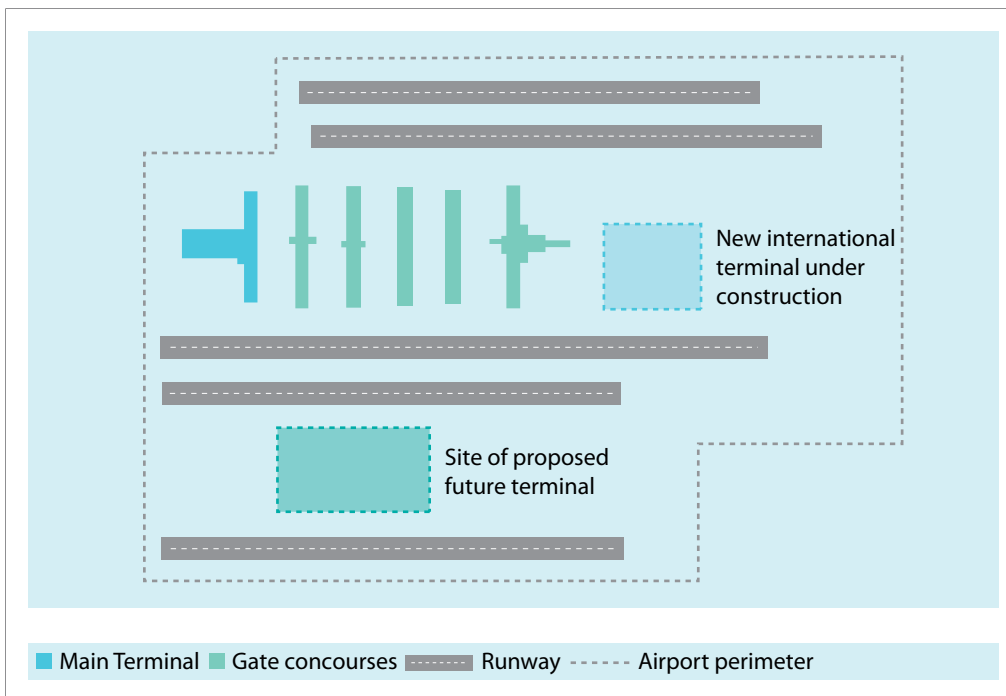
Although Atlanta is an important regional centre, it was far from obvious that its airport would become the world's busiest. Foundations for its success were laid in the 1970s when Delta Airlines established one of America's first true hub operations. It has grown ever since, aided first by airline deregulation in the US and then by the expansion of its international network, underpinned by increasing levels of transfer traffic. Since 1999, Atlanta's airport has been the world's busiest by passenger numbers and today serves 89 million passengers a year. More than 80 per cent of the US population market lies within two hours' flight time of the airport⁹⁵.

Atlanta's hub has helped the city punch substantially above its economic weight. Although only the ninth most populous

metropolitan area in America, Atlanta has the country's fourth largest collection of Fortune500 companies and the third highest number of regional headquarters (by foreign companies)⁹⁶. The airport's ability to attract inward investment is based not only on its links to major US trading partners in Europe and Asia, but also on its growing access to Latin America.

Between 1997 and 2008, Atlanta's annual economic growth averaged 3.1 per cent, with a 39 per cent increase in population matched by a 36 per cent increase in average income per capita – despite the severe economic downturn the US experienced in the later years of this period. The Metro Atlanta Chamber estimates that the airport contributes \$17bn a year to the regional economy, and that this contribution will almost double to \$32bn by 2015⁹⁷. The region's employment profile also reflects the benefits of the hub airport⁹⁸, with two of the three dominant sectors directly and indirectly linked to it – 'Trade, Transport and Utilities' and 'Professional and Business Services'. (The third is 'Government'.)

Figure C1: Plan of Atlanta airport



Future development

Although it is the world's busiest airport by some margin, Atlanta is not standing still. In 2000, the city initiated a \$5.4bn development programme to enable the airport to serve a predicted 121 million passengers by 2015. The fifth runway was completed in 2006 and a new terminal is due for completion in April 2012. As well as addressing delays, the new runway will increase ATM capacity by 40 per cent, from an average of 184 to 237 flights an hour⁹⁹.

Munich

Munich Airport is the most notable example of a significant new hub airport in Europe, having been developed over the last 20 years. Its remarkable development, becoming one of Europe's major airports within two decades of opening, demonstrates the increase in utility that can derive from hub operations.

Background

During the 1980s, Germany's aviation market was dominated by the German flag carrier Lufthansa, which served the major German airports with a number of domestic and international routes. However, only one, Frankfurt, with its wide range of domestic, European and - in particular - long-haul connections, could be characterised as a hub. Munich, by contrast, primarily served the demand in its local market and focused on a range of point-to-point services.

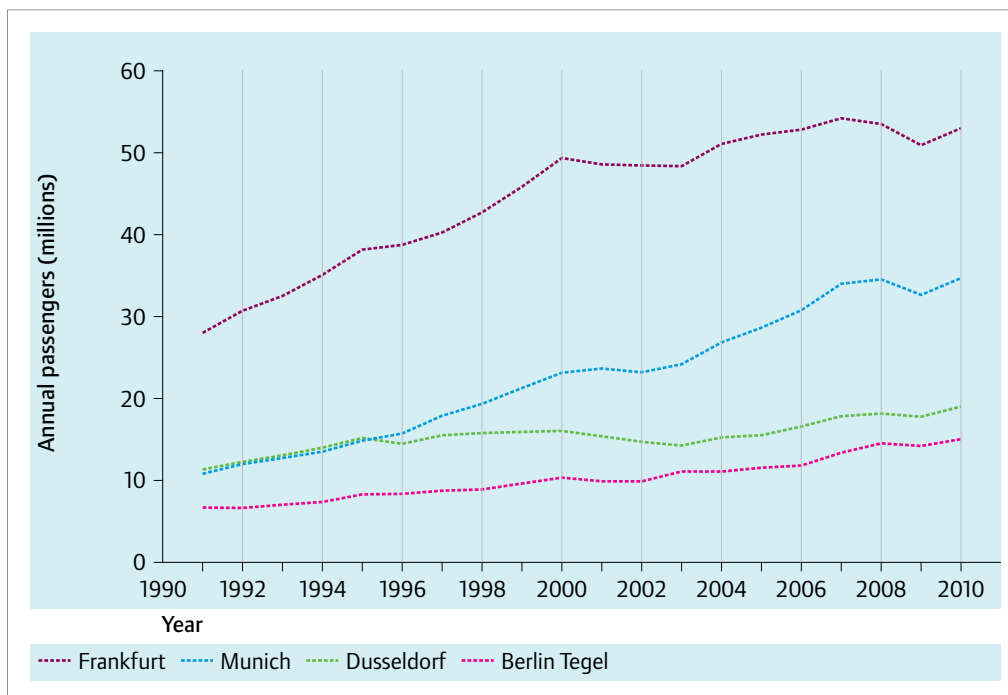
Two factors contributed most to the development of a hub in Munich. The first was the opening of a new airport for the city in 1992. The previous airport had reached its capacity and the city and region recognised the need for an airport that could support the city's future economic development. Rather than expand the existing airport's constrained city location, a new rural location was decided on with the potential for future expansion.

Around the same time, Germany's main airport, Frankfurt, was also nearing capacity and facing strong local opposition to its further expansion. Lufthansa in particular feared the consequences of its sole hub continuing to suffer severe capacity constraints and so quickly identified the opportunity of establishing a second hub at Munich, thus reducing its reliance on Frankfurt.

The hub develops

By the summer of 1995 Lufthansa had begun operating a range of new long-haul routes from Munich, as well as a range of new routes to Southern and Eastern Europe. Just two years later, the new hub airport was one of the top 10 airports in Europe and the rate of growth resulted in the need for new terminal capacity. The new second terminal, dedicated to Lufthansa and its partners, opened in 2003. The minimum connecting times between flights in Terminal 2 is just half an hour, the best of any major European hub airport.

Figure C2: Annual passengers at Germany's four principal airports



ADV Airport Association, Annual Airport Statistics 1991-2010, 2011

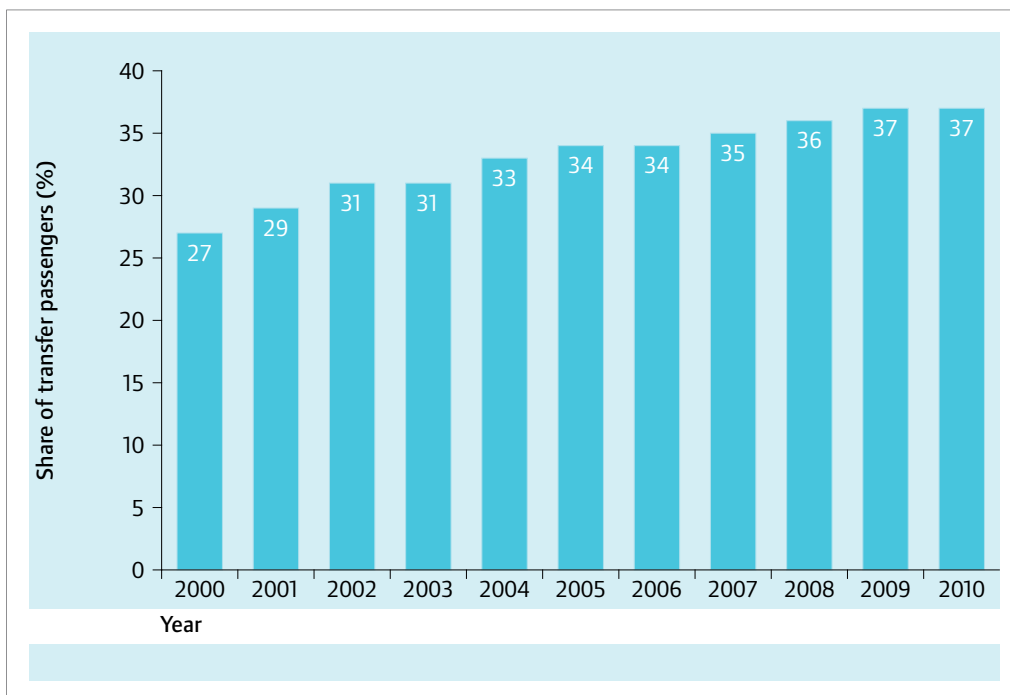
A transformation in connectivity

Passenger data suggests the impact of the move into hub operations has been significant. Figure C2 below illustrates the rapid growth in passengers at the airport, which has overtaken Dusseldorf to become Germany's second airport.

Over the period 1990-2011, Munich witnessed a 222 per cent increase in passenger numbers compared with just 68 per cent at Dusseldorf, starting from a similar

base. While the regional economies around each undoubtedly differ, these differences cannot account for such widely divergent growth trajectories.

Figure C3: Transfer traffic as a percentage of all passengers at Munich airport



Source: Munich Airport, www.munich-airport.de/en/company/facts/diagramm/verk_struk_daten/index.jsp

Data on transfer passengers shows that increasing numbers of passengers are taking advantage of the greater connectivity the new hub offers. As Figure C3 shows, between 2000 and 2010 the share of transfer passengers (as a percentage of all departing passengers) increased 37 per cent (from 27 per cent to 37 per cent).

Economic impact

In a survey of new companies or those relocating to the area since 1988, 31 per cent of respondents cited the airport as the primary factor in their location decision, even though only 14 per cent of those surveyed were engaged in businesses directly related to the airport itself¹⁰⁰. Indeed, it is estimated that for every additional job created at the airport, a further 1.8 jobs are created outside the airport¹⁰¹.

Future development

Almost 20 years after the new airport opened, it maintains its impressive growth rate. In the first half of 2011 it reported a 13.4 per cent year-on-year increase in passenger numbers, with a 13.9 per cent increase in freight¹⁰². Perhaps even more significantly, passenger traffic to and from the key markets of Brazil, India, China and South Africa was more than 26 per cent higher than it had been during the same period in 2010.

With growth showing no signs of abating, the airport is already looking to future expansion. Lufthansa and Munich Airport have already agreed construction of a new satellite building¹⁰³, set to open in 2015, which will double the number of gates in Terminal 2 and increase annual passenger capacity by 11 million.

The airport is also beginning to face constraints on runway capacity at certain times of day. In light of these constraints, Munich Airport is seeking to build a third runway; its proposals received state government approval in August 2011. A third runway will allow a substantial increase in the possible number of aircraft movements from 90 to 120 an hour.

Seoul (Incheon)

Seoul's Incheon Airport opened in 2001 and was built on 5,600 hectares of reclaimed land sandwiched between two islands¹⁰⁴ after it became clear the city's old airport could not cope with increasing passenger traffic.

Today Incheon is the world's eighth busiest international airport for passengers and the world's second busiest for international cargo throughput. Incheon has very successfully maintained its position as the gateway to South Korea but also to both Japan and China. With 38 destinations in China and 26 destinations in Japan¹⁰⁵, the new airport has been uniquely placed to tap into economy growth in the economic powerhouses on its doorstep.

Incheon has maintained a minimum connecting time for international flights of 45 minutes, an average arrivals processing time of 12 minutes (compared with 45 minutes internationally) and an average departure processing time of 16 minutes (versus 60 minutes worldwide).

Given the airport's remote island location, surface access infrastructure has been key, and has included a 250,000 square metre integrated transport centre, new motorway and fast rail link. The rail link provides access to the centre of Seoul, with non-stop express trains covering the 58km journey in 43 minutes, and an airline check-in facility at the city centre terminus. Starting in 2012, a number of KTX high-speed services will also use the airport directly to destinations on the Korean high-speed network¹⁰⁶.

As Table C1 shows, development has been strong and is set to continue, with the passenger capacity of the airport set to more than double by 2020.

Table C1: Historic and planned development of Incheon Airport

New development	Phase 1: 2001	Phase 2: 2008	Phase 3: 2015	Phase 4: 2020
New Runways	2	1	-	2
New Terminals	New 500,000m ² terminal complex	New 170,000m ² remote concourse	New 350,000m ² terminal complex	Further terminal capacity
Other Infrastructure	Transport centre, 3 cargo terminals	Cargo terminal	Expansion of cargo facilities	Additional cargo facilities
Annual Capacity (cumulative)				
ATMs	170,000	410,000	410,000	740,000
Passengers	27m	44m	62m	100m
Cargo Tonnage	1.7m	4.5m	5.8m	7m

Source: *Incheon Airport, A Story Begins, 2011*

The third phase of the airport's expansion is explicitly designed to 'create a world-class mega hub airport', enabling Incheon to 'meet future aviation demand increases and improve [its] competitive footing with respect to other airports in the region'. The airport wishes to become 'Northeast Asia's Undisputed Hub Airport' and is making the investment in infrastructure necessary to achieve this objective.

Incheon City

Incheon Airport's ambitions are not limited to aviation. It is setting out to create an 'Airport City' in a bid to become 'Northeast Asia's logistics, leisure and business hub... becoming a new growth engine for national economic development'¹⁰⁷.

This in turn is part of the greater vision to make Incheon a major trade and logistics hub,

with the city also home to Korea's second largest port. In 2003, three districts of Incheon were designated as Korea's first Free Economic Zone, covering a total area of 209 sq kms. The zone is designed to encourage foreign investment and in particular five key industries – IT, medical, bio-technology, parts and materials, and logistics. The scale of the development is unprecedented. New Songdo, the largest new district, has a masterplan for nine million square metres of the 1,500 acres of reclaimed land and the development will cost a total of \$35bn¹⁰⁸.

Hong Kong

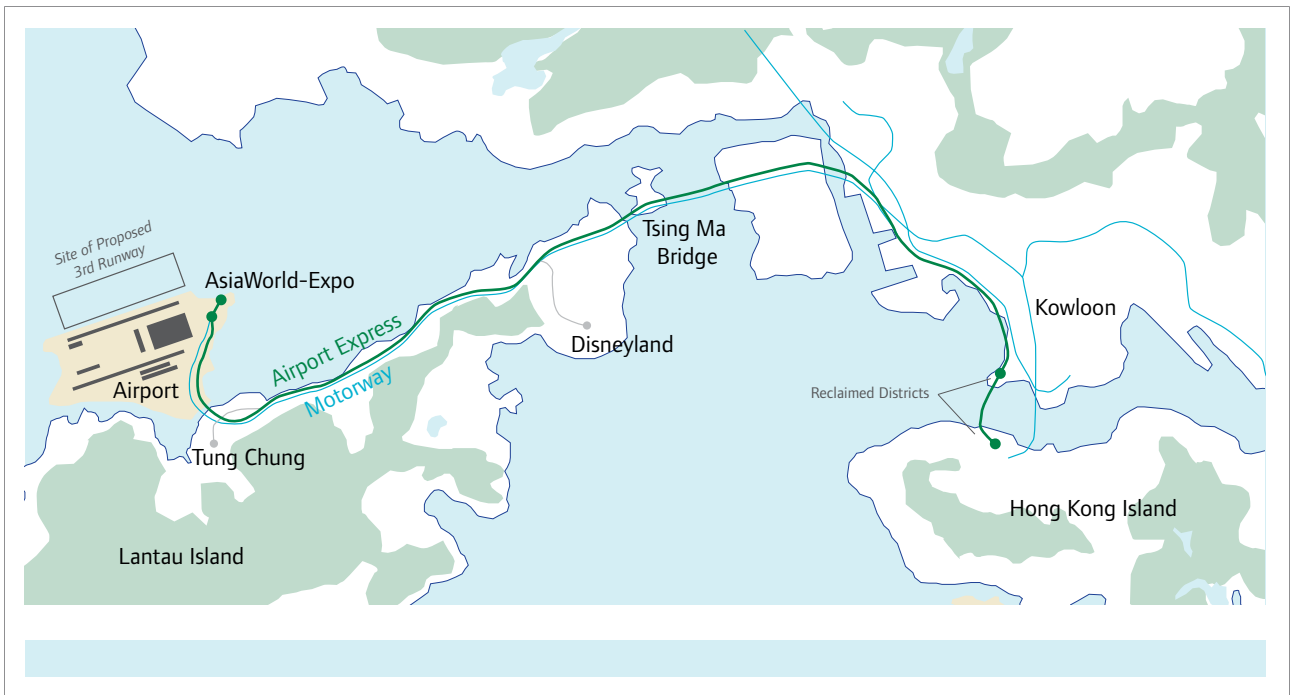
By the 1980s, Hong Kong had established itself as a major trading hub in East Asia and was still experiencing rapid growth. However, it was becoming clear that the location of the city's Kai Tak airport meant that it was unable to continue to fulfil the role of Hong Kong's hub. Reliant on a single runway, the airport was hemmed in between mountainous and densely populated areas, which were sensitive to unavoidable noise impacts.

The only long-term solution was a new airport. Chep Lap Kok, off Lantau Island, opened in 1998 and has two runways. Chep Lap Kok, located 25km east of the city, is away from populated areas and planes can be routed over the South China Sea, minimising any noise impacts and enabling 24-hour operation.

Airport Core Programme

The Airport Core Programme was a key means of maximising the benefits of the new airport. Under the programme, Chep Lap Kok was accompanied by nine other infrastructure projects designed to support and capitalise on the new airport. Foremost among these was the new fastrail and motorway corridor linking Lantau Island and the airport with central Hong Kong. This included the 1,377 metre-long Tsing Ma Bridge, carrying both the motorway and railway line, and when opened, the second longest suspension bridge in the world. Also included was the first phase of the North Lantau new town at Tung Chung – providing new housing which would be connected to the city by the airport road and rail links while also serving as a residential area for airport workers. The Airport Core Programme also included major land reclamation projects at the sites of the new airport express stations in Kowloon and Hong Kong Island, enabling future development of these areas.

Figure C4: Road and rail corridors to Hong Kong Airport



The airport today

In a little over a decade, Chep Lap Kok airport has successfully established itself at the heart of the global air network and is the world's third busiest international passenger airport, and the busiest airport worldwide for international cargo throughput. Indeed, airport freight accounts for 36 per cent of all Hong Kong's external trade¹⁰⁹. The airport has positioned itself as a gateway to the rapidly

growing Chinese economy, with flights to around 45 destinations in mainland China.

The economic contribution of Hong Kong's aviation industry has been estimated at HK\$78bn, corresponding to 4.6 per cent of the territory's GDP¹¹⁰. The territory recognises the particularly vital role played by aviation in supporting the city's four economic pillars: financial services, trading and logistics, professional services, and tourism.

Key messages

- Hub airports are underpinned by the operations of one or more base airline but reinforced by other carriers attracted by the increasing demand base and connectivity
- Although airlines are the ones which decide on and develop a hub, government authorities are key to ensuring the provision of an airport infrastructure that can support efficient hub operations
- The connectivity provided by a hub airport is significantly greater than the range of flights the host region alone could support
- As a result, a hub airport has the potential to transform the economic fortunes of the wider region, serving as a magnet for business relocation and foreign investment attracted by the connectivity offered
- Maximising the benefits of a hub airport entails a wider planning perspective, including surface access and focused regeneration schemes
- If a hub airport is not to lose its advantage it must continue to develop to ensure it has the capacity to meet demand growth and the future economic needs of its region

1. Available at <http://www.london.gov.uk/sites/default/files/Developing-a-sustainable-framework-for-UK-aviation-scoping-document.pdf>
2. Available at <http://www.london.gov.uk/sites/default/files/Developing-a-sustainable-framework-for-UK-aviation-scoping-document.pdf>
3. A.T. Kearney, *The Urban Elite*, 2011.
4. ONS, *Regional GVA*, 2010
5. NOMIS (Official labour market statistics, Office for National Statistics), *Business Register and Employment Survey*, 2009.
6. GLA Economics, *Economic Evidence Base to support the London Plan, the Transport Strategy and the Economic Development Strategy*, May 2010.
7. GLA Economics, *Economic Evidence Base to support the London Plan, the Transport Strategy and the Economic Development Strategy*, May 2010.
8. GLA, *Filling the coffers: London's tax export*, November 2008.
9. ADS UK (Advancing UK Aerospace, Defence and Security industries), 2011.
10. Think London, *52 Billion: The value of foreign direct investment to London*, 2007.
11. Oxford Economics USA, *The return on investment of US business travel*, September 2009.
12. This presents fresh analysis, undertaken by York Aviation on behalf of TfL, following methodology originally used by Oxford Economic Forecasting (OEF) in 1999. It uses criteria similar to those used by OEF, although it uses UK input-output tables for 2008 rather than 1996 and the original threshold of £500 per head has been increased to £1,000 reflecting inflation and changes in the market. There has been little change between 1999 and the present in the composition of sectors which are most aviation intensive.
13. This represents those sectors for which the number employed in London is more than 50 per cent higher than would be expected on the basis of a simple distribution of jobs arranged across London's employment base, in relation to the UK total.
14. UKT&I, *European headquarters in the UK: key facts, 2011* (Available at www.ukti.gov.uk/uktihome/aboutukti/localisation/113922.html, accessed 14 July 2011)
15. The total number of offices in Hillingdon is far lower than in central London boroughs, so fewer head offices are required to increase the location quotient.
16. UNCTAD statistics database (http://unctadstat.unctad.org/ReportFolders/reportFolders.aspx?sCS_referer=&sCS_ChosenLang=en)
17. UK Trade and Investment, *UK Inward investment report 2010/11*, 2011.
18. GLA Economics, *Economic Evidence Base to support the London Plan, the Transport Strategy and the Economic Development Strategy*, May 2010.
19. Department for Business, Innovation and Skills, *Paper No 13: International Trade and Investment – the Economic Rationale for Government Support*, May 2011.
20. Department for Business, Innovation and Skills, *Paper No 13: International Trade and Investment – the Economic Rationale for Government Support*, May 2011.

-
21. Think London, 52 Billion: The Value of Foreign Direct Investment to London, 1 April 2007
22. BBC, China-Germany trade: Wen meets Merkel in Berlin, June 2011
23. UNCTAD, Inward and outward foreign direct investment flows, annual, 1970-2010, 2011
24. Frontier Economics, Connecting for growth: the role of Britain's hub airport in economic recovery, 2011
25. Denstadli, J.M, 'Impacts of videoconferencing on business travel: the Norwegian experience', *Journal of Air Transport Management*, 10(6):371-376, November 2004
26. Since the direction of flow of money is outbound.
27. Data presented in the Committee on Climate Change report, Meeting the UK's Aviation Target, 2009. The average number of trips per year by those with an income of less than £20,000 was approximately 2.2 per year while for those on incomes above £60,000 it was approximately 3.7 per cent. This data includes business users but since business travel only accounts for about a quarter of the total number of trips it seems unlikely that the discrepancy in usage between income groups can be accounted for solely by a higher rate of business travel among higher income groups.
28. A/B and C1 categories [as per National Readership Survey (NRS) social grades] accounted for 80 per cent or so of the total while only representing around 55 per cent of the population, while the C2 and D/E categories accounted for only 20 per cent or so of aviation use despite representing around 45 per cent of the population. (This data is for all aviation passengers.)
29. ONS, International Passenger Survey, 2010.
30. SOAS, How The Rise Of Chinese Tourism Will Change The Face Of The European Travel Industry, October 2011.
31. Visit Britain, 2010.
32. Visit Britain, UK Aviation Policy and Future inbound tourism, October 2011.
33. DfT, Focus on Freight, December 2006.
34. Oxford Economic Forecasting, The Economic Contribution of the Aviation Industry in the UK, October 2006.
35. HMRC, Overseas Trade Statistics, 2007.
36. Oxford Economic Forecasting, The Economic Contribution of the Aviation Industry in the UK, October 2006.
37. Oxford Economic Forecasting, The Economic Contribution of the Aviation Industry in the UK, October 2006.
38. UPS estimates that overall the express sector contributes £1.3bn of economic activity and facilitates £10bn of UK exports.
39. Neiberger, C. Air Freight. Trends and issues in aviation and climate change. Earthscan, p229. 2009.
40. Doganis, R. Flying off Course: The Economics of International Airlines, 2010.
41. Bloomberg, BA Uses Iberia to Challenge Lufthansa in Cargo: Freight Markets, June 2011.
42. Bloomberg, BA Uses Iberia to Challenge Lufthansa in Cargo: Freight Markets, June 2011.

43. CAA, Connecting the Continents: Long-haul Passenger Operations from the UK, July 2007.
44. The consumption, investment and exports/ imports categories are included in order to capture the main ways in which aviation services contribute to economic growth using the expenditure method: GDP = consumption + investment + Government expenditure + exports – imports. Government expenditure, the other main category, is not included because it is not significant for commercial aviation.
45. For the purposes of considering the economic growth impacts, tax revenues are not however to be treated as additional benefits to, for example, consumption or export revenues, but rather as a transfer.
46. Outbound tourists using the hub airport generate important network benefits along with all other passengers – see Chapter 3
47. CAA, UK Airport Annual Statistics for 2010, 2011.
48. CAA, UK Airport Annual Statistics for 2010, 2011.
49. CAA, UK Airport Annual Statistics for 2010, 2011.
50. In 2010, when all passengers across all journey purposes are counted, the four main London airports served approximately six to seven times the total volume of passengers as Manchester (CAA, 2011)
51. CAA, UK Airport Annual Statistics for 2010, 2011.
52. AECOM, Heathrow Freight Movement Study, 2009.
53. OAG timetable data, June 2011.
54. York Aviation, extracted from CAA data, 2010.
55. DfT, UK Aviation forecasts. August 2011.
56. Campos, J. and Gagnepain, P., Measuring the intermodal effects of high speed rail. Unpublished, University of Gran Canaria, 2007.
57. Discussions with Virgin Atlantic Airways, August 2011.
58. The value of the imported component of goods purchased in this way should be deducted from the calculation.
59. Heathrow Airport Limited, Annual report and financial statements for the year ended 31 December 2009, 2010.
60. Grant Thornton, Prepared for the Mayor of London. Accessible hotels in London, 2010.
61. www.munich-airport.de/en/micro/tm/connect/index.jsp
62. Hong Kong International Airport. Annual Report 2009-10, www.hongkongairport.com/eng/pdf/media/publication/report/09_10/e_full.pdf
63. BAA, Review of Heathrow's noise mitigation schemes, 2011.
64. OAG, OAG Schedules Data, June 2011.
65. Gatwick also plays a role in serving long-haul destinations, particularly in the Caribbean and other mainly point-to-point markets, but this is relatively minor in comparison to Heathrow.
66. The Independent, China's deep south or the frozen north? Head for Heathrow, 25 June 2011.
67. ThisDay, Federal Government slashes BA's flights to Nigeria, 3 November 2011.
68. Confederation of British Industry/ KPMG, Making the right connections: CBI/KMPG Infrastructure Survey, 2011.

69. OAG, OAG Schedules Data, June 2011.
70. EUROCONTROL, ATM Airport Performance Framework, 2009.
71. Airport Coordination Limited (ACL), 2011.
72. BAA, Review of Heathrow's noise mitigation schemes, 2011.
73. Gatwick Airport, Environmental Noise Directive: Noise Action Plan 2010-2015, 2010.
74. Stansted Airport, Environmental Noise Directive: Noise Action Plan 2010-2025, 2009.
75. Environmental Resources Management (ERM). Developed to support European Commission Study of Aircraft Noise Exposure at and around Community Airports: Evaluation of the Effect of Measures to Reduce Noise, TREN/F3/15-2006, 2011. Most data for 2006 and self reported to the EC under Directive EC2002/49. 2011.
76. BAA Heathrow, Working towards a sustainable a Heathrow, 2010.
77. TfL research, 2011.
78. BAA Heathrow, Working towards a sustainable a Heathrow, 2010
79. A. Schafer and D. G. Victor. 'The future mobility of the world population', Transportation Research Part A, 34:171–205, 2000.
80. PricewaterhouseCoopers, The World in 2050: The accelerating shift of global economic power: challenges and opportunities, 2011.
81. China, India, Brazil, Russia, Indonesia, Mexico and Turkey.
82. PricewaterhouseCoopers, The World in 2050: The accelerating shift of global economic power: challenges and opportunities, 2011.
83. McKinsey Global Institute, Urban world: Mapping the economic power of cities, 2011.
84. McKinsey Global Institute, Urban world: Mapping the economic power of cities, 2011.
85. McKinsey Global Institute, Urban world: Mapping the economic power of cities, 2011.
86. China Daily, China to add 97 airports in 12 years. 25th March 2008.
87. Airbus, Global Market Forecast, 2011, and Boeing, Current Market Outlook 2011-2030, 2011.
88. DfT, UK Aviation forecasts. August 2011.
89. Manchester is expected to remain the UK's leading regional airport. It is also the next best alternative to Heathrow in the DfT's capacity constrained case in terms of long-haul network coverage.
90. It should be noted that this classification is as per 2006 and does not reflect some of the recent changes in membership of the OECD.
91. Number 10. The Prime Minister's speech on economic growth. January 6th, 2011.
92. Passengers whose origin and final destination are both outside of the UK.
93. Air India's routes to second tier cities such as Amritsar involve service stops at Delhi.
94. The Independent, China's deep south or the frozen north? Head for Heathrow, 25 June 2011.
95. Metro Atlanta Chamber, Metro Atlanta Rankings 2009.
96. Metro Atlanta Chamber, Summary of Economic Growth 1997-2008.
97. Metro Atlanta Chamber, Supply Chain Success Stories.

98. Georgia Department of Labour, Non-Agricultural Employment Data, September 2011.
99. Airport-technology.com, Atlanta International Airport.
100. GfK, Germany Purchasing Power Survey 2011.
101. Munich Airport, www.muc-ausbau.de/gruende/gruende_2/index.html
102. Flightglobal, Munich Airport traffic up 13.4% in first half of 2011, 11 July 2011.
103. Flightglobal, Lufthansa and Munich operator approve Terminal 2 satellite, 23 December 2010.
104. Halcrow, www.halcrow.com/Our-projects/Project-details/Incheon-Airport-Seoul/
105. Incheon Airport, A Story begins, 2011.
106. Korea JoongAng Daily, Bullet trains coming to a town near you by 2020, 2 September 2010.
107. Incheon Free Economic Zone, www.ifez.go.kr
108. Songdo IBD, www.songdo.com/songdo-international-business-district/the-city/master-plan.aspx
109. Financial Times, Aerotropolis, 25 February 2011.
110. Hong Kong Airport, www.hongkongairport.com

