Executive Summary

As a small, open economy, Ireland is crucially dependent on its air links for international trade. It is clear that airports and economic activity are closely associated and in the context of a European single market and an increasingly global market, air transport is essential to economic progress. Cork Airport commissioned a study to quantify the contribution of the airport to employment, the regional economy and to economic growth. The key findings are presented below.

Cork Airport is Ireland’s second largest airport and a gateway to the South-West of Ireland. Its economic importance is reflected in the estimated 10,710 jobs supported or facilitated by the airport and the € 727 million contributed to Gross Domestic Product.
Direct, indirect and induced impacts: day-to-day activity at Cork Airport directly provides employment for 1,920 people. Including the businesses that supply the goods and services to airport activity (indirect impacts) and spending of employees in the wider economy (induced impacts), a total of 4,550 jobs are supported by Cork Airport.

The economic impact of airport activity is provided in Table ES-1. Economic impact can be measured in a number of ways:

- **Employment** – the number of people employed by businesses involved in activities linked to Cork Airport.
- **Income/Wages** – the wages and salaries earned by the people employed in activities linked to Cork Airport.
- **Gross Value Added (GVA)** – GVA is broadly equivalent to *Gross Domestic Product* (GDP), whereby the value-added of each industry sums to the total GDP of an economy.¹

Direct employment supported by on-going operations at Cork Airport (e.g., airport company, airlines, air traffic control, ground handlers, airport security, immigration, customs, airport retail, etc.) amounted to 1,920 jobs. Adjusting for part-time and seasonal employment, this equates to 1,650 Full-Time Equivalent jobs (FTEs). The total income/wages of these employees is € 71 million, which equates to an average of € 42,800 per FTE, which is 9% higher than the national average. The total direct GVA generated by Cork Airport in 2013 is estimated to be € 134 million.

Adding in multiplier impacts (indirect and induced), the total employment supported by activities at Cork Airport is estimated to be 4,550 jobs (or 3,980 FTEs), earning a total of € 160 million. The contribution to GDP is estimated to be € 306 million.

**Table ES-1: Total Economic Impact of Cork Airport**

<table>
<thead>
<tr>
<th>Impact Type</th>
<th>Direct Impact</th>
<th>Indirect Impact</th>
<th>Induced Impact</th>
<th>Total Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Jobs</td>
<td>1,920</td>
<td>1,180</td>
<td>1,450</td>
<td>4,550</td>
</tr>
<tr>
<td>Full-Time Equivalents (FTEs)</td>
<td>1,650</td>
<td>1,050</td>
<td>1,280</td>
<td>3,980</td>
</tr>
<tr>
<td>Income/Wages (€ Million)</td>
<td>71</td>
<td>43</td>
<td>46</td>
<td>160</td>
</tr>
<tr>
<td>GVA (€ Million)</td>
<td>134</td>
<td>82</td>
<td>90</td>
<td>306</td>
</tr>
</tbody>
</table>

Numbers may not add up due to rounding.

¹ Gross Value Added (GVA) is the value of the operating surpluses of business linked to Cork Airport, plus the income/wages of employees and consumption of fixed capital. GDP is the sum of the GVA of all industries plus taxes less subsidies on production.
Cork Airport offers the highest connectivity of any Irish airport outside Dublin, with 42 non-stop scheduled routes and service to 11 countries in 2014. This connectivity contributes to increased tourism, trade, investment and productivity for the region.

Connectivity is fundamentally about access to markets and regions. A location that has linkages to only a limited number of destinations will be a less desirable place to do business. Travel costs for staff and for goods will be higher due to the need to purchase multiple flight legs to move people and goods. On the other hand, a community with direct access to a broad range of markets will be a lower cost place to do business. It will also enhance customer servicing, and goods and support staff can easily and quickly get to a range of destinations.

Analysis in this study found that Cork has the second highest air connectivity levels in the Republic of Ireland (after Dublin). The range and density of Cork’s European network provides the region with high levels of connectivity. The scale of Cork’s services to major hubs such as London Heathrow, Paris and Amsterdam ensures a better quality of connectivity than other regional Irish airports, enabling easier links to the wider world.
Catalytic impacts: the connectivity provided by Cork Airport helps attract tourists, facilitates trade and investment, and contributes to the growth of the regional economy. These catalytic impacts total 6,200 jobs and € 421 million in GVA.

Outside of Dublin, the South-West and Cork region has the highest levels of GDP per capita and FDI in the country. A large number of multinational corporations have major operations in the Cork region including pharmaceutical and life sciences (e.g., Pfizer, GlaxoSmithKline, Johnson & Johnson) and technology and internet services (e.g., Apple, EMC, VMware, Amazon). Cork is also home to University College Cork and the Cork Institute of Technology. The region also attracts nearly 2 million overseas tourists each year.

A large number of factors have contributed to the South-West’s economic success – business regulations, government policy, taxation, the education and skillset of the local population, geographic location, etc. The quality and range of air services available at Cork Airport is also a key contributing factor. The region’s position as centre for pharmaceuticals, information technology and tourism is supported by the air connectivity provided by Cork Airport. The air service at Cork Airport helps transport high-value exports around the world, and enables employees of multinational businesses to travel to clients, regional offices and global headquarters.

The importance of Cork Airport’s connectivity is reinforced by a recent survey of businesses by the Cork Chamber of Commerce. A survey of 139 businesses based in and around Cork found that 93% of respondents indicated that the level of direct air services to/from Cork Airport is important or very important for businesses when deciding to locate or expand within the region. Over three quarters (77%) of businesses would be directly/indirectly affected by the loss of passenger services to/from Cork Airport.

Analysis was undertaken to estimate the catalytic impacts of Cork Airport. The results of this analysis are provided in Table ES-2. It is estimated that the catalytic impacts of Cork Airport amount to 6,200 jobs (5,500 FTEs) and € 421 million in GVA (equivalent to 1.5% of the GDP of the South-West of Ireland).

Table ES-2: Catalytic Impacts Facilitated by Cork Airport

<table>
<thead>
<tr>
<th>Impact Type</th>
<th>Total Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Jobs</td>
<td>6,200</td>
</tr>
<tr>
<td>Full-Time Equivalents (FTEs)</td>
<td>5,500</td>
</tr>
<tr>
<td>Income/Wages (€ Million)</td>
<td>216</td>
</tr>
<tr>
<td>Value-Added (€ Million)</td>
<td>421</td>
</tr>
</tbody>
</table>

Source: Central Statistics Office Ireland.

Source: Cork Chamber of Commerce Biennial Business Air Travel Survey 2014.
Total Impacts: combining the direct, indirect, induced and catalytic impacts, Cork Airport generates or facilitates 10,710 jobs and contributes €712 million to GDP.

The total economic impact of Cork Airport is summarised in Table ES-3. Including the activity directly related to the airport, the multiplier impacts that flow from it, and the other sectors of the economy facilitated by the airport, Cork Airport contributes to the employment of 10,710 people in Ireland, equivalent to 9,480 full-time jobs, earning a total of €373 million. Furthermore, a total of €727 million is contributed to GDP. It is estimated that €638 million (88%) of this GDP is generated in the South-West region, meaning that Cork Airport generates or facilitates an amount equal to 2.2% of the regional economy. The largest component of these impacts are the catalytic impacts, reflecting the way in air connectivity enables other important activities to be conducted - trade, business development, visits to business headquarters and regional offices, visit locations for holidays, and so on.

It should be noted that these figures are not attempting to credit Cork Airport with creating over 2% of the regional economy. This economy is far more complex than that. It clearly takes a wide range of players acting together to generate economic growth – government, business, infrastructure providers, residents, etc. However, what the figures do show is that without Cork Airport, and the connectivity at the airport, the regional economy would not be as large, affluent or diverse as it is today. It also demonstrates that the growth and development of Cork Airport is a vital component in Cork and South-West’s future growth and success.

Table ES-3: Total Economic Impact Generated and Facilitated by Cork Airport (Direct+Indirect+Induced+Catalytic)

<table>
<thead>
<tr>
<th>Impact Type</th>
<th>Jobs</th>
<th>FTEs</th>
<th>Income (€ Million)</th>
<th>GVA (€ Million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct</td>
<td>1,920</td>
<td>1,650</td>
<td>71</td>
<td>134</td>
</tr>
<tr>
<td>Indirect</td>
<td>1,170</td>
<td>1,050</td>
<td>43</td>
<td>82</td>
</tr>
<tr>
<td>Induced</td>
<td>1,420</td>
<td>1,280</td>
<td>46</td>
<td>90</td>
</tr>
<tr>
<td>Catalytic</td>
<td>6,200</td>
<td>5,500</td>
<td>214</td>
<td>421</td>
</tr>
<tr>
<td>Total</td>
<td>10,710</td>
<td>9,480</td>
<td>373</td>
<td>727</td>
</tr>
</tbody>
</table>

Numbers may not add up due to rounding.

4 Based on data from the Central Statistics Office Ireland, the GDP of the South-West was estimated to be €29 billion in 2013.
## Glossary of Terms and Abbreviations

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catalytic Impacts</td>
<td><em>Catalytic Impacts</em>, also known as Wider Economic Benefits, captures the way in which specific economic activities facilitates further economic or business impacts in other sectors of the economy. Air transport creates catalytic impacts primarily through increased connectivity and improves national economic performance through the following mechanisms: tourism, trade in goods and services, investment, and increased productivity.</td>
</tr>
<tr>
<td>CSO</td>
<td>Central Statistics Office, Ireland.</td>
</tr>
<tr>
<td>daa</td>
<td>State owned corporation responsible for the operation and management of Dublin and Cork airports.</td>
</tr>
<tr>
<td>Direct impacts</td>
<td><em>Direct Impacts</em> arise immediately from the conduct of those entities performing the activity in question. For an airport, the “direct impacts” would include the activities of airlines, the airport itself, forwarders, ground handling agents, and other firms whose principal business involves commercial aviation.</td>
</tr>
<tr>
<td>E/D Passengers</td>
<td>Enplaned/deplaned passengers. A measure of passenger volume that counts each passenger who enplanes or deplanes an aircraft.</td>
</tr>
<tr>
<td>Economic Impact</td>
<td>Economic impact is a measure of the employment, spending and economic activity associated with a business, a sector of the economy, a specific project (such as the construction of a new facility), or a change in government policy or regulation.</td>
</tr>
<tr>
<td>FDI</td>
<td>Foreign Direct Investment. Investment from one country into another (normally by companies rather than governments) that involves establishing operations or acquiring tangible assets, including stakes in other businesses.</td>
</tr>
<tr>
<td>FTE</td>
<td>A full time equivalent (FTE) year of employment is equivalent to the number of hours that an individual would work on a full time basis for one year (also known as a person year). FTEs are useful because part time and seasonal workers do not account for one full time job.</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product, a measure of the total output of an economy.</td>
</tr>
<tr>
<td>GVA</td>
<td>Gross Value Added (GVA) – the value of the operating surpluses of business linked to Cork Airport, plus the income/wages of employees and consumption of fixed capital. GVA is broadly equivalent to Gross Domestic Product (GDP), whereby the value-added of each industry sums to the total GDP of an economy.</td>
</tr>
</tbody>
</table>
I-O Model

Input-Output (I-O) model. A representation of the flows of economic activity within a region or country. An I-O model captures what each business or sector must purchase from every other sector in order to produce a dollar’s worth of goods or services.

Indirect impacts

*Indirect Impacts* involve the supply chain of the businesses or entities conducting the primary activity (i.e., those included in the direct impact). The airlines at an airport purchase fuel which has been refined at a plant and transported to the airport by pipe or truck. Catering companies at the airport buy food from wholesalers. The items purchased can be used for many purposes besides commercial aviation, and would usually occur off site. The materials support the primary aviation activity, although they could be used for many purposes.

Induced impacts

*Induced impacts* capture the economic activity generated by the employees of firms directly or indirectly connected to the airport spending their income in the national economy. For example, an airline employee might spend his/her income on groceries, restaurants, child care, dental services, home renovations and other items which, in turn, generate employment in a wide range of sectors of the general economy.

Low Cost Carrier (LCC)

Also known as low fares, no-frills or budget carriers. These are airlines that generally have lower fares and fewer amenities than network or legacy carriers. Although there is considerable variation in the business models, low cost carriers typically operate a single aircraft type (to reduce training and maintenance costs), do not offer first or business class travel, do not provide in-flight services such as meals and entertainment (or offer them at additional charge), and focus on point-to-point travel offering limited connecting options. Examples in Europe include EasyJet, Ryanair, Wizz Air, Norwegian Air Shuttle and Vueling.

Multiplier Impacts

Economic multipliers are used to infer indirect and induced effects from a particular sector of the economy. These are typically derived from an Input-Output model. See Chapter 2 and Appendix E for detailed information on how multiplier impacts were derived in this study.

Wider Economic Benefits

See *Catalytic Impacts*. 
Contents

1 Introduction .............................................................................................................................. 1
   1.1 What is Economic Impact? ................................................................................................. 3
   1.2 Categories of Economic Impact ......................................................................................... 3

2 Methodology for the Economic Impact Study ...................................................................... 7
   2.1 Surveying Direct Impacts ................................................................................................. 7
   2.2 Inferring Employment ....................................................................................................... 8
   2.3 Full-Time Equivalent Jobs ............................................................................................... 8
   2.4 Economic Multipliers ....................................................................................................... 8
   2.5 Study Time Frame ............................................................................................................ 10

3 Overview of Cork Airport .................................................................................................... 11
   3.1 Traffic at Cork Airport ..................................................................................................... 11
   3.2 Overview of Cork Airport’s Air Services ......................................................................... 14
   3.3 Measuring Airport Connectivity ..................................................................................... 16

4 Direct Employment Impacts of Airport Activity ................................................................. 19
   4.1 Overall Direct Employment ............................................................................................. 19
   4.2 Direct Employment by Business Type ............................................................................ 21
   4.3 Direct Employment by Occupation ............................................................................... 23
   4.4 Direct Employment by Location .................................................................................... 24

5 Indirect and Induced Impacts of Airport Activity ............................................................... 25
   5.1 Overall Multiplier Impacts of Cork Airport .................................................................... 25
   5.2 Multiplier Impacts by Region ......................................................................................... 27

6 Facilitating the Wider Economy – The Catalytic Impact of Cork Airport ......................... 28
   6.1 Overview of Catalytic Impacts ........................................................................................ 29
   6.2 Linkage Between Cork Airport’s Connectivity and the Economy .................................. 35
   6.3 Estimating the Catalytic Impact of Cork Airport ............................................................. 38

7 Summary: Total Economic Impact of Cork Airport ............................................................ 42

Appendix A: Employment Survey Sample .............................................................................. 44
Appendix B: Sample Survey Form .......................................................................................... 45
Appendix C: Calculating Inferred Employment ...................................................................... 54
Appendix D: Calculation of Full-Time Equivalent Jobs ......................................................... 55
Appendix E: Further Information on the Input-Output Tables and the Economic Multipliers ...... 56
1 Introduction

“Cork is by some way the second largest City Region in terms of population, business activity and economic value in Ireland. As the principal international Gateway to the South of Ireland, Cork Airport is a major resource for the region, providing vital connectivity for businesses in the region and facilitating the growth of tourism. The retention of existing routes and enhancement of air connectivity are critical if Cork is to realise its potential as a major regional engine of national economic growth.

Cork City and County Councils are working together with Fáilte Ireland to develop a cohesive vision and action plan to promote future growth of tourism to the region. Cork Airport is also working with Cork City and County Councils, and other stakeholders in the Cork Region, to deliver a compelling and coherent regional brand strategy for the economic development of Cork - to attract and retain businesses and jobs, grow visitor numbers and revenue from both the business and leisure tourism sectors, and position Cork as a successful global business location. Cork Airport and the reach of its services are a critical part of this effort. One of the key messages underpinning the Cork proposition is that Cork is an easily accessible business location for globally operating companies with great European air connectivity and direct links to London, Amsterdam and Paris hubs.”

Cork City Council, January 2015

Cork Airport commissioned InterVISTAS Consulting Ltd. to conduct an economic impact study of Cork Airport. This report documents the methodology and findings of the study, and is structured as follows:

- Chapter 2 outlines the methodology used to estimate the economic impact of Cork Airport.
- Chapter 3 presents an overview of the traffic activity at Cork Airport and the connectivity it provides for Ireland.
- Chapter 4 provides the economic impact directly generated by the activities at Cork Airport.
- Chapter 5 provides estimate of the down-stream multiplier impacts (indirect and induced impacts) generated by the activities at Cork Airport.
- Chapter 6 discusses the catalytic impacts facilitated by air service at Cork Airport and provides an estimate of the economic contribution to Ireland.
- Chapter 7 totalises the economic impact of Cork Airport, including direct, indirect, induced and catalytic impacts.
Additional details are provided in the appendices. As part of the study process, meetings were held with a number of stakeholders in the region:

- Cork Convention Bureau;
- Fáilte Ireland;
- Irish Hotels Federation;
- Tourism Ireland;
- Cork Business Association;
- Cork Chamber of Commerce.

In addition, other businesses and organisations were contacted regarding their use and requirements of Cork Airport. The insights of these organisations regarding the impact and importance of Cork Airport are provided throughout this report.

“The future vision for Cork is heavily intertwined with that of Cork Airport. With a growing population, expanding and enhanced educational outputs, increasing employment particularly in technology and sciences, pharmaceutical, agri-business and global corporate services sectors, including a well-developed and sustained positive international brand, the maximisation of the capacity of Cork Airport to support Cork’s development as the engine of growth in the Southern Region of Ireland is of paramount importance.

A number of key projects within the region, under development in order to progress national policy objectives, are also reliant on the enhanced presence of Cork Airport. These include the Cork Science and Innovation Park and the International Convention Centre.

Cork Airport continues to also be a key driver in developing tourism in the Southern Region. Notwithstanding the struggling international economy of recent years, the south-west tourism region continues to attract international visitor numbers in excess of 1.5 million per annum – generating over €500 million in revenue. Recognising the key regional economic role played by tourism, Cork County Council - in conjunction with other key stakeholders, such as Cork Airport - continues to identify and develop opportunities to protect and enhance the south-west region’s internationally acclaimed tourism brand. Additionally, via initiatives such as the Wild Atlantic Way Cork is developing its potential as a gateway into the national tourism market – to the benefit of other tourist regions within the state.

Cork International Airport is a national asset which needs to perform at its optimum capacity to ensure that the Irish economy derives maximum benefit from its investment in the airport and, that the Cork region can maximise its contribution to continued national economic growth.”

Cork County Council, January 2015
1.1 What is Economic Impact?

Economic impact is a measure of the employment, spending and economic activity associated with a business, a sector of the economy, a specific project (such as the construction of a new facility), or a change in government policy or regulation. In this case, economic impact refers to the economic contribution associated with the on-going activities at Cork Airport. Economic impact can be measured in a number of ways:

- **Employment** – the number of people employed by businesses involved in activities linked to Cork Airport.
- **Income/Wages** – the wages and salaries earned by the people employed in activities linked to Cork Airport.
- **Gross Value Added (GVA)** – the value of the operating surpluses of business linked to Cork Airport, plus the income/wages of employees and consumption of fixed capital. GVA is broadly equivalent to Gross Domestic Product (GDP), whereby the value-added of each industry sums to the total GDP of an economy.\(^5\)

It should be borne in mind that these measures attempt to assess the gross level of activity or expenditure associated with Cork Airport. As such, they are not “net” measures that weigh benefits against costs, but nevertheless these measures can be useful in demonstrating the economic contribution of the airport.

1.2 Categories of Economic Impact

There are four distinct types or categories of economic impact associated with airports:

1.2.1 Direct Economic Impact

This is the employment, income and GDP associated with the operation and management of activities at Cork Airport including firms on-site at the airport and airport-related businesses located elsewhere near the airport. This includes activities by the airport operator, the airlines, air traffic control, fixed base operators (General Aviation), ground handlers, airport security, immigration and customs, aircraft maintenance, etc.

While a straight-forward definition of the direct airport economic impact would be the activities and businesses located at the airport, this would not reflect the full extent of the airport’s economic base. Other businesses closely connected to airport activities are not based at the airport (or only partially based at the airport), such as aircraft maintenance, logistics operators, aircraft parts suppliers, etc. These businesses would not exist, or would be much smaller, without the activities at the airport. Therefore, off-airport businesses closely linked to airport activities were also included as part of the direct economic impact.

\(^5\) GDP is the sum of the GVA of all industries plus taxes less subsidies on production.
1.2.2 Indirect Economic Impact

The employment, income and GDP generated by down-stream industries that supply and support the activities at Cork Airport. For example, these include: wholesalers providing food for inflight catering, oil refining activities for jet fuel, companies providing accounting and legal services to airlines, travel agents booking flights, etc.

1.2.3 Induced Economic Impact

This captures the economic activity generated by the employees of firms directly or indirectly connected to the airport spending their income in the national economy. For example, an airline employee might spend his/her income on groceries, restaurants, child care, dental services, home renovations and other items which, in turn, generate employment in a wide range of sectors of the general economy.

1.2.4 Catalytic Economic Impacts

While the economic impact described above can be seen as down-stream impacts resulting from activities at Cork Airport, catalytic impacts (also known as Wider Economic Benefits) capture the way in which the airport facilitates the business of other sectors of the economy. As such, air transportation facilitates employment and economic development in the national economy through a number of mechanisms:

- Tourism. Air service facilitates the arrival of larger numbers of tourists to a region or country. This includes business as well as leisure tourists. The spending of these tourists can support a wide range of tourism-related businesses: hotels, restaurants, theatres, car rentals, etc. Of course, air service also facilitates outbound tourism, which can be viewed as reducing the amount of money spent in an economy. However, even outbound tourism involves spending in the home economy, on travel agents, taxis, etc. In any case, it is not necessarily the case that money spent by tourists flying abroad would be spent on tourism at home if there were no air service.

- Trade in Goods and Services. Both the trade of goods and the trade of services are facilitated by passenger air services. Face-to-face meetings play a crucial role in making sales and delivering services and support. The ability be at a client’s side rapidly and cost-effectively is important to many industries. Much of the time, these functions cannot be replaced by teleconferencing or other forms of communication. Air transport connects businesses to a wide range of global markets, providing a significantly larger customer base for their products than would be accessible otherwise. It is particularly important for high-tech and knowledge-based sectors, and suppliers of time-sensitive goods. It is not just the trade

- Investment. Air connectivity is important in attracting international business headquarters and foreign investment into a country. A key factor many companies take into account when making decisions about the location of offices, manufacturing plants or warehouses is proximity of an international airport. Therefore, airports are essential assets for regions wishing to expand industrial activity. Their proximity encourages
industrial development. Industries choose to locate close to airports in order to gain easy access to air transport and the associated infrastructure.

- **Productivity.** Air transportation offers access to new markets, which in turn enable businesses to achieve greater economies of scale; inward investment can enhance the productivity of the labour force (e.g., state-of-the-art manufacturing facilities); air access also enables companies to attract and retain high quality employees. All of these factors contribute to enhanced productivity, which in turn increases the national income.

In effect, the catalytic impact of aviation is to increase the productive potential of the economy (in economist terms, moving the production–possibility frontier). Improvements in aviation connectivity enable economies to attract more tourists, conduct more trade and draw more foreign investment. The overall effect of all these mechanisms is an increase in employment and GDP. Without effective air transportation links, it is much harder for economies to attract tourists, to conduct trade and attract investment from other countries. As a result, the country’s economy and employment potential would suffer.

It should be noted that catalytic impacts are not a simple matter of the airport generating employment and economic activity in the same way that direct, indirect and induced impacts arise. National economies are far more complex than that. It clearly takes a wide range of players acting together to generate economic growth – government, business, infrastructure providers, residents, etc. For example, if no one had decided to build hotels in a country, tourism would also be substantially lower.

However, what the catalytic impacts do show is that without these airports and the air services they support, the economy would not be as large or affluent. Thus, catalytic impacts are about the economic value and employment that airports facilitate rather than generate. The connectivity enabled by airports is not sufficient on its own to fully support economic activity, but it a necessary element of economic growth and development.

In discussing catalytic impacts, the issue of causality often arises. For example, while air service can facilitate trade, it is also true that increased trade leads to increased demand for air services. This study recognises that there is a two-way relationship between air connectivity and economic growth. Economic growth stimulates demand for air services while at the same time, these air services open up new opportunities for tourism, trade, business development, etc. This in turn can stimulate further demand for air services, and so on, in a “virtuous cycle”. The analysis in this study uses parameters that control for this two-way relationship.

Catalytic impacts are discussed in greater detail in Chapter 6. These four categories of impacts are summarised in **Figure 1-11**.
Figure 1-1: Categories of Economic Impact Generated or Facilitated by Cork Airport

- **DIRECT**: At airport and airport related businesses
- **INDIRECT**: Supplying and supporting businesses
- **INDUCED**: Employees spending economy
- **CATALYTIC**: Air service facilitating:
  - tourism
  - trade
  - investment
  - productivity growth
2 Methodology for the Economic Impact Study

This chapter describes the methodology and sources that were used to measure the economic impact of Cork Airport. Results of this are provided in Chapter 4.

2.1 Surveying Direct Impacts

The primary tool for estimating the economic impact of Cork Airport was an employment survey. This was augmented by data from government and airport sources. Employment attributable to airport operations was measured by surveying businesses located at Cork Airport, plus offsite businesses economically linked to the airport, along with ground transportation firms. A total of 59 firms were contacted for the survey. These businesses included passenger and cargo airlines, courier/integrators, ground handlers, government agencies, aircraft maintenance firms, air cargo, warehousing and logistics, car rental firms, hotels, airport retailers. While information on individual respondents is not provided in this report, in order to preserve the confidentiality of the respondents, further detail on the type and location of businesses surveyed is provided in Appendix A.

The survey questionnaire collected information on:

- Type of business;
- Employment at the firm, broken down into full time, part time and temporary;
- Annual payroll or average salary per employee;
- Breakdown of employment by type of job;
- Proportion of the firm’s business related to the airport (as some businesses may also conduct business not related to the airport);\(^6\)
- Proportion of business related to air cargo (where relevant);
- Expenditures on goods and services and the geographic location of that expenditure.

The surveyed firms were asked to provide information for calendar year 2013 wherever possible. Different versions of the questionnaire were created, tailored to the type of business being surveyed. An example of the survey questionnaire is provided in Appendix B.

The questionnaires were initially sent out by email. Telephone follow-up was conducted to increase the response rate. Particular effort was made to ensure that survey responses were obtained from known large employers such as airlines and aircraft maintenance. There was a strong response to the survey, with 79% of the firms contacted providing information, these firms representing an estimated 83% of total employment represented in the survey.

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\(^6\) Offsite employment reported by the businesses was scaled down by the percentage reported in the survey, to ensure that only airport-related employment was represented.
2.2 Inferring Employment

Employment was “inferred” for firms that did not respond to the survey by using other information sources, such as annual reports, or using information on similar firms that did respond to the survey. For example, if 15 retailers were sent surveys but only 10 returned them, and other information on these firms was not available, an average employment figure was derived from the responding firms. The employment number was the mean total employment of the responding firms excluding the highest and lowest employers (to avoid the mean being skewed by outliers). Further details are provided in Appendix C.

There may be firms which were not surveyed simply because it was not known that they existed. We do not include an estimate of employment for such unidentified firms because there is no basis for an assessment. In any event, we expect most of these to be very small in terms of missed employment.

2.3 Full-Time Equivalent Jobs

Often employment is measured by counting the number of jobs. However, when part-time and/or temporary workers are used, this can be a misleading measure resulting in an overstatement of economic impact. For example, one firm with 100 part-time employees may have a smaller overall economic impact than another firm with 100 full-time employees.

Therefore, the employment estimate was converted to full-time equivalents (FTEs), where the employment is weighted according to the number of hours typically worked. For example, 100 part-time employees working 20 hours a week would equate to approximately 50 FTEs. Further details can be found in Appendix D.

Whenever possible, employment impacts are provided both in terms of the number of jobs and the number of FTEs.

2.4 Economic Multipliers

While the direct employment and income/salary impacts of Cork Airport were based on survey information, such an approach is not practical for estimating indirect and induced economic impacts. While it might be possible to conduct a survey of businesses impacted indirectly, the survey would need to cover thousands of companies. For induced employment, the entire economy would need to be scrutinised. In addition to the time and financial resources needed to conduct such surveys, the quality of responses would be suspect.

As an alternative to costly and inaccurate surveys, indirect and induced effects were estimated using economic multipliers, as is common practice for economic impact studies. In addition, the direct value-added impacts were also estimated using economic multipliers.

These multipliers were based on the Input-Output model of the Irish economy maintained by the Central Statistics Office Ireland. An Input-Output (I-O) model is a representation of the flows of economic activity within a region or country. The model captures what each business or sector must purchase from every other sector in order to produce a Euro’s worth of goods or services. Using such a model, flows of economic activity associated with any
change in spending may be traced either forwards (spending generating income which induces further spending) or backwards (visitor purchases of meals leads restaurants to purchase additional inputs - groceries, utilities, etc.). By tracing these linkages between sectors, I-O models can estimate indirect and induced impacts. These indirect and induced impacts are represented by economic multipliers, normally expressed as a ratio of total impacts (i.e., direct plus indirect plus induced) to direct impacts. Using the I-O model, multipliers can be produced for employment, remuneration, valued-added and economic output, normally expressed in terms of a unit of direct impact (e.g., per dollar of direct economic output).

The size of these economic multipliers is a function of a number of factors:

- The nature of the industry or economic sector under consideration. Multipliers vary across different industries within the economy based on the mix of labour and other inputs, and the propensity of each industry to buy goods and services from within the economy. Some industries require large amounts of goods and services from other sectors of the economy, and therefore have large multiplier impacts. Other sectors are more labour intensive and require fewer inputs from other sectors of the economy, resulting in smaller multiplier impacts.\(^7\)

- The amount of imports needed as an input to production. Industries or economic sectors that require large amount of imports have lower multiplier impacts as this part of the spending goes outside of the national economy (in essence, this part of the multiplier impact is occurring in another country).

- Propensity to consume domestic goods. The spending patterns of consumers in the national economy will affect the induced impacts. The greater the propensity to consume domestically produced goods and services, the greater is the multiplier effect. Similarly, higher spending on imports or higher savings rates will dampen the induced multiplier.\(^8\)

- Government taxation and spending has a complex influence on the size of the multiplier impacts. Higher taxation rates can dampen multiplier impacts, although this can be offset by how the government chooses to spend these tax revenues.

The multipliers used in this study were based on the 2010 Input-Output tables (the I-O model output) produced by the Central Statistics Office Ireland.\(^6\) These were the most current I-O tables available at the time of the study. The economic multipliers developed from the I-O tables have been updated to reflect 2013 price levels, but no structural changes have been assumed. Structural changes might include changes in the input purchases of certain industries (e.g., consuming more or less goods and services from other industries for each

\(^7\) In such a case, the indirect impacts may be smaller than the induced impacts, as induced impacts are based on the spending of labour income.

\(^8\) In the case of savings, this is a function of the time period examined. The multiplier impacts capture the economic impact occurring in a particular year. Savings represent deferred spending that will occur at some time in the future. However, there is not reliable technique for estimating these longer term multiplier impacts.

unit of output, or purchasing more or less imports), changes in tax rates, and changes in the consumption patterns. Such structural changes could result in smaller or larger multiplier impacts depending on the nature of the change. However, there was not data available to suggest what structure changes may have occurred or to conduct the necessary updating.

As with any model of a complex economy, I-O models have their limitations. For example, I-O models assume constant returns to scale (i.e., no economies or diseconomies of scale) and a fixed input structure with no substitution of inputs (e.g., one fuel type cannot be substituted for another). Furthermore, due to the large amount of data collection and analysis required, the I-O data can be released several years after the period on which they are based, so may not precisely represent current conditions. Nevertheless, I-O models are the most widely accepted and well-established means for estimating multiplier impacts and are based on data unparalleled in its detail and breadth.

Further details on the I-O tables, including the derivation of the multipliers, are provided in Appendix E.

2.5 Study Time Frame

The employment survey was conducted between October and November 2014 and the results reflect employment and financial information for calendar year 2013.
3 Overview of Cork Airport

“Cork has great potential to enhance and expand its tourism profile. The region’s success in information technology, pharmaceuticals and bio-tech has led to a diverse and sophisticated offering in retail, restaurants and entertainment. It also has a strong cultural heritage, particularly in music and the arts and acts as a gateway to the natural beauty of the south west of Ireland and the Wild Atlantic Way. It is also a gateway to the East and South ‘Heritage Region’ which will be the new tourism proposition for Ireland when it is launched in 2015 and it will open up this area for visitors to explore.

Cork Airport will play a vital role in Cork achieving its tourism potential. It is the second largest visited county outside of Dublin and has seen an increase in visitor numbers, as well as accolades from Lonely Planet, Travel Publications, etc in recent years. Its existing network of services to major centres across Europe makes Cork attractive and convenient to both short- and long-stay visitors, and the sustainable growth of air service at Cork Airport is seen as a vital element in realising Cork’s tourism potential.”

Fáilte Ireland, November 2014

Cork Airport, operated by daa, is the second largest airport in the Republic of Ireland in terms of passenger volumes, behind Dublin but ahead of Shannon (it is the third largest airport on the island of Ireland, after Dublin and Belfast International). Located approximately 8 kms south of Cork City, the airport acts as an important gateway to the South-West region of Ireland and the newly launched iconic Wild Atlantic Way coastal drive.

3.1 Traffic at Cork Airport

In 2014, passenger movements at Cork Airport totalled 2.14 million passengers. The breakdown of passenger traffic by region is shown in Figure 3-1. As can be seen, traffic to/from the UK accounted for over half (54.4%) of passenger traffic in 2014, with Continental Europe accounting for most of the remaining traffic. Domestic traffic accounted for 3,801 passengers and other destinations 1,190 passengers.
Passenger traffic at Cork Airport has seen periods of growth and contraction over the past eighteen years. Between 1995 and 2008, passenger movements at the airport increased from 1.0 million to 3.3 million, at an impressive average growth rate of 5.3% per annum. However, since 2008, there has been a decline in passenger traffic at Cork Airport. This should be seen in the context of traffic declines experienced across the country, largely the result of the global financial crisis and severe recession in Ireland (the Irish economy was in recession for all of 2008 and 2009, contracting by over 10% in that period).\textsuperscript{10}

\textbf{Figure 3-2} compares the traffic performance of Cork Airport with other airports in Ireland between 2008 and 2013. While Cork has experienced a decline of 31% over this period, this is a smaller decline than experienced at Shannon and Waterford, and similar to that of Kerry. Excluding Ireland’s hub airport, Dublin, the Irish air market has declined 41%, so Cork has performed better than the regional airport average.

---

\textsuperscript{10} Source: Central Statistics Office Ireland.
Figure 3-2: Passenger Traffic Declines at Irish Airports, 2008 to 2013

<table>
<thead>
<tr>
<th></th>
<th>2008 Passengers (Thousands)</th>
<th>2013 Passengers (Thousands)</th>
<th>Percentage Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dublin Airport</td>
<td>23,467</td>
<td>20,167</td>
<td>-14%</td>
</tr>
<tr>
<td>Cork Airport</td>
<td>3,259</td>
<td>2,258</td>
<td>-31%</td>
</tr>
<tr>
<td>Shannon Airport</td>
<td>3,170</td>
<td>1,400</td>
<td>-56%</td>
</tr>
<tr>
<td>Knock Airport</td>
<td>631</td>
<td>666</td>
<td>+6%</td>
</tr>
<tr>
<td>Kerry Airport</td>
<td>426</td>
<td>306</td>
<td>-28%</td>
</tr>
<tr>
<td>Waterford Airport</td>
<td>144</td>
<td>28</td>
<td>-80%</td>
</tr>
<tr>
<td>Other Airports</td>
<td>405</td>
<td>67</td>
<td>-84%</td>
</tr>
<tr>
<td><strong>Total in Ireland</strong></td>
<td><strong>31,501</strong></td>
<td><strong>24,891</strong></td>
<td><strong>-21%</strong></td>
</tr>
<tr>
<td><strong>Total Excluding Dublin</strong></td>
<td><strong>8,034</strong></td>
<td><strong>4,724</strong></td>
<td><strong>-41%</strong></td>
</tr>
</tbody>
</table>

Source: daa for Dublin and Cork; airport website for Shannon Airport; CSO Ireland for all other airports.

The traffic declines at Cork Airport have largely been in two sectors:

- Domestic traffic, which has dropped to negligible levels, from 443,252 passengers in 2008 to 3,801 in 2014. This decline is due, in part, to the vastly improved road infrastructure between Cork and Dublin.

- UK, which declined from 1,595,517 passengers in 2008 to 1,167,241 (a 27% decline). Most of this lost traffic has been to/from regional UK airports (Birmingham, East Midlands, Liverpool, Cardiff), airports which have seen a general reduction in airline capacity following the global financial crisis and the recession in the UK.

In addition to 2.14 million passengers, in 2014, Cork Airport also handled 729 tonnes of air cargo, and 41,056 aircraft movements.


12 Source: Cork Airport.
3.2 Overview of Cork Airport’s Air Services

As Ireland’s second largest airport, and gateway to the South-West of Ireland, Cork Airport serves a multitude of destinations throughout Europe. Figures 3-3 shows the scheduled passenger routes served from Cork Airport in 2014. A total of 42 non-stop scheduled routes were operated from Cork Airport primarily by Aer Lingus, Stobart Air (operator of Aer Lingus’s regional services) and Ryanair. Of these destinations, 19% were served by more than one carrier, and 17% were operated on at least a daily basis year round. Furthermore, 31% of destinations had at least five-times weekly service and 45% had twice weekly service year round. On average, 25 scheduled flights depart from Cork Airport every day.

Figure 3-3: Cork Airport’s Scheduled Route Network (2014)

Source: Diio Schedule Data for 2014.

13 Source: Diio schedule data for 2014.
14 Ibid.
As summarised in Figure 3-4, passenger air services at Cork Airport connect Cork and South-West Ireland to 11 countries across Europe. Scheduled air service from Cork Airport connects the region to major international gateways in Europe (e.g., London Heathrow, Amsterdam Schiphol, and Paris Charles de Gaulle), regional business centres, and leisure destinations along the Mediterranean coast and Canary Islands.

Figure 3-4: Countries Directly Connected to Cork by Air Service from Cork Airport (2014)

<table>
<thead>
<tr>
<th>Europe [11 countries]</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium (1)</td>
<td>Poland (4)</td>
</tr>
<tr>
<td>France (6)</td>
<td>Portugal (2)</td>
</tr>
<tr>
<td>Germany (1)</td>
<td>Spain (10)</td>
</tr>
<tr>
<td>Italy (3)</td>
<td>Switzerland (1)</td>
</tr>
<tr>
<td>Lithuania (1)</td>
<td>United Kingdom (12)</td>
</tr>
<tr>
<td>Netherlands (1)</td>
<td></td>
</tr>
</tbody>
</table>

Source: Diio Schedule Data for 2014.
Figures in parenthesis indicate the number of routes operated to that country.

By comparison, in 2014, Shannon Airport had 33 routes in total (21% less than Cork) and connected to 8 European countries (plus routes to North America). Kerry had 5 overseas routes serving 4 European countries and Waterford had 2 routes to the UK.
3.3 Measuring Airport Connectivity

“In 2013, international conferences and meetings facilitated through the Cork Convention Bureau brought in €8.2 million in spending to the city, an average of €1,400 per delegate. This convention activity supported an estimated 300 jobs.

Cork Airport’s air connectivity is absolutely vital to attracting conventions to the city. The ability for delegates to travel easily to and from Cork is a key factor in determining whether the convention will be held there. Over 80% of the international convention business in Cork is with markets that have direct air service to Cork Airport. The sustainable growth and development of air services at Cork Airport will open up new conference opportunities.”

Cork Convention Bureau, November 2014

Connectivity can be seen not simply as a matter of the number of routes or number of frequencies operated. Connectivity is fundamentally about access to markets and regions. A location that has continental and intercontinental linkages only to a limited number of destinations will be a less desirable place to do business. Travel costs for staff and for goods will be higher due to the need to purchase multiple flight legs to move people and goods. On the other hand, a community with direct access to a broad range of markets, especially the fastest growing markets, will be a lower cost place to do business. It will also enhance customer servicing and goods and support staff can easily and quickly get to a range of destinations.

To capture this, the International Air Transport Association (IATA) has developed a measure of air service connectivity which aims to measure the quality of the air transport network from the point of view of the country’s economy. The IATA connectivity index seeks to measure the scope of access between an individual airport, region or country, and the global economy. The index measures the number and size (in terms of passenger air traffic) of destinations served, as well as the frequency of service to each destination and the number of onward connections available from those destinations. Thus, the index recognises that connections to major global gateways provide greater global connectivity than connections to the same number of spoke ends. For example, direct service to 40 small regional destinations does not have the same importance as direct connections to 40 major global markets.

The IATA index is calculated from airline schedule data for passenger services and is based on both domestic and international services. The connectivity index measures the number of frequencies and available seats to a particular destination. It then weights the number of available seats by the size of the destination airport (in terms of number of passengers handled in each year). This weighting reflects both the size and economic importance of the destination and the potential for convenient onward connections.

For example, in 2013, Atlanta airport was the world’s largest airport and so was given a weighting of one. London Heathrow, which handles 80% of the number of passengers handled by Atlanta, was given a weighting of 0.80. Therefore, if an airport has 1,000 seats available to Atlanta it is given a weighted total of 1000. But if it also has 1,000 seats
available to London Heathrow, these are only given a weighted total of 800. The weighted totals are then summed for all destinations (and divided by a scalar factor of 1,000) to determine the connectivity indicator.

The connectivity index is therefore calculated as:

\[
\frac{\text{Number of destinations} \times \text{Weekly Frequency} \times \text{Seats per flight}}{\text{Weighted by the Size of the Destination Airport}}
\]

Scalar factor of 1000

A higher figure for the connectivity indicator denotes a greater degree of access to the global air transport network. **Figure 3-5** shows the connectivity indexes of Ireland’s top airports in 2013. Unsurprisingly, Dublin Airport has the highest connectivity score of the Irish airports, nearly four times that of all the other airports combined. Cork has the second highest score in Ireland. The range and density of Cork’s European network provides the region with high levels of connectivity. The scale of Cork’s services to major hubs such as London Heathrow, Paris and Amsterdam ensures a better quality of connectivity than other regional Irish airports, enabling easier links to the wider world.

**Figure 3-5: The Connectivity Rankings of Ireland's Airports, 2013**

Source: Based on Diio Schedule Data and Passenger Traffic Data for 2013.
The strength of Cork’s connectivity is further illustrated in comparison with regional airports within the United Kingdom, shown in Figure 3-6. As can be seen, Cork has a higher connectivity score than Belfast International, Leeds Bradford, East Midlands and Liverpool despite those airport handling larger passenger volumes than Cork in 2013. This is the result of Cork’s connections into hub airports and business centres, rather than to predominately leisure destinations, as is the case with some of the UK regional airports.\textsuperscript{15}

**Figure 3-6: Connectivity of Cork Airport in Comparison with Regional UK Airports, 2013**

Source: Based on Diio Schedule Data and Passenger Traffic Data for 2013. The 2013 passenger (pax) volumes in millions for each of the airport are provided on the X-axis.

\textsuperscript{15} Belfast City has a higher connectivity score than Belfast International due in part to its frequent service to Heathrow, operated by Aer Lingus and British Airways. Prior to 2013, Aer Lingus operated its Heathrow service from Belfast International.
4 Direct Employment Impacts of Airport Activity

“Cork Airport is one of the primary drivers in the Southern Region serving a population base of 1.3 million. Its continued development and expansion is vital for business growth in the region. It is essential we have a balanced spatial strategy for the country and accordingly Cork Airport must be enabled to develop in tandem with this logic.

The Cork region itself has a growing population in excess of half a million. Cork makes the second largest economic contribution to the Irish economy after Dublin. Cork is particularly strong in global growth sectors of technology, bio pharma and life sciences, agribusiness and food, energy, and tourism. Major global businesses are located in the region such as Pfizer, Novartis, GlaxoSmithKline, Eli Lily, EMC, Apple and Amazon, along with thriving indigenous businesses, plus over 35,000 students and highly regarded R&D institutions such as Tyndall National Research Institute. Cork Airport plays a pivotal role in supporting all these enterprises and its importance to the economic & social life of the region cannot be overstated.”

Cork Business Association, November 2014

This chapter documents the economic impact of on-going operations at Cork Airport in 2013 in terms of its direct employment and income/wages. Breakdowns of the employment and economic impact by industry, occupation and region are also provided.

4.1 Overall Direct Employment

The direct employment impacts of Cork Airport are provided in Figure 4-1. Direct employment related to ongoing operations at Cork Airport amounts to 1,920 direct jobs. After adjusting for part-time and seasonal employment, these jobs equate to 1,650 full-time equivalents (FTEs).

These employees received an estimated total of €70.6 million in income/wages, providing an average of €42,800 per FTE. This is 9% higher than the national full-time earnings in 2013.\(^\text{16}\)

\(^{16}\) Based on data from Central Statistics Office Ireland, average earnings were €21.70 per hour in 2013. Multiplied by average hours per annum (see Appendix C), the average full-time wage is €39,300.
**Figure 4-1: Direct Employment Impacts Generated by Cork Airport**

<table>
<thead>
<tr>
<th>Direct Employment Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Jobs</td>
</tr>
<tr>
<td>Full-Time Equivalent Jobs (FTEs)</td>
</tr>
<tr>
<td>Income/Wages</td>
</tr>
<tr>
<td>Average Income per FTE</td>
</tr>
</tbody>
</table>

Numbers may not add up due to rounding.

As shown in **Figure 4-2**, the survey results show that the majority (71%) of direct jobs generated by Cork Airport are permanent full-time positions, while 18% are permanent part-time positions and 11% are seasonal positions (e.g., additional employment at busy times of the year).

**Figure 4-2: Full-Time, Part-Time and Seasonal Jobs Generated by Cork Airport**

<table>
<thead>
<tr>
<th>Direct Jobs</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permanent Full-Time Jobs</td>
<td>1,360</td>
</tr>
<tr>
<td>Permanent Part-Time Jobs</td>
<td>340</td>
</tr>
<tr>
<td>Seasonal Jobs</td>
<td>220</td>
</tr>
<tr>
<td><strong>Total Jobs</strong></td>
<td><strong>1,920</strong></td>
</tr>
</tbody>
</table>

Numbers may not add up due to rounding.
4.2 Direct Employment by Business Type

A breakdown of the direct employment at Cork Airport is provided in Figure 4-3:

- **Airlines** account for 470 jobs in 2013, approximately a quarter of the direct employment generated by Cork Airport. This category includes scheduled and charter air carriers.
- **Ground Transport** includes taxis, buses, car rental and car parking. This category accounts for 340 jobs, 18% of all direct employment.
- The **airport company** is the third largest employer group at the airport, accounting for 290 jobs in 2013, 15% of total direct employment. This comprises just over 260 jobs at Cork Airport plus 24 jobs at daa headquarters in Dublin assigned to the management of Cork Airport.
- **Ground Handling and Other Support** includes ground-handling (loading and unloading of baggage, aircraft cleaning and turnaround, etc.), aircraft fuelling, private security services and other support services. This category of business employs 250 jobs, 13% of the total.
- **Maintenance, Repair and Overhaul** accounts for 170 jobs, 9% of total direct employment. These organisations manage the mechanical requirement of the aviation industry, such as aircraft maintenance and repair and parts supply and manufacturing.
- **Government agencies** include the Irish Aviation Authority (including air traffic control), and customs and immigration. These agencies account for 130 jobs (7% of employment).
- **Retail and Food & Beverage** services in the Cork Airport buildings account for 130 jobs, 7% of the total.
- **Logistics, Warehousing and FBOs (Fixed Base Operation or General Aviation)** account for 110 jobs, 6% of total employment.
- **Hotels**, providing accommodation for airline crews and transiting passengers, account for 40 jobs, 2% of employment.\(^\text{17}\)

\(^\text{17}\) Surveyed hotels were asked to estimate the proportion of their business that related to accommodating airline crews and transit passengers. Only that proportion of the employment has been counted as part of the direct economic impact to avoid double-counting with catalytic (tourism) impacts.
Figure 4-3: Direct Employment (Jobs) by Business Type

- **Airlines**: 460
- **Airport Company**: 290 (266 at Cork and 24 at Dublin)
- **Ground Transport**: 340
- **Ground Handling & Other Support**: 250
- **Maintenance, Repair, & Overhaul**: 170
- **Logistics, Warehousing, & FBOs**: 110
- **Retail, Food, & Beverage**: 130
- **Government Agencies**: 130
- **Hotels**: 40

Cork Airport Economic Impact Study
4.3 Direct Employment by Occupation

Cork Airport is a source of a wide variety of job categories and positions. Figure 4-4 shows the distribution of direct jobs by job category in 2013. As can be seen, the largest occupation type is Food Preparation / Cleaning / Manual, accounting for 19% of the employment (370 jobs). Over a quarter (26%) of the employment is in managerial or skilled employment (professional/managers, pilots, air traffic control and craftsmen/mechanics).

Figure 4-4: Direct Employment by Occupation (Jobs)

<table>
<thead>
<tr>
<th>Job Category</th>
<th>Direct Jobs</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food Preparation / Cleaning / Manual</td>
<td>370</td>
<td>19%</td>
</tr>
<tr>
<td>Professional / Managers</td>
<td>320</td>
<td>17%</td>
</tr>
<tr>
<td>Drivers 18</td>
<td>320</td>
<td>17%</td>
</tr>
<tr>
<td>Cashiers / Customer Services</td>
<td>240</td>
<td>13%</td>
</tr>
<tr>
<td>Aircraft Loading / Unloading / Ramp</td>
<td>180</td>
<td>9%</td>
</tr>
<tr>
<td>Craftsmen / Mechanics</td>
<td>110</td>
<td>6%</td>
</tr>
<tr>
<td>Security / Government</td>
<td>110</td>
<td>6%</td>
</tr>
<tr>
<td>Flight Crew</td>
<td>60</td>
<td>3%</td>
</tr>
<tr>
<td>Pilots</td>
<td>30</td>
<td>2%</td>
</tr>
<tr>
<td>Air Traffic Controllers</td>
<td>30</td>
<td>2%</td>
</tr>
<tr>
<td>Other</td>
<td>150</td>
<td>7%</td>
</tr>
<tr>
<td><strong>Total Jobs</strong></td>
<td><strong>1,920</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Numbers may not add up due to rounding.

18 Includes drivers of on-airport vehicles, taxis, shuttle buses, courier trucks, etc.
4.4 Direct Employment by Location

The location of the employment by region is provided in Figure 4-5. The location is based on the location of business where the employment takes place (rather than the residence of the employee). As can be seen, 73% of the direct employment is at the airport, with a further 15% in County Cork, and 12% in Munster or the rest of Ireland.\(^\text{19}\)

Figure 4-5: Direct Employment by Location (Jobs)

<table>
<thead>
<tr>
<th>Location</th>
<th>Direct Jobs</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>At Airport (On-Site)</td>
<td>1,400</td>
<td>73%</td>
</tr>
<tr>
<td>Rest of County Cork</td>
<td>280</td>
<td>15%</td>
</tr>
<tr>
<td>Rest of Munster</td>
<td>50</td>
<td>3%</td>
</tr>
<tr>
<td>Rest of Ireland</td>
<td>190</td>
<td>10%</td>
</tr>
<tr>
<td><strong>Total Jobs</strong></td>
<td><strong>1,920</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Numbers may not add up due to rounding.

\(^{19}\) Taxi driver employment has been allocated to Rest of County Cork.
5 Indirect and Induced Impacts of Airport Activity

“As noted previously, the economic impact of Cork Airport does not end with the direct impacts. Other sectors of the economy benefit from the activities at Cork Airport. As described in Section 1.2, this includes indirect impacts in businesses that supply the goods and services to the direct activities linked to the airport, and induced impacts resulting from direct and indirect employees spending their wages in the general economy. The indirect and induced impacts were estimated using economic multipliers derived from government data, detailed in Chapter 2 and the appendices. The direct GVA was also estimated using these economic multipliers.

5.1 Overall Multiplier Impacts of Cork Airport

The direct and multiplier economic impact of Cork Airport is summarised in Figure 5-1. Using economic multipliers, it was estimated that in addition to the 1,920 direct jobs, the airport generated 1,180 indirect jobs (1,050 FTEs) and 1,450 induced jobs (1,280 FTEs) in 2013. In total, the employment generated was 4,550 jobs (3,980 FTEs), earning a total of € 160 million in income/wages. The total GVA generated was € 306 million.
Figure 5-1: Direct and Multiplier Impacts of Cork Airport

<table>
<thead>
<tr>
<th>Impact Type</th>
<th>Jobs</th>
<th>FTEs</th>
<th>Income (€ Million)</th>
<th>GVA (€ Million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct</td>
<td>1,920</td>
<td>1,650</td>
<td>70.6</td>
<td>133.7</td>
</tr>
<tr>
<td>Indirect</td>
<td>1,180</td>
<td>1,050</td>
<td>43.2</td>
<td>82.3</td>
</tr>
<tr>
<td>Induced</td>
<td>1,450</td>
<td>1,280</td>
<td>45.9</td>
<td>89.9</td>
</tr>
<tr>
<td>Total</td>
<td>4,550</td>
<td>3,980</td>
<td>159.8</td>
<td>305.9</td>
</tr>
</tbody>
</table>

Numbers may not add up due to rounding.

The ratio of indirect+induced jobs to direct jobs is 1.35, indicating that there are 1.35 indirect and induced jobs generated for each direct job.\(^{20}\) Similarly, the ratio for GVA is 1.29 – for each €1 of direct GVA, there is € 1.29 of indirect and induced GVA.\(^{21}\) While, as noted in Section 2.5, these multiplier ratios can vary depending on the nature of the industry and the structure of the economy, the ratios in this study are in line with results for other airport elsewhere in the world. For example, a 2014 study of Heathrow airport found an indirect+induced jobs to direct jobs ratio of 1.29.\(^{22}\) A study for Munich airport produced a ratio of 1.64,\(^{23}\) and for Brussels Airport the ratio was estimated to be 1.90.\(^{24}\)

The total GVA estimate of € 306 million includes the nearly € 160 million in income/wages, as GVA is made up of income/wages, operating surpluses (profits) and consumption of fixed capital. Approximately 52% of the GVA impact is income/wages. The remaining 48% of GVA comprises the operating surplus of the relevant firms and their consumption of capital. The aviation industry is fairly capital intensive (e.g., aircraft, specialised equipment, airport infrastructure, etc.) and therefore capital consumption contributes considerably to the GVA figure.

\(^{20}\) \((4,550 / 1,920) – 1 = 1.35.\)
\(^{21}\) \((305.9 / 133.7) – 1 = 1.32.\)
5.2 Multiplier Impacts by Region

The estimated direct and multiplier impacts by region are provided in Figure 5-2. The location of the multiplier impacts were estimated using responses to survey questions regarding the location of the business spending on goods and services, and CSO Ireland data on the national distribution of employment and GVA.

Including multiplier impacts, 69% of the employment (3,110 jobs) occurs in County Cork, due to the presence of the airport in that county. A further 6% (250 jobs) occurs in the rest of Munster and 25% (1,160 jobs) occurs in the rest of Ireland.

Figure 5-2: Direct and Multiplier Impacts of Cork Airport by Region

<table>
<thead>
<tr>
<th>Region</th>
<th>Direct</th>
<th>Indirect</th>
<th>Induced</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cork Airport/Country Cork</td>
<td>1,590</td>
<td>790</td>
<td>730</td>
<td>3,110</td>
</tr>
<tr>
<td>Rest of Munster</td>
<td>50</td>
<td>100</td>
<td>100</td>
<td>250</td>
</tr>
<tr>
<td>Rest of Ireland</td>
<td>280</td>
<td>290</td>
<td>590</td>
<td>1,160</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1,920</td>
<td>1,180</td>
<td>1,420</td>
<td>4,520</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Region</th>
<th>Direct</th>
<th>Indirect</th>
<th>Induced</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cork Airport/Country Cork</td>
<td>104.0</td>
<td>52.6</td>
<td>44.5</td>
<td>211.9</td>
</tr>
<tr>
<td>Rest of Munster</td>
<td>3.1</td>
<td>6.4</td>
<td>6.2</td>
<td>16.4</td>
</tr>
<tr>
<td>Rest of Ireland</td>
<td>18.6</td>
<td>19.8</td>
<td>35.8</td>
<td>77.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>125.7</td>
<td>78.8</td>
<td>86.4</td>
<td>305.9</td>
</tr>
</tbody>
</table>

Numbers may not add up due to rounding.
6 Facilitating the Wider Economy – The Catalytic Impact of Cork Airport

“The southwest attracts 28% of our tourists, and as the most visited region outside Dublin, a successful, sustainable Cork Airport gateway is crucial to the continued success of the region as a destination

As a gateway to the Wild Atlantic Way, the continued enhancement of Cork Airport in terms of routes and passenger facilities is a vital component in the multi-million Euro international promotion of this world class visitor attraction.”

Tourism Ireland, November 2014

Chapter 3 describes the connectivity that Cork Airport provides for the local and national economy. The air services at Cork Airport have contributed the direct, indirect and induced economic impacts documented in Chapters 4 and 5. However, it is not just the air transport sector, its suppliers and employees that benefit from air services at Cork Airport. The air services at Cork Airport facilitate many other sectors of the economy, including tourism and trade, and contribute to Ireland’s attractiveness as a place to do business and to invest. Industries and activities that would otherwise not exist in the country can be attracted by improved air transport connectivity.

As introduced in Chapter 2, the role of air transport in facilitating other parts of the economy is referred to as catalytic impacts. These impacts are not generally reflected in Input-Output models of the economy of the sort used to estimate indirect and induced impacts. Input-Output models reflect the purchasing decisions of businesses within the economy, whereas catalytic impacts capture a different relationship between businesses. For example, hotels, restaurants and entertainment places in Ireland do not purchase services from airlines to any great extent, but they do benefit from the large number of tourists arriving in Ireland by air that spend money in their businesses. Similarly, a multinational company’s decision to locate an office or facility in Ireland partially on the basis of air connectivity is not reflected in the Input-Output models.

Section 6.1 below discusses in more detail the nature of these catalytic impacts and growing evidence of its impact and magnitude. This is followed in Sections 6.2 and 6.3 by estimates of the catalytic impacts facilitated by Cork Airport.

25 These businesses may purchase air services to support their business activities (e.g., visits to headquarters) but not for the larger number of tourists that benefit their business.
6.1 Overview of Catalytic Impacts

As discussed in Chapter 1, catalytic impacts capture the way in which the aviation facilitates the business of other sectors of the economy. This comprises:

- **Tourism** – air service facilitates the arrival of larger numbers of tourists to a country. This includes business as well as leisure tourists. The spending of these tourists can support a wide range of tourism-related businesses: hotels, restaurants, entertainment and recreation, car rentals, and others.
- **Trade** – air transport provides connections to export markets for both goods and services.
- **Investment** – a key factor many companies take into account when making decisions about the location of offices, manufacturing plants or warehouses in proximity of an international airport.
- **Productivity** – air transportation offers access to new markets which in turn enables businesses to achieve greater economies of scale. Air access also enables companies to attract and retain high quality employees.

A number of studies have demonstrated that air transportation plays an important role in trade, investment and business location decisions, while additional studies have uncovered empirical evidence demonstrating a strong linkage between air service and employment and economic growth. Provided below is a summary of this research examining the catalytic impact of aviation, taken from academic and industry research.
### 6.1.1 Trade

A number of research papers have produced evidence that aviation positively contribute to the trade of both goods and services

<table>
<thead>
<tr>
<th>Paper</th>
<th>Methodology</th>
<th>Key Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cech (2004)</td>
<td>Used a cross-section statistical comparison method to investigate how air cargo services affect the economies of 125 U.S. counties.</td>
<td>Higher levels of air cargo services contribute to increased earnings and increased employment.</td>
</tr>
<tr>
<td>EUROCONTROL (2005)</td>
<td>The study estimated the net contribution of air transportation to trade (i.e., export minus imports).</td>
<td>Net contribution of air transportation to trade was €55.7 billion in 2003 across the 25 current EU members.</td>
</tr>
<tr>
<td>UK Institute of Directors (2008)</td>
<td>Surveyed 500 UK businesses about their use and the importance of air transportation.</td>
<td>The use of air travel strongly linked to business trade and sales. Almost three quarters of businesses using passenger air services said that their business would be adversely affected if the amount of air travel they could undertake was significantly curtailed.</td>
</tr>
<tr>
<td>Poole (2010)</td>
<td>Econometric analysis of U.S. trade and travel data from 1993 to 2013.</td>
<td>A 10% increase in business travel to the U.S. by non-residents led to a 1.2% increase in the volume of exports from the U.S. and 0.3% increase in export margins. The effect was strongest for travel from non-English speaking countries, suggesting that business travel help overcome language barriers in trade relationships.</td>
</tr>
<tr>
<td>PWC (2013)</td>
<td>Examined the relationship between the UK’s international air seat capacity and international trade, controlling for other factors affecting trade.</td>
<td>A 10% increase in seat capacity increased goods exports by 3.3% and goods imports by 1.7%.</td>
</tr>
</tbody>
</table>

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27 Cooper, A. and Smith, P. (2005), “The Economic Catalytic Effects of Air Transport in Europe,” Commissioned by EUROCONTROL. EUROCONTROL is a civil and military organisation established in 1963 to facilitate a safe, seamless pan-European Air Traffic Management (ATM) system.


### 6.1.2 Investment and Business Location

The impact of aviation on investment and business location decisions has been the subject of a number of papers. These papers have found evidence of air connectivity contributing to increased investment and beneficial location decision for the surrounding regions or the country.

<table>
<thead>
<tr>
<th>Paper</th>
<th>Methodology</th>
<th>Key Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hansen and Gerstein (1991)(^{31})</td>
<td>Used data from 1982 to 1987, the analysis related the amount of Japanese investment in each U.S. state to measures of level of air service operated between Japan and that state (and other background factors).</td>
<td>The amount of Japanese investment in each U.S. state was causally linked to the air service between Japan and that state.</td>
</tr>
<tr>
<td>EUROCONTROL (2005)(^{32})</td>
<td>Analysed the relationship between air transportation and business investment in the EU.</td>
<td>A 10% increase in air transportation usage increases business investment by 1.6% in the long run (the impact takes approximately five years to fully manifest).</td>
</tr>
<tr>
<td>IATA (2005)(^{33})</td>
<td>IATA surveyed 625 businesses in five countries (China, Chile, United States, Czech Republic and France).</td>
<td>25% of surveyed businesses in five countries indicated that 25% of their sales were dependent on good air transport links; 30% of Chinese firms reported that they had changed investment decisions because of constraints on air services.</td>
</tr>
<tr>
<td>Bel and Fageda (2008)(^{34})</td>
<td>Statistically analysed the relationship between international air service and the location of large firm’s headquarters across major European urban areas.</td>
<td>A 10% increase in supply of intercontinental air service was associated with a 4% increase in the number of large firm headquarters located in the corresponding urban area.</td>
</tr>
</tbody>
</table>

---


\(^{32}\) Cooper, A. and Smith, P. (2005), “The Economic Catalytic Effects of Air Transport in Europe,” Commissioned by EUROCONTROL. EUROCONTROL is a civil and military organisation established in 1963 to facilitate a safe, seamless pan-European Air Traffic Management (ATM) system.


### 6.1.3 Impact on Employment, Economic Growth and Productivity

The increased trade, investment, business activity and tourism facilitated by aviation ultimately results in increases in economic productivity (e.g., GDP per worker), in GDP and in employment (e.g., increased trade facilitated by air services results in increased employment in the businesses producing the traded goods and services). A number of research papers have examined the overall impact on the economy and employment as a result of the catalytic effects of aviation.

<table>
<thead>
<tr>
<th>Paper</th>
<th>Methodology</th>
<th>Key Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Button, Lall, Stough and Trice (1999)(^{37})</td>
<td>Used data from 321 U.S. metropolitan areas in 1994 to regressed high-tech employment against a number of controlling factors including a dummy indicating that the region was served by a hub airport.</td>
<td>The analysis found that the presence of a hub airport increased high-tech employment by an average of 12,000 jobs in a region.</td>
</tr>
<tr>
<td>Button and Taylor (2000)(^{38})</td>
<td>Used data for 41 metropolitan areas in the U.S. to regress “new economy” employment against a number of control factors including the number of direct routes to Europe offered by airports in the region.</td>
<td>Increasing the number of routes between the U.S and Europe from 3 to 4 at an airport generated approximately 2,900 “new economy” jobs in the surrounding region.</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Paper</th>
<th>Methodology</th>
<th>Key Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brueckner (2002)&lt;sup&gt;39&lt;/sup&gt;</td>
<td>Regressed employment in 94 metropolitan areas in the U.S. against a number of factors including measures of air service.</td>
<td>A 10 percent increase in passenger enplanements in a metropolitan area leads to an approximately 1 percent increase in employment in service-related industries.</td>
</tr>
<tr>
<td>Ishutkina and Hansman (2009)&lt;sup&gt;40&lt;/sup&gt;</td>
<td>Aggregate and individual country-level data were analysed in terms of the relationship between air transportation passengers and GDP. A data analysis of 139 countries over a time period of 30 years (1975 to 2005).</td>
<td>Found statistical evidence of a (two-way) feedback relationship between air transport and economic activity.</td>
</tr>
<tr>
<td>PWC (2013)&lt;sup&gt;41&lt;/sup&gt;</td>
<td>Estimated an Error Correction Model of UK GDP and air seat capacity between 1991 and 2010.</td>
<td>A 10% change in the growth rate of seat capacity leads to approximately a 1% change in the growth rate of GDP. The analysis also found evidence of a two-way relationship between the variables – GDP growth causes seat capacity and seat growth causes GDP growth.</td>
</tr>
<tr>
<td>ACI Europe/InterVISTAS</td>
<td>Analysed the relationship between national air connectivity and GDP per capita using data for 40 European countries between 2000 and 2012.</td>
<td>This recently completed analysis found that a 10% increase in connectivity was associated with an increase in GDP per capita of 0.6%. Additional analysis found evidence that this relationship was two-way. That is, as an economy grows, it supports a larger air transport sector, but it appears to also be the case that growth in air transport supports economic growth.</td>
</tr>
</tbody>
</table>

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6.1.4 Conclusions

A body of research has developed over the last 15 years or so which has examined and quantified the contribution of air transport to trade, investment and economic growth. Through the use of different empirical methods and data sets, this research has consistently found a significant and positive relationship between aviation and economic growth. Furthermore, much of the research has established that air transport growth has been the cause of economic growth, rather than simply economic growth leading to increased air transport levels.

“Tourism is critically important to the west of Ireland, with the accommodation and food services sector one of the main employers in the region. In 2010, 12% of all tourists to the South-West region arrived through Cork Airport.”

Irish Tourist Industry Confederation’s New Directions for Tourism in the West, 2011.

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42 Source: Irish Tourist Industry Confederation’s New Directions for Tourism in the West, 2011. 83% of visits to the South-West arrived by air – 54% via Dublin, 12% via Cork and the reminder via other airports.
6.2 Linkage Between Cork Airport’s Connectivity and the Economy

To explore Cork Airport’s contribution to the national and regional economy, analysis was conducted of the relationship between connectivity at the airport and key economic indicators. Connectivity at Cork Airport was measured using the IATA connectivity index described in Section 3.4, and the economic indicators were:

- Inbound tourism to the South-West region of Ireland
- The regional GDP of the South-West region.

The scatter plots below show the relationship between connectivity at Cork Airport and each of these economic indicators for a period of around 11 years (depending on data availability). In each case, the plots demonstrate a positive correlation between connectivity and the economic indicator. In some cases, there is considerable scatter of observations which is not surprising, given that there a large number of other factors that affect the economic indicator. However, even given these sources of variation, there appears to be a clear pattern visible with these simple plots.

**Tourism**

**Figure 6-1** shows a clear and fairly strong relationship between connectivity and overseas visitors to the South-West over time. Increases in air connectivity are associated with increases in tourism.

**Figure 6-1: Overseas Visitors to the South-West and Cork Airport Connectivity, 2002-2013**

Source: Diio Schedule Data and Fáilte Ireland.
Economic Growth
Similarly, Figure 6-2 shows a clear and fairly strong relationship between connectivity and regional economic activity.

Figure 6-2: Regional GDP (South-West) and Cork Airport Connectivity, 2000-2011

Source: Diio Schedule Data and Central Statistics Office Ireland.

The plots presented here are indicative of the underlying relationship between Cork Airport’s connectivity and economic development. More detailed analysis would be required to control for other factors affecting the economic indicators (e.g., government policy, general economic environment, etc.) and to establish the nature of the causal relationship between connectivity and the economic indicators. For example, air connectivity alone cannot create tourism – a new air service to a country will most effectively attract tourists when combined with marketing and other tourism indicatives. However, it can be said that poor air connectivity to a region will significantly hinder the ability to attract tourists to that region and to compete for tourism with better connected parts of the world.

The data in these charts is not sufficiently large to conduct a more detailed analysis which controls for other factors. Therefore, use has been made of the results from a larger European study in order to estimate the catalytic impact of Cork Airport. This is described in Section 6.3.
The use and value of Cork Airport by local businesses is further illustrated by the results from the Cork Chamber of Commerce’s Business Air Travel Survey, which is summarised in the box below.

Cork Airport’s Critical Role for Business Connectivity - Cork Chamber of Commerce Business Air Travel Survey

In 2014, the Cork Chamber of Commerce conducted a survey of 139 businesses in and around the Cork region. The respondents range from Small-Medium Enterprises (SMEs) to multinational businesses. Those responding to the survey collectively employ 63,400 locally and in excess of 3 million globally.

The survey found a high use of Cork Airport by businesses in the region: 9% of businesses use the air travel services of Cork Airport on a daily basis, 22% on at least a weekly basis and almost a third (31%) on at least a monthly basis. In total, the responding companies took an estimated minimum of 20,000 air trips in the preceding twelve months.

The survey also found that Cork Airport was an important factor in business location decisions: 93% of respondents indicated that the level of direct air services to/from Cork Airport is important or very important for businesses when deciding to locate or expand within the region. Over three quarters (77%) of businesses would be directly or indirectly affected by the loss of passenger services to/from Cork Airport.

Improved frequency and tailoring of flight times to facilitate working-hours business activities was highlighted as important to encourage even greater uptake of these routes for business travel. The survey found high demand for a number of new routes which, if implemented could contribute to higher levels of business activity amongst existing businesses, attract new inward investment and make a significant contribution to economic development and growth in the South of Ireland. Of these routes, the top four most requested were Frankfurt (47%), Berlin (28%), Boston (27%) and Dublin (27%).
6.3 Estimating the Catalytic Impact of Cork Airport

“The Irish Exporters Association views that there is an opportunity to increase the frequency and connectivity of both passenger and cargo at Cork Airport which would be welcomed by local exporters.”

Irish Exporters Association, January 2015

The economy of Ireland is a diversified knowledge-based economy, focusing on services and high-tech industries and dependent on trade, industry and investment. Adjusted for cost of living (purchasing power parity), the IMF ranks Ireland fifth in Europe in terms of per capita GDP, behind Luxembourg, Norway, Netherlands and Switzerland, but ahead of Germany, Sweden, the UK and France. This is despite the severe economic downturn Ireland suffered starting in 2008. There are now signs that the Irish economy has turned a corner, and is set to return to strong growth.

Outside of Dublin, the South-West and Cork region has the highest levels of GDP per capita and FDI in the country. A large number of multinational corporations have major operations in the Cork region, including Pfizer (Pharmaceutical), GlaxoSmithKline (Pharmaceutical), Johnson & Johnson (Pharmaceutical), EMC (Data Storage), Apple Inc.(European headquarters), Avery Dennison (Financial Shared Services), Siemens Group (tech support) and the Marriott Group (Shared Services and Customer Service Contact Centre), Centocor (Biopharmaceutical Manufacture), McAfee (Security Software, EU Operations Centre), VMware (Enterprise Software and International Support/Shared Services Centre), Clearstream and Amazon. Cork is also home to University College Cork and the Cork Institute of Technology.

A large number of factors have contributed to the South-West’s economic success – business regulations, government policy, taxation, the education and skillset of the local population, geographic location, etc. Nevertheless, the quality and range of air services available at Cork Airport is a contributing factor. The region’s position as centre for pharmaceuticals, information technology and tourism is supported by the air connectivity provided by Cork Airport. Section 6.1 documented research showing the importance of air service to business location decisions and how air service facilitates other sectors of the economy. The air service at Cork Airport helps transports high-value exports around the world and enables employees of multinational businesses to travel to clients, regional offices and global headquarters.

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43 World Economic Outlook Database, IMF, 2013.
44 “Ireland set to become fastest-growing EU economy”, Irish Times, 4 November 2014.
45 Source: Central Statistics Office Ireland.
Quantifying the catalytic impacts that Cork Airport provides to the Irish economy is difficult. To do so in detail would require a massive survey covering the majority of businesses based in Ireland. Even with such a survey, some aspects of the catalytic impact would be difficult to ascertain. While measuring the tourism and trade transported by air would be fairly easy, it is far more difficult to determine and value Cork Airport’s role in affecting business location decisions, investment and expansion decisions, facilitating corporate mobility, and attracting international talent.

An alternative approach is to use generalised parameters drawn from statistical analysis of historical data. This analysis seeks to determine the contribution of air transport to economic growth by examining the relationship between these factors over time or compared between different countries (or both). The analysis attempts to control for other factors that also contribute to economic growth (education spending, government policies, investment, research and development spending, etc.), in order to isolate the impact of air transport. The catalytic impact of Cork Airport was estimated in this way, using findings from recent research.

The connectivity parameter was taken from a study undertaken by InterVISTAS on behalf of ACI Europe. This study was previously referenced in Section 6.1.3. It was selected because it has been recently completed using the most current data and was based on data from 40 European countries including Ireland.

The parameter from that study found that a 10% increase in air connectivity increased GDP per capita by 0.5%. The measure of connectivity used for this parameter is the IATA index presented in Section 3.4. While the outcome from the parameter is expressed in terms of GDP per capita, it captures the aggregate net effect of a range of catalytic impacts, including tourism, trade, investment, business location, etc., which manifest themselves as greater per capita GDP.

To estimate the catalytic impact of Cork Airport, the analysis was based on the growth in air connectivity Cork Airport over the last 20 years – 1993 to 2013. The year 1993 was selected as it ties in with the completion of the European Union’s de-regulation of aviation (the “third package” came into place in 1993, which fully opened up the EU market for all EU airlines) and the start of the Low Cost Carrier phenomenon. It also coincides with the start of the “Celtic Tiger” period of rapid growth in Ireland. Using the results from the ACI Europe study, the analysis estimated the GDP per capita that has been facilitated by the growth in connectivity at Cork Airport since 1993. In other words, it is that amount of GDP that would have been foregone if air connectivity at Cork Airport had been unchanged since 1993. Arguably, this is a conservative approach to estimating the catalytic impacts, as it does not consider connectivity changes prior to 1993.

Between 1993 and 2013, Ireland’s connectivity index (divided by GDP) increased by 66%, of which Cork Airport was responsible for 8.6%. Applying the catalytic parameter, this suggests that the contribution to per capita GDP growth was 8.6% x 0.05 x 66% = 0.28%.

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percentage was applied to the GDP per capita of the Ireland in 1993 (inflated to 2013 prices) and multiplied by the estimated 2013 population of Ireland to estimate the overall GDP impact:

\[ € 35,600 \times 0.28\% \times 4.59 \text{ million} = € 421 \text{ million} \]

The GDP attributable to the catalytic impacts of Cork Airport is the result of incremental economic activity supported and stimulated by air connectivity – increased tourism visits and spending, greater trade, new investment, etc. This activity supports additional jobs in the economy, which were estimated by dividing the GDP estimate by the average GDP per worker. Similarly, the income impacts were based on the average wage figures.

These employment and economic estimates are presented in Figure 6-3. It is estimated that a total of 6,200 jobs are associated with the catalytic impacts of Cork Airport, earning €216 million in income and wages. The catalytic impacts of Cork Airport facilitated €421 million in GDP. This catalytic impact is assumed to occur almost entirely in the South-West region, suggesting that the catalytic impacts were approximately 1.5% of the South-West’s GDP.

**Figure 6-3: The Catalytic Impacts of Cork Airport**

<table>
<thead>
<tr>
<th>Impact Type</th>
<th>Total Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Jobs</td>
<td>6,200</td>
</tr>
<tr>
<td>Full-Time Equivalents (FTEs)</td>
<td>5,500</td>
</tr>
<tr>
<td>Income/Wages (€ Million)</td>
<td>216</td>
</tr>
<tr>
<td>Value-Added (€ Million) (% of South-West GDP)</td>
<td>421 (1.5%)</td>
</tr>
</tbody>
</table>

Numbers may not add up due to rounding.

These catalytic impact figures include the economic activity generated by businesses choosing to locate in Cork due to the airport’s connectivity. Some of this activity is likely located at Cork Airport Business Park, described in the box overleaf.

47 Based on data from the Central Statistics Office Ireland, the GDP of the South-West was estimated to be €29 billion in 2013.
Cork Airport Business Park – Leveraging the Airport’s Connectivity

Cork Airport Business Park is located adjacent to Cork Airport, a three-minute drive from the airport. The park was established in 1998 to help attract national and international businesses to Cork’s already rapidly developing economy and to benefit from the airport’s growing connectivity. Cork Airport Business Park has contributed to region’s diversification from agriculture to pharmaceuticals, life sciences and information technology.

In 2013, over 40 businesses were located at Cork Airport Business Park, employing a total of 3,100 jobs. Major employers include:

- Amazon.com (online retail)
- Citco Data (financial services and IT)
- Bank of New York/AIB (finance)
- RedHat (software)
- Altera (IT)
- IBM (IT)
- Cork International Airport Hotel
- Marriott Hotels (customer services)
- Alimentary Health (pharmaceuticals)
- McKesson (pharmaceuticals)

The airport is not the only reason these and other businesses have chosen to locate at Cork Airport Business Park, but it will have been a contributing factor for many of them, particularly given the international focus of much of these businesses and the degree to which they depend on ease of access for their business development. The catalytic impacts presented in Figure 6-3 captures some of the employment at Cork Airport Business Park that resulted from Cork Airport’s connectivity.49

48 Based on information provided by Cork Airport Business Park.
49 The employment at Cork Airport Business Park is not included in the direct economic impact of the airport.
7 Summary: Total Economic Impact of Cork Airport

The total economic impact both generated and facilitated by Cork Airport is shown in Figure 7-1. Including the activity directly related to the airport, the multiplier impacts that flow from it, and the other sectors of the economy facilitated by the airport, Cork Airport contributes to the employment of 10,710 people, equivalent to 9,480 full-time jobs, earning a total of €373 million. A total of €727 million is contributed to GDP.

**Figure 7-1: Total Economic Impact Generated and Facilitated by Cork Airport (Direct+Indirect+Induced+Catalytic)**

<table>
<thead>
<tr>
<th>Impact Type</th>
<th>Jobs</th>
<th>FTEs</th>
<th>Income (€ Million)</th>
<th>GVA (€ Million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct</td>
<td>1,920</td>
<td>1,650</td>
<td>70.6</td>
<td>133.7</td>
</tr>
<tr>
<td>Indirect</td>
<td>1,170</td>
<td>1,050</td>
<td>43.2</td>
<td>82.3</td>
</tr>
<tr>
<td>Induced</td>
<td>1,420</td>
<td>1,280</td>
<td>45.9</td>
<td>89.9</td>
</tr>
<tr>
<td>Catalytic</td>
<td>6,200</td>
<td>5,500</td>
<td>213.6</td>
<td>420.8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>10,710</strong></td>
<td><strong>9,480</strong></td>
<td><strong>373.4</strong></td>
<td><strong>726.8</strong></td>
</tr>
</tbody>
</table>

Numbers may not add up due to rounding.

The total economic impact broken down by region is provided in Figure 7-3. About 86% of the employment impact (9,310 jobs) occurs within County Cork, with remainder (1,490 jobs) occurring in the rest of Munster and Ireland.

It was estimated that 88% of the €727 million in GVA attributed to Cork Airport (€638 million) occurs in the South-West region. With the GDP of the South-West estimated at €29 billion, this suggests that Cork Airport generates or facilitates an amount equal to 2.2% of the regional economy.  

50 Based on data from the Central Statistics Office Ireland, the GDP of the South-West was estimated to be €29 billion in 2013.
Figure 7-2: Total Economic Impact Generated and Facilitated by Cork Airport by Region (Direct+Indirect+Induced+Catalytic)

<table>
<thead>
<tr>
<th>Impact Type</th>
<th>Jobs</th>
<th>FTEs</th>
<th>Income (€ Million)</th>
<th>GVA (€ Million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cork Airport/Cork County</td>
<td>9,300</td>
<td>8,230</td>
<td>324.5</td>
<td>632.7</td>
</tr>
<tr>
<td>Rest of Munster</td>
<td>250</td>
<td>220</td>
<td>8.6</td>
<td>16.5</td>
</tr>
<tr>
<td>Rest of Ireland</td>
<td>1,160</td>
<td>1,030</td>
<td>40.3</td>
<td>77.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>10,710</strong></td>
<td><strong>9,480</strong></td>
<td><strong>373.4</strong></td>
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</tr>
</tbody>
</table>

Numbers may not add up due to rounding.
Appendix A: Employment Survey Sample

A total of 58 businesses were surveyed about their employment and other aspects of the businesses, of which 46 provided information, a response rate of 79%. The categories of businesses surveyed were:

**Airlines**
All of the airlines operating at the airport, based on contact information provided by Cork Airport, were sent a survey form. This included both passenger and cargo airlines and both home and foreign carriers.

**Airport Tenants**
All tenants on airport property were sent a survey form, using contact information provided by Cork Airport. This included government agencies, security providers, retail and food & beverage outlets, car rental firms, ground handlers, aircraft maintenance and repair, and others.

**Offsite Businesses**
Using directory and internet searches, businesses in Cork were identified in the aviation and aerospace industries with possible linkages to the Cork Airport. The businesses included integrators/couriers not based at the airport, aircraft maintenance and repair, aircraft parts suppliers and manufacturers. To ensure only employment directly linked to the airport was captured, the businesses were asked to state what percentage of their business directly related to the airport. The total employment of the business was then scaled by this percentage.

**Hotels**
A number of other hotels located near to the airport, or known to be used by airlines, were also surveyed. These hotels were asked about the proportion of their business that was related to accommodating transiting passengers or airline crews. Only this proportion of the employment was counted as part of the direct economic impact of the airport to avoid double-counting with catalytic (tourism) impacts.

**Ground Transportation**
Bus and coach companies that partially or wholly serve airport passengers. To ensure only employment directly linked to the airport was captured, the businesses were asked to state what percentage of their business directly related to the airport traffic. The total employment of the business was then scaled by this percentage.
Appendix B: Sample Survey Form
26th September 2014

To All Members of the Cork Airport Business Community:

Re: Cork Airport Economic Impact Study

Dear Sir/Madam,

The success and development of Cork Airport is built on the contribution of a wide range of businesses including your own. Cork Airport wants to understand the range of activities, employment and value of businesses that are associated with the airport and communicate the economic benefits generated for the region and the country as a consequence of the combined airport business community.

In order to achieve this we have commissioned InterVISTAS Consulting LTD and TOBIN Consulting Engineers to conduct a study into the economic impact of Cork Airport.

We are asking all businesses on the airport campus and in close proximity to the airport to complete the attached survey so we can build a full picture of our combined impact.

The completed survey can be submitted directly to InterVISTAS via one of the following methods:

- Clicking on the [Submit Form] icon on the top right hand corner of the survey form;
- Emailing to daasurvey@intervistas.com; or
- Fax to +44-1225-330-209, Attention: Ian Kincaid

We appreciate that some of the information requested in the survey may be of a sensitive nature to your company. Please be assured that InterVISTAS and TOBIN will maintain the confidentiality of your survey response, and that any data provided to daa will not identify individual respondents. Only aggregate survey totals will be published in the final report or in press releases.

This economic impact survey is conducted under the supervision of Ian Kincaid. Should you have any questions regarding the study or the survey, please contact Ian at +44-208-144-1835.
We will make a contribution for every completed survey to the daa Charity of the Year Programme which supports the Jack & Jill Foundation, Cystic Fibrosis and Special Olympics Ireland this year.

I want to thank you sincerely for your cooperation in this study and look forward to sharing the report’s outputs with you once this study is completed.

Yours Sincerely,

Niall MacCarthy
Managing Director
Cork Airport
Employment and Activity Survey

The figures you provide in the following sections are strictly confidential and will be viewed only by InterVISTAS Consulting LTD and TOBIN Consulting Engineers. Only aggregate survey totals will be published in the final report.

For the purposes of this study, it is important that the figures you provide are as accurate as possible. However, where it is not possible to provide precise information, we would appreciate estimates rather than no response at all.

Please complete this survey electronically by responding directly into the form. Alternatively, you can print out the form and complete by hand. Wherever possible, please state figures for calendar year 2013 (please indicate where this is not the case).

Name of Company: ____________________________
Address of Company: ____________________________
Contact Person: ____________________________ Phone number: ____________________________
Email: ____________________________

Q1. Principal Business Activity
Please indicate your principal business activity. If you are involved in more than one of the businesses below, please choose the one that best describes your business (i.e., contributes the largest proportion of revenues).

Air Carriers
☐ 1. Scheduled Air Passenger Carrier
☐ 2. Charter Air Passenger Carrier
☐ 3. Dedicated Cargo Carrier
☐ 4. Courier / Integrator
☐ 5. General Aviation Operator
☐ 6. Other: ____________________________

Other Business Types
☐ 7. Airport Authority
☐ 8. Freight Forwarder, Cargo Agent, etc.
☐ 9. Warehousing
☐ 10. Customs Broker
☐ 11. Aircraft Maintenance, Repair and Overhaul
☐ 12. Airport Ground Handler
☐ 13. Fuelling Company
☐ 14. Fixed Base Operator
☐ 15. Aircraft Parts Supplier
☐ 16. Aviation Related Manufacturing
☐ 17. Aviation Related Training
☐ 18. In-flight Catering Company
☐ 19. Security Services
☐ 20. Airport Retail Outlet, Restaurant, etc.
☐ 21. Government Agency/Department
☐ 22. Car Rental
☐ 23. Taxi, Bus
☐ 24. Hotel
☐ 25. Other: ____________________________
Q2. Employment at Your Company

We want to be able to document the employment linked to Cork Airport. Please state the number of staff (permanent, temporary and contract staff) employed in 2013 by your company both on-site at Cork Airport and off-site (but within the Republic of Ireland). Please break down the employment into permanent, temporary, full-time and part-time.

<table>
<thead>
<tr>
<th>Location</th>
<th>Permanent Employees</th>
<th>Seasonal / Temporary Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Full-Time</td>
<td>Part-Time</td>
</tr>
<tr>
<td>On-Site (Cork Airport)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Off-Site (in Ireland)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note:  
- Full-time = 30 hours or more per week.  
- Part-time = Less than 30 hours per week.  
- Seasonal/Temporary = Less than 6 months of the year.  
- For employees that split their time between on-site and off-site locations, please allocate them to the location where they spend the most time.

Q3. Employment Related to Cork Airport

To ensure that we do not overstate the employment related to Cork Airport, please estimate the proportion of employment in Question 2 that is related to activities at Cork Airport. For example, some businesses will derive all their business from airport related activities, while others will do business in other sectors of the economy (e.g., maritime shipping). Please estimate the percentage of on-site (at Cork Airport) and off-site (in Ireland) employment related to Cork Airport.

<table>
<thead>
<tr>
<th></th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-site Employment - % Related to Cork Airport</td>
<td></td>
</tr>
<tr>
<td>Off-site Employment - % Related to Cork Airport</td>
<td></td>
</tr>
</tbody>
</table>

Q4. Employment Related to Air Cargo

We would like to be able to document the impact of the airport’s air cargo services. Please help us by indicating the proportion of your employment that is related to servicing air cargo at Cork Airport.

<table>
<thead>
<tr>
<th></th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-site Employment - % Related to Air Cargo</td>
<td></td>
</tr>
<tr>
<td>Off-site Employment - % Related to Air Cargo</td>
<td></td>
</tr>
</tbody>
</table>

Note: the percentages entered should be the same or less than those entered in Question 3.
## Q5. Employment by Occupation

We would like to illustrate the range of employment opportunities offered by businesses linked to Cork Airport. Please estimate the number of on-site and off-site employees included in Question 2 that are in the following occupation categories. The figures entered in each column should sum to the same on-site and off-site totals as Question 2 or sum to 100%.

<table>
<thead>
<tr>
<th>Occupation Category</th>
<th>Number or % of Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>On-Site</td>
</tr>
<tr>
<td><strong>Airline &amp; Airline Servicing Trades</strong></td>
<td></td>
</tr>
<tr>
<td>Airline Pilots</td>
<td></td>
</tr>
<tr>
<td>Flight Attendants</td>
<td></td>
</tr>
<tr>
<td>Aircraft and Equipment Mechanics</td>
<td></td>
</tr>
<tr>
<td>Customer Service Agents</td>
<td></td>
</tr>
<tr>
<td>Aircraft Servicing (cleaning, catering, etc.)</td>
<td></td>
</tr>
<tr>
<td>Baggage Loading/Unloading</td>
<td></td>
</tr>
<tr>
<td>Air Cargo Ramp Staff</td>
<td></td>
</tr>
<tr>
<td><strong>Support Services</strong></td>
<td></td>
</tr>
<tr>
<td>Air Traffic Control</td>
<td></td>
</tr>
<tr>
<td>Security Personnel</td>
<td></td>
</tr>
<tr>
<td>Fire Services</td>
<td></td>
</tr>
<tr>
<td>Food Service Workers</td>
<td></td>
</tr>
<tr>
<td>Drivers / Delivery / Couriers</td>
<td></td>
</tr>
<tr>
<td>Dispatchers</td>
<td></td>
</tr>
<tr>
<td>Call Centre / Reservations</td>
<td></td>
</tr>
<tr>
<td>State Services (e.g., customs, immigration, agriculture, etc.)</td>
<td></td>
</tr>
<tr>
<td><strong>Retail Trades</strong></td>
<td></td>
</tr>
<tr>
<td>Sales / Cashiers</td>
<td></td>
</tr>
<tr>
<td>Food &amp; Beverage Preparation</td>
<td></td>
</tr>
<tr>
<td><strong>General</strong></td>
<td></td>
</tr>
<tr>
<td>Managerial / Supervisory (e.g., chief executives, general managers, heads of finance, marketing, human resources, etc.)</td>
<td></td>
</tr>
<tr>
<td>Professionals (e.g., engineers, accountants, lawyers, etc.)</td>
<td></td>
</tr>
<tr>
<td>Craftsmen and Trade Workers (e.g., electricians, carpenters, etc.)</td>
<td></td>
</tr>
<tr>
<td>Cleaners, Manual Labourers and Similar</td>
<td></td>
</tr>
<tr>
<td><strong>Other (Please specify)</strong></td>
<td></td>
</tr>
</tbody>
</table>

September 2014

3
Q6. Payroll and Wages
In order for us to estimate the earnings associated with Cork Airport, please state the total payroll paid by your company in 2013 for the employees included in Question 3 previously. As indicated previously, these figures will be kept strictly confidential.
This figure should include all full-time, part-time and temporary workers and any contract employees. If you are unable to estimate payroll for 2013, please provide figures for your last financial year, and indicate which year that was.

| Total Annual Payroll (2013): | € |
| Financial year (if not calendar year 2013): |

Alternatively, if you are unable to answer this question, please provide an approximate estimate of the average annual wage/salary per employee.

Average Salary/Wage: € ________________ per annum.

Q7. Expenditures on Goods and Services
We want to be able to demonstrate how airport related businesses such as yours benefit other businesses in the region and elsewhere. To help us with this, please estimate your company’s total expenditure on goods and services related to operations at Cork Airport in 2013.
If you are unable to estimate your expenditures for 2013, please estimate your expenditures in the last accounting year, and indicate which year that was. Please do not include any contract employment already accounted for in Question 3.

| Total good and services expenditures (2013): | € |
| Accounting year (if not calendar year 2013): |
Q8. Expenditures by Location of Supplier

Please estimate how much of your expenditures in Question 7 were with suppliers located in the following areas.

<table>
<thead>
<tr>
<th>Area</th>
<th>€ or % of Expenditure</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-site at Cork Airport</td>
<td></td>
</tr>
<tr>
<td>Elsewhere in County Cork</td>
<td></td>
</tr>
<tr>
<td>Rest of Munster</td>
<td></td>
</tr>
<tr>
<td>Elsewhere in the Republic of Ireland</td>
<td></td>
</tr>
<tr>
<td>Outside the Republic of Ireland</td>
<td></td>
</tr>
</tbody>
</table>
Clarifications and Comments:
If you have any clarifications on the information you have provided, or any other related comments, please enter them in the box below. If you have any files or reports that you think would be relevant to this study, please email them to daasurvey@intervistas.com.

Thank you for your assistance in completing this survey.
Please complete and return this survey by the 24th October, 2014.
Please return the completed survey electronically by clicking the [Submit Form] icon on the top right hand corner, or by email / fax to:

Email: daasurvey@intervistas.com
Fax: +44-1225-330-209, Attention: Ian Kincaid

If you have any questions, please contact:
Ian Kincaid at ian.kincaid@intervistas.com or +44-208-144-1835.
Appendix C: Calculating Inferred Employment

InterVISTAS’ approach was to utilise information from responding firms for each type of business, along with publicly available information on individual non-responding firms, to make inferences. This approach is generally deemed to be the best approach, and indeed is often used for developing the national income and products account (i.e. partial survey with inference for non-surveyed or non-responding firms based on responses of surveys received).

The employment data in this report was constructed from a combination of two sources:

1. Employment reported by employers on surveys.

2. Employment inferred for employers who did not provide a survey response. Inferred employment was based on employment information from firms in each business type that did respond to the survey. The mean employment of respondents in each business type was calculated, excluding outliers. For example, especially large firms were excluded from the analysis, and any firms with employment more than two standard deviations from the raw mean. This "adjusted mean" employment for each business type was then applied to the non-respondent firms.

For example: if 15 retail businesses were sent surveys but only 10 returned them, and other information on the non-responding firms was not available, an average employment figure was derived from the responding firms, excluding outliers, and applied to the non-responding firms.
Appendix D: Calculation of Full-Time Equivalent Jobs

The average number of employment hours comprising a Full-Time Equivalent (FTE) job is as follows:

Number of Days per Year \(= 365\)

\textbf{Minus}

Weekends \((52 \times 2)\) \(= 104\)

Number of Public/Bank Holidays \(= 9\)

Average Number of Vacation Entitlements\(^{51}\) \(= 20\)

Average Sick Days Taken\(^{52}\) \(= 5.5\)

\textbf{Total Working Days:} \(= 225\)

Average Number of Hours Worked Per Day: \(= 8\)

\textbf{Multiply by number of working days} \((8 \times 225)\) \(= 1,812\) Hours

A Full-Time Equivalent job is equivalent of 1,812 hours of labour per annum.

\(^{51}\) Source: \(\text{http://www.citizensinformation.ie/en/employment/employment_rights_and_conditions/leave_and_holidays/}\).

Appendix E: Further Information on the Input-Output Tables and the Economic Multipliers

As described in Chapter 2, the economic impact multipliers (indirect and induced) impacts were based on an Input-Output (I-O) model of the economy of the Republic of Ireland maintained by the Central Statistics Office Ireland.

The I-O model output was used to estimate the direct, indirect and induced economic effects in this study. This approach has been widely accepted as the most comprehensive approach for the study of economic impact.

The Input-Output Model

The I-O model of an economy links the gross output of an industry to the final demand for that industry and to the intermediate demands made by other sectors for its output. **Figure E-1** illustrates the basic structure of the input-output model.

**Figure E-1: A Highly Simplified Input-Output Accounting Framework**

<table>
<thead>
<tr>
<th>Industries (Purchases)</th>
<th>Final Demand</th>
<th>Total Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industries (Sales)</td>
<td>Z</td>
<td>Y</td>
</tr>
<tr>
<td>Value-added (primary inputs)</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Total output</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

Analytically, we have the following basic identity for sector \(i\),

\[
X_i = Z_{i1} + Z_{i2} + \cdots + Z_{in} + Y_i, \quad i = 1, \cdots, n. \quad (1)
\]

In Figure D-1,

- The first row characterizes the “purchasing sectors” (purchasers), while the first column captures the “selling sectors” (sellers);
- Each data column under “Industries” represents the sales from other sectors to sector \(i\); that is, sector \(i\)’s purchases of the products of various producing sectors in the economy. Hence the column represents the sources and magnitudes of sector \(i\)’s inputs.
- On the other hand, in engaging in production, a sector also pays for other items – for example, labor and capital – and uses other inputs as well, such as inventoried items. All of these together are termed the value-added in sector \(i\). In addition, imported goods
may be purchased as inputs by sector i. All of these inputs (value added and imports) are lumped together as purchases from what is called the payments sector (Vi in Figure D-1).

In the case of Ireland, the net final demand (Y) is the sum of the following items:

- Final consumption of households;
- Government consumption expenditure;
- Gross capital formation;
- Change in inventory; and
- Exports.

For Ireland, the total value-added (V) is the sum of the following items:

- Imports of goods and services;
- Operating surplus;
- Compensation of employees;
- Consumption of fixed capital;
- Product and other indirect taxes less subsidies.

In other words, referring back to Figure D-1, each row for sector i=1 to n records the sales of that sector’s output to other industrial sectors in the economy plus sales to private consumers, government, capital formation, inventory and overseas purchasers. Each column for sector i=1 to n records the purchases of production inputs for that sector in order to produce its total output. This includes purchases from other sectors of the economy, purchases of imports, payment for labour, payment of government taxes, and generation of profits.

**Input-Output Coefficients**

Input-output table becomes an economic tool when Leontief introduced an assumption of fixed-coefficient linear production functions related to input used by a sector along each column to its output flow, i.e., for one unit of every industry’s output, a fixed amount of input of each kind is required.\(^{53}\) That is, we define the following coefficients:

\[ a_{ij} = \frac{Z_{ij}}{X_j}. \]

This ratio is termed a technical coefficient, commonly known as input-output coefficient or direct input coefficient. With this specification of production technology, the model basically assumes that the industry shows constant returns to scale, which is a reasonable approximation in short-run, but nevertheless is also a limitation of the model.

Once the notion of a set of fixed input-output coefficients is accepted, the system of equations (1) can be represented as follows:

---

\[ X_i = a_{i1}X_1 + a_{i2}X_2 + \cdots + a_{in}X_n + Y_i, \quad i = 1, \ldots, n. \quad (2) \]

This leads to the matrix representation:

\[ X = A X + Y \quad (3) \]

Hence, with the net final demand vector \( Y \), we can solve for the output vector, via matrix inverse as follows:

\[ X = (I - A)^{-1} Y \quad (4) \]

where \( I \) stands for the identity matrix. And the matrix \((I - A)^{-1}\) is the Leontief inverse coefficients. These measure the total amount of output in each sector that is required to be produced in order to satisfy the direct and indirect demands produced by one unit increase in the final demand for a given sector (i.e., the direct + indirect multiplier). The economic interpretation of the Leontief inverse coefficients is consistent with the derivation of the Keynesian multipliers (e.g., expenditure multiplier) that are commonly used in macroeconomics. In other words, it can be interpreted as a result of successive rounds of iterations. An important implication of this connection with the Keynesian multiplier is that the inverse coefficients capture both direct and indirect effects of the final demand from all sectors identified in the I-O table. In practice the multipliers from I-O tables are usually expressed in values so that coefficients measure the requirements in dollars on sector \( i \) when sector \( j \) increases its final demand by one dollar.

**Indirect and Induced Impacts - Open System and Closed System**

The economic impact multipliers are expressed as ratios that measure the impact on the total economy as a result of an initial autonomous change in any of the final demand components. The action of the multiplier can be illustrated by the sequence of events that follow after the initial autonomous change. Different kinds of multiplier can be generated depending on the purpose of analysis. The common multipliers used are output, valued-added, employment, and income multipliers. For comparative purposes, multipliers use usually expressed with respect to a unit of autonomous change in final demand.

**Open Model: Direct and Indirect Impacts**

Each of the multipliers listed above can be generated from two different models: open and closed. The intrinsic difference between them is the treatment of household income and personal consumption expenditure. In the open model, all final demand components are assumed to be exogenous. Hence the open model captures the production-induced effects resulting from a change in final demand. The multipliers generated using the open model are also known as simple multipliers or Leontief multipliers. This kind of model is described as open because at each round of the multiplier process, there is leakage from the system. The leakage consists of payments for imports and primary inputs and the recipients are assumed to make no use of their receipts. Even if a small part of the receipts were spent on goods and services, there would be further multiplier repercussions. In our analysis, Leontief multipliers capture the direct and indirect effects of an autonomous change in final demand.
Closed Model: Direct, Indirect and Induced Impacts

Conversely, in the closed model, the household sector is treated as endogenous to the system. The household sector receiving income from the work done in the production process would spend some of this income on local products. This increase in consumption would in turn increase the level of output of the products. In other words, the closed model accounts for both the production-induced effects as well as the consumption-induced effects. The multipliers generated using the closed model are commonly known as the total multipliers or Leontief-Keynes multipliers. In our analysis, Leontief-Keynes multipliers will capture the direct, the indirect AND the induced effects.

The total multiplier from the closed model is by definition larger than the simple multiplier from open model. The difference between the two multipliers is the induced impact.