

THE INFLUENCE OF FLIGHT DELAYS ON BUSINESS TRAVELLERS

by

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DECLARATION

I declare that the Master's script, which I hereby submit for the degree MCom Tourism Management at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at another university.

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ABSTRACT

The main aim of the study was to assess the influence of flight delays on business travellers. Studies on flight delays have been done from a number of perspectives; these include the reasons for flights delays, the costs to airlines and airports, the effect on airline scheduling and the impact on airline market share. An area that has received little, if any, attention is the impact of flight delays on business travellers, one of the most lucrative markets for airlines. This study empirically researches the direct cost of flight delays to travellers of a specific corporation. In addition, the use of mobile technology in communicating the occurrence of flight delays to business travellers, and how this could alleviate traveller frustrations, are discussed from a theoretical perspective.

The study followed a quantitative methodology to determine man-hours lost and the direct costs of flight delays to travellers from a selected corporation. Two data sets were used, one provided by the corporation on flights undertaken by their corporate travellers over a predetermined period, the other by the Air Traffic and Navigation Services (ATNS) on all flights over the same period. The two sets of data were matched and analysed to determine which flights undertaken by the corporate travellers were delayed, based on actual arrival times, and if any significant relationships could be determined between flight delays and types of traveller (frequent versus infrequent) or specific time periods (time of day, day, week and month).

The results indicated that frequent travellers experienced the majority of flight delays, and consequently represented the greatest cost to the corporation. The study also found significant relationships between substantial delays and the month of the year, day of the week, and the time of day flown. The identification of patterns could provide business travellers with the information to better manage their travel arrangements and optimise their travel times and costs. In calculating the direct monetary cost, the value of time lost was found not to constitute a substantial amount to the corporation, but this result must be viewed against the limitations of the study.

This study serves to provide a foundation for future research into the cost of flight delays to business travellers. Future research should include larger samples (large global or multiple companies could be used) and extend the time periods for assessing delays. Future studies could also include other direct and indirect costs not covered here and the study could be replicated in different geographical areas, particularly areas with a high density of flights such as Asia, the United States of America and Europe.

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CHAPTER 1

THE PROBLEM STATEMENT AND RESEARCH OBJECTIVES

1.1 INTRODUCTION

According to the US Department of Transportation (DOT), in 2000 air traffic delays were the most common source of customer complaints by airline passengers (Forbes, 2006). Additionally, in a study on the American travel market conducted by Orbitz Travel, when respondents were asked to identify which part of their travel caused the most trouble during their journeys, the majority of respondents indicated the flying segment of their travels, with 40% citing flight delays as their “most problematic” experience (Hotelmarketing.com, 2007; smh.com, 2007). The US DOT indicated that, owing to the increase in air traffic, travel woes had contributed to a sharp rise in customer complaints, and that problems such as flight delays and flight cancellations were the most common source of customer complaints by airline passengers (smh.com, 2007; Forbes, 2006).

As society becomes more complex, the majority of people have less time available, which means that waiting caused by delays in services is becoming a source of negative feelings (AhmadBeygi, Cohn, Guan & Belobaba, 2008; Abdelgany, Shah, Raina & Abdelgany, 2004; Suzuki, 2004). The speed at which services are dispensed has become an increasingly important attribute; this is especially true for business and corporate travellers, whose travel schedules are often dictated by pre-arranged appointments. Delays in the rendering of services can have significant run-on implications, which may ultimately foster negative feelings.

Apart from affecting business travellers on an emotional level, flight delays can significantly affect business travellers’ costs and en-route productivity (AhmadBeygi *et al.*, 2008; Muller & Santana, 2008; Suzuki, 2004; Forbes, 2006; Bauer, 2000). Flight delays and cancellations cost travellers time and money (Bauer, 2000), in the form of longer waits for service and increased costs (Suzuki, 2004). Such monetary costs can be both direct (paying for alternative flights/methods of transport; or perhaps additional accommodation and catering if

an overnight stay is required) and indirect (missed business opportunities and time wasted in excessive waiting at airports that cannot be used productively for work-related tasks) (AhmadBeygi *et al.*, 2008; Knowler, 2008; Suzuki, 2004). Lost business opportunities can result from being unable to arrive at a scheduled meeting due to the delay, thereby losing the potential profits/benefits that could have arisen from a successfully concluded business transaction.

Time spent travelling during the working day is a cost to the employer's business (UK Department of Transport, 2003). It is assumed that savings in travel time convert non-productive time to productive use and that, in a free labour market, the value of an individual's working time to the economy is reflected in the wage rate paid. The perceived value of working time is the value as perceived by the employer. Bauer (2000) indicated that the Air Transport Association of America (ATA) estimated a conservative cost of \$20 per hour as the value of a passenger's time and inconvenience, while the Federal Aviation Administration (FAA) estimated such time as being worth \$44 an hour. More recently, the FAA recommended an estimated \$35.70 per hour as the average value of a passenger's time (ATA, 2008). ATA therefore consequently estimated that the total US delay costs to air travellers over the twelve-month period ending September 2008 was considerable and totalled \$4.5 billion (ATA, 2008).

Even though airlines also lose profit through having to reimburse some travellers in the case of flight delays, the process of actually receiving the necessary monies could often be a long and arduous battle for those travellers (Knowler, 2008). The issue of "who is primarily responsible for flight delays" is often raised (The Boyd Group, 2008; Knowler, 2008; Wilber, 2006; Bauer, 2000; Bhat, 1995). However, there has been no common agreement on who should be primarily held accountable, as well as how the issue could be resolved. The parties most often blamed for the occurrence of flight delays are:

- Airlines;
- Airport regulating companies or air traffic control centres such as ATNS (Air Traffic and Navigation Services Company) in South Africa and the FAA in the USA;
- Governments, owing to legislative measures such as changes in the take-off and landing restrictions;

- The weather (Bauer, 2000; Smuts & Brits, 1999; Ashford, Stanton & Moore, 1997).

Bauer (2000) describes this “passing the buck” as follows: “Airlines are blamed for ineffective scheduling. Airlines then blame the Air Traffic Control Companies, such as the FAA or ATNS, who in turn blame the weather”.

The issue of “who/what is largely responsible for the occurrence of flight delays and cancellations” is an important and highly disputed subject. The various factors potentially contributing to the occurrence of flight delays will be discussed as a context to the topic under discussion, but the overall purpose of the study is not to identify the root of this problem or any potential solutions. This study will focus primarily on assessing a direct cost of flight delays to corporate and business travellers.

Briefly stated, some delays may result from problems that are hard to predict and often beyond an airline’s control. Bunching of flights, air traffic control procedures, mechanical repairs, weather, and the inability of air traffic control systems to keep pace with the increased demand are some factors beyond an airline’s control that cause delays and affect every airline (AhmadBeygi *et al.*, 2008; Muller & Santana, 2008; Bauer, 2000; Bhat, 1995). Weather may be forecast to improve but could instead deteriorate, or a mechanical problem could turn out to be more complex than initially estimated. Moreover, as airline scheduling is often focused on maximising utility, the resulting schedule’s ability to absorb disruption can be severely limited (AhmadBeygi *et al.*, 2008; Givoni & Rietveld, 2006). An initial flight delay which may have been due to local weather or local air traffic control may furthermore propagate to delay subsequent arriving and departing flights (AhmadBeygi *et al.*, 2008; The Boyd Group, 2007; CNNMoney.com, 2007; Skyguide, 2005; Bauer, 2000). Every deviation from the ideal situation sets off a chain reaction and can result in a lengthier final delay (AhmadBeygi *et al.*, 2008; Skyguide, 2005). As a result, the options available to individual airlines to improve flight departures/arrivals may be severely limited. The causes of and solutions to flight delays will be discussed in greater depth in the literature review.

In the early stages of a delay, the duration of the delay is also sometimes difficult for an airline to estimate. Developments such as weather or mechanical problems can occur which

may not have been anticipated when the airline made its initial estimate of the length of the delay. Furthermore, the manner in which these delays, or changes in delay estimates, are communicated to passengers could either add to or reduce the levels of frustration experienced by travellers. Frustration levels could easily increase if passengers are not adequately and timeously informed in the event of delays. The study takes a brief theoretical look at how mobile technology can be used to advise passengers of delays.

Mobile technology is increasingly being used in the airline industry for communication (particularly through text messages/SMS). The travel industry, in realising the possible benefits of m-commerce, is working on technologies that will deal with travel arrangements, update customers on flight status, notify them as information changes, and so forth (Wikipedia, 2007a). The use of mobile technology via SMS is a cost-effective way of assisting customer service departments and call centres to notify passengers of flight delays, thus enabling the better management of passenger expectations during and after flight delays (Steinbock, 2005; Foss & Stone, 2001).

Early communication of flight delays can greatly benefit business travellers by allowing them to manage their time better, or even to make alternative arrangements. Not only is early communication essential, but communication providing valuable information such as the estimated length of the delay, with regular updates on the situation, could help business travellers to organise their diaries better, and subsequently to better manage the potential costs resulting from flight delays. Thus mobile technology could be a valuable tool for airline companies to improve management of client relations during and after flight delays. In this study the use of mobile technology in the airline industry will be examined specifically with regard to better communication around the occurrence of flight delays. The following section will focus on discussing the primary problem to be addressed in this study.

1.2 PROBLEM STATEMENT

The introduction provided a brief background of the various industry factors relevant to this research study. In this section the problem statement and the primary reasons influencing the conception of the problem statement are discussed. The problem being looked at in this study is the influence of flight delays on business travellers, with specific focus on the direct cost of flight delays in regard to business travellers, which will be tested empirically. In addition, the manner in which flight delays are communicated to business travellers, and how this could alleviate traveller frustration, will also be discussed from a theoretical perspective.

Studies on flight delays have been done from a number of perspectives as they affect airlines, airports and passengers. Muller and Santana (2008) analysed flight operating costs and delays, focusing on aircraft in-flight delays and their costs in the Sao Paulo terminal manoeuvring area. They noted that the effective management of congestion was vital to managing delays, and accordingly costs. Forbes (2006) discussed the effect of flight delays on fares for certain routes and found that, on average, airline ticket prices fell by \$1.07 for each additional minute of flight delay, and that the price response was substantially larger in more competitive markets. Additionally, he found that airline ticket prices at nearby airports tended to rise in response to longer flight delays at the airport chosen.

Prior to this, Milan Janic (2005) modelled congestion charges at an airport, that is, the cost of marginal delays that a flight could impose in regard to other flights due to congestion. Research has also been done concerning the potential effects of service failures (including flight delays) on passengers. Suzuki (2000) analysed the relationship between on-time performance and airline market share, finding that once flight delays had been experienced, passengers were more likely to switch airlines for subsequent flights. Suzuki furthered this research in 2004 by looking at a number of service failures, including seat denials (bumping), baggage mishandling and flight delays, and how airline choices were affected. AhmadBeygi *et al.* (2008) studied the potential for delays in passenger airline scheduling, finding that when airlines schedule their costly resources (aircraft), they often focus primarily on achieving high levels of utilisation, thus limiting the schedule's ability to absorb any disruptions such as flight delays. Initial flight delays may propagate to delay subsequent flights as well. None of the

studies mentioned above have focused on business travel and the actual costs in regard to business travellers resulting from flight delays.

Studies have been conducted on the reasons for the occurrence of flight delays, as well as potential methods available to reduce the impact or even prevent flight delays. Bard *et al.* (2001) discussed optimising aircraft routings in response to groundings and flight delays, and found that, following flight delays, the immediate objective of airlines was to minimise the cost of reassigning aircraft to flights, taking into account available resources and other system constraints. Wu and Caves (2003) investigated the influence of flight schedule punctuality control and management. They found that where previous research had indicated that the insufficiency of infrastructure capacity in an air transport system was generally blamed for poor punctuality performance in the implementation of flight schedules, ground operations of airlines were the second major cause of flight delays at airports.

Studies on business travellers in relation to air travel have mainly focused on airline selection criteria and airline service attributes. Many of these studies have acknowledged “on-time performance” as an important service attribute and selection criterion (Forbes, 2006; Janic, 2005; Mason, 2000; Suzuki, 2004; Suzuki, 2000; Evangelho *et al.*, 2005). However, none of these studies took into account the influence or cost of flight delays, leaving a gap in the research which this study addresses.

This study will also, from a purely theoretical perspective, look at the use of mobile technology to communicate in regard to flight delays. To date, there has been limited research on m-commerce (Gould *et al.*, 2006; Okazaki, 2006). Okazaki (2006) summarised the progress and the future directions of m-commerce research. He indicated that despite the proliferation of internet-enabled mobile handsets, empirical research had been undertaken only in a limited number of research areas. In the airline field, Yoon *et al.* (2006) conducted research on the impact of e-business on the air travel market, focusing mostly on the impact of airline e-business on the performance of air ticket distribution channels, but not on mobile technology as a means of communication with passengers. Gould *et al.* (2006) surveyed the wireless landscape, specifically from a non-technologist’s perspective, providing wide-ranging and contemporary examples of mobile applications in Australia but not covering their use in the airline industry. While this study will not empirically test the use of m-

commerce (such as text messaging) in the airline industry, it will provide a theoretical discussion on communicating with business travellers about flight delays.

It is evident that there is a gap in the research on the effect of flight delays on business travellers, as well as on communicating about flight delays through m-commerce tools such as SMS/text messaging. This study will focus specifically on analysing the direct cost of flight delays in regard to corporate travellers, as well as discussing the manner in which information on flight delays can be communicated to passengers to better manage traveller frustrations and expectations. In order to do this, certain research objectives have been identified.

1.3 RESEARCH OBJECTIVES

As noted, the overall purpose of this study is to determine the effect of flight delays on business travellers and to describe the manner in which these delays are communicated to travellers.

In the analysis of the effect of flight delays on business travellers, the following research objectives have been identified:

- To describe the concept of flight delays and the factors potentially contributing to their occurrence;
- To determine if a substantial percentage of business travellers are affected by flight delays;
- To assess man-hours lost due to the flight delays experienced by travellers of an organisation over a specified period;
- To quantitatively measure the direct cost in terms of man-hours lost as a result of flight delays in regard to corporate travellers of an organisation;
- To identify any patterns in the occurrence of flight delays as experienced by business travellers of a specific organisation in terms of routes flown, seasonality (particular month travelled), departure days (weekdays vs weekends) and arrival times (workday vs night flights).

Because each organisation within the commercial aviation system has its own interests and agendas, each may have a very different view of the delay problem (Bauer, 2000). From research, it is evident that there is not only one specific reason for the occurrence of flight delays, but rather a multitude of factors. To better understand the occurrence of flight delays, the various reasons potentially contributing thereto need to be discussed.

Apart from understanding the reasons for the occurrence of flight delays, the effects of these occurrences on business travellers need to be determined. The impact of flight delays ranges from direct costs, such as man-hours lost, additional accommodation, meals, or even alternative flight bookings, to indirect costs that could be described as opportunity costs. This study will be limited to analysing the direct cost of the delay in terms of a per-hour monetary value for each traveller assessed, which will be used to estimate the cost of time lost resulting from a flight delay. The study will also aim to identify any patterns in the occurrence of flight delays in the source data. In this regard, the study will focus on identifying whether there is a greater potential for the occurrence of flight delays in a specific airline, on a specific route flown, or even during a particular hour / day / month travelled.

In addition, communication regarding flight delays will be discussed by way of a literature review and current analysis of industry actions and strategies in this regard. Discussion of the manner in which the occurrence of flight delays is managed and communicated to passengers will involve a review of industry actions and strategies in this regard. This will not only include discussing how flight delays are communicated, but also how the early communication of flight delays to business travellers can aid in managing expectations. Communicating timely and accurate delay estimates (estimated time/duration of the delay) to business travellers can enable them to better prioritise their own time or make the necessary alternative arrangements.

This section discussed the research objectives which can address the problem of determining the effect of flight delays in regard to business travellers and describe how these delays are communicated to travellers. Certain hypotheses have been derived to further delineate the empirical research and these are presented in the following section.

1.4 HYPOTHESES

From the research objectives identified in Section 1.3, a number of hypotheses are formulated:

- H1: Flight delays adversely affect more than 30% of frequent corporate travellers in terms of cost and time.
- H2: There is a relationship between the occurrence of flight delays and specific airlines.
- H3: There is a relationship between the occurrence of flight delays and specific routes.
- H4: There is a relationship between the occurrence of flight delays and the month of the year.
- H5: There is a relationship between the occurrence of flight delays and the day of the week.
- H6: There is a relationship between the occurrence of flight delays and the time of flight arrival.

Where certain patterns are identified, the potential reasons for these trends will be discussed. A number of factors can cause a higher frequency of flight delays at different destinations; some of these are beyond the destination's control, such as weather and legislative restrictions. The following section will provide a brief overview of the methodology employed in this study for the testing of the hypotheses.

1.5 METHODOLOGY

The study follows two phases. The first is an investigation of the literature in order to provide a comprehensive description of the airline environment; the potential reasons for flight delays; the business travel market and finally, the current way in which flight delays and cancellations are communicated to business travellers.

The second phase follows an empirical approach using a quantitative methodology to determine man-hours lost and cost as a result of flight delays experienced by business travellers.

The population for this study will be drawn from a list of business and corporate travellers provided by Philips South Africa, a company which specialises in providing a wide range of information products and services for both consumer and business-to-business telecommunication markets (Philips, 2009). Philips has a broad international client base and consequently undertakes a substantial amount of business travel, making the company ideal for this study. The data provided by Philips will include travel details from January 2008–June 2008.

Only the corporate travellers of Philips South Africa are included in this study, so while a quantitative methodology is used to analyse the data, Philips can be viewed as a corporate case study in determining the effect of flight delays on their travellers. The results of this study cannot therefore be generalised to all business and corporate travellers, other organisations, regions or periods of time. However, the study does provide a basis for replication in other environments and time periods.

One measure that can be used to determine the cost of flight delays and cancellations is the remuneration levels of business travellers (company executives, for instance). Should such data not be available, other measures such as approximations of the value of business time can be used. The aim is not to achieve an exact numerical figure of the direct cost of flight delays, but to assess the approximate value of time lost as a result of delays.

To accurately identify the occurrence and extent of flight delays over the same period of time (January 2008 – June 2008), the second source of data is the records of the Air Traffic and Navigation Services (ATNS).

The two sets of data will be matched to determine which of the flights undertaken by the Philips business travellers were delayed, by identifying any differences between the data in terms of scheduled flight times (Philips data), and the actual departure/arrival times (ATNS data).

From the data provided, trends or patterns in flight delays in terms of seasonality, departure days (weekends vs weekdays) or even departure and arrival times (workday vs night flights) will be identified. Some airlines may show a higher frequency of flight delays.

The calculation of certain estimates will be required to address two of the objectives of the study: first, to estimate the number of flights affected by delays and the subsequent time lost as experienced by the selected group of business travellers, and secondly, to establish the cost that can be allocated to this time.

To assess the value of the time lost to business travellers, the grouping of business travellers according to seniority level will also be considered. The number of flight delays and cancellations will be matched to the estimated value of time per seniority level, which can then be used to further define the value of the time lost.

Hypothesis tests will be carried out to establish if certain patterns exist across airlines, routes, departure points and time periods. The following section highlights the main benefits to be derived from undertaking this research.

1.6 IMPORTANCE AND BENEFITS OF THE STUDY

This study on the effect of flight delays on business travellers is relevant for a number of reasons:

- First, business travel constitutes a large segment of the air travel market, and the results of this study could provide business travellers with valuable insights to allow the optimising of travel times.
- Certain perceptions exist regarding the benefits of negotiating travel contracts with airline companies. Through quantifying the effects of flight delays experienced by business travellers, the study could help to ensure the contracting of agreements that are truly mutually beneficial to both business travellers of specific organisations and airline companies.
- Furthermore, the study could identify certain patterns or trends that could affect the likelihood of the occurrence of flight delays, such as the specific airline flown, the route flown, the month, day of the week or even time of day.
- Finally, the study could also identify to airlines the benefits of utilising mobile technology to more efficiently manage and communicate to travellers regarding the occurrence of flight delays, with a view to reducing the negative emotions that could potentially arise from such disruptions in service.

The study can result in benefits to both business travellers of a specific organisation and individual airline companies. The findings could promote better utilisation of travel time by business travellers and, if any patterns are identified, better selection of flights for business travel purposes.

A number of studies have been done on the causes, costs of and potential solutions for flight delays (Forbes, 2006; Suzuki, 2004; Bauer, 1999). Yet few have been done with regard to the better management of business travel by taking potential flight delays into account. With the growth in flight travel and competition among airlines, an increase in the occurrence of flight delays seems inevitable. With this in view, this study will also aim to identify to airlines the benefits of using mobile technology to more effectively manage and communicate the occurrence and probable course of flight delays to their travellers.

1.7 STRUCTURE OF THE STUDY

Chapter 1 presents an introduction to the study, dealing with the various problems, objectives and hypotheses to be researched and giving a brief overview of the methodology to be used. A brief discussion of the importance and potential benefits of the research study is given, and the chapter concludes with an overview of how the rest of the study is structured.

Chapter 2 provides an overview of the air transport system with specific discussion of the various components (airlines, airports and users) that contribute to the successful functioning of the system and the various environments in which it operates. Mention is also made of various air transport regulations and regulating companies.

Chapter 3 addresses the occurrence of flight delays across the value chain, focusing on the various factors that could potentially play a role in the occurrence of flight delays. Apart from looking at the possible causes of flight delays, Chapter 3 also suggests potential solutions for reducing their impact.

Chapter 4 gives an introduction to the various types of travellers, with specific reference to the characteristics, needs and travel patterns of business and corporate travellers. This chapter also discusses the various elements influencing the travel patterns of corporate travellers, including the role of travel departments, travel budgets and corporate travel policies. In addition the chapter discusses the potential influence of flight delays on corporate travellers' costs as well as on future contract negotiations with suppliers, specifically airlines. Finally, the use of mobile technology in communicating information about flight delays to passengers is covered.

Chapter 5 contains a detailed discussion of the data sets provided by Philips and ATNS, as well as the methodology to be used in the statistical analysis. Chapter 6 presents and discusses the results in terms of the research objectives and hypotheses, at the same time highlighting the limitations.

Chapter 7 concludes the study by summarising the relevant problems and interpreting the findings, ending with a brief discussion of potential future research areas.

1.8 SUMMARY

Chapter 1 provided an overview of the problem of the occurrence of flight delays in relation to their influence on business travellers from a time and cost perspective. The research objectives were identified and a number of hypotheses stated to guide the research on the influence of flight delays and the further empirical analysis of whether there are any trends or patterns in the occurrence of flight delays in terms of seasonality (month of the year), days of the week (weekends vs weekdays) or even arrival times (workday vs night flights).

The methodology to be used in the analysis of the two sets of data received from Philips and ATNS was briefly mentioned, and the importance and benefits of the study to both organisations as well as individual airline companies was discussed.

Chapter 2 will give an overview of the air transport industry to provide a context for understanding the occurrence of flight delays.

CHAPTER 2

AN OVERVIEW OF THE AIR TRANSPORT INDUSTRY

2.1 INTRODUCTION

The previous chapter discussed the main problems to be addressed in this study and highlighted some of the previous research studies conducted in this field, which resulted in the identification of a gap in the research on the influence of flight delays on business travellers, and communicating the occurrence of flight delays through m-commerce tools such as SMS/text messaging. This chapter looks at the air transport system and how flight delays occur, also discussing the stakeholders, rules and regulations within the system as they may pertain to the occurrence, management or even prevention of flight delays

2.2 THE AIR TRANSPORT SYSTEM

The term “air transport system” is used in its widest sense to encompass all the subsystems needed to meet the demand for air transport (Smuts & Brits, 1999; Kane, 1996). More specifically, the air transport system consists of aircraft, airports and route services (air traffic and navigation), including all the necessary inputs for operating the various subsystems effectively (Smuts & Brits, 1999). Figure 2.1 shows the air transport system and the various influences to which it is subject (constraints and controls/regulations), as well as the factors with which it interacts (demand).

Figure 2.1: The Air Transport System

QuickTime™ and a
TIFF (LZW) decompressor
are needed to see this picture.

Source: Smuts, CA & Brits, A. 1999. Air Transport: Study Guide for TRL303-6. Department of Transport Economics and Logistics/UNISA.

One of the biggest issues facing airlines and airports is passenger growth, which is forecast to rise from just over two billion in 2006 to 2.75 billion by 2011 (SITA, 2008b; IATA, 2007). A variety of factors have given rise to a surging worldwide demand for air transport, including economic growth and the concomitant increase in the wealth of individuals, the growing importance of international trade, technological advancement in aviation, the liberalisation of markets and the emergence of new routes and services. These factors have resulted in the greater availability of air transport, declining operating costs due to economies of scale and consequently lower fares (IATA, 2007; Smuts & Brits, 1999). Due to the rising demand, the air transport system and its subsystems are under increasing pressure to provide a safe and effective service. The rising strain on system capacity has contributed to the potential for flight delays.

As the subsystems are interdependent, deficiencies in one automatically affect the ability of the system as a whole to provide a satisfactory service. It can be seen from Figure 2.1 that

the system may affect air transport demand either positively or negatively, depending on the extent to which it succeeds in providing safe and effective services that at the same time meet users' needs (Smuts & Brits, 1999). Ultimately, it is imperative that all the various subsystems work together and that the equilibrium of the overall system should not be disturbed too often.

The three major components of the air transport system are identified as:

- The airport, including the air traffic control system;
- The airline; and
- The user (Bauer, 2000; Smuts & Brits, 1999; Ashford *et al.*, 1997).

All three components have a vital role to play in the on-time performance of airlines. The airline's aircraft constitute the system's mobile units and, as such, perform the transport function, which is to move people and goods through space between an origin and a destination (Hanlon, 1999; Smuts & Brits, 1999). Due to advancements in aviation technology, the rate at which new aircraft are being developed, produced and commissioned has provided the much needed capacity to adapt to the requirements of operators and users in the market, although increasing demand has multiplied the number of aircraft in the air, creating the problem of congestion (UNESCAP, 2003). The role of airlines in the occurrence of flight delays will be discussed in Section 2.4.5.

In terms of capacities and characteristics, it is far more difficult to adapt the airport sub-system to changing circumstances. Airports are made up primarily of fixed assets with a long service life, such as runways, terminal buildings and facilities and access systems, which require major capital investment. Since the capacity and location of these assets are largely fixed, it is extremely difficult to adapt them to changing circumstances. Most of the time, only minor changes are possible, which are in most cases extremely costly. Strained facilities can lead to delays in the processing of passengers, which could potentially lead to flight delays. To prevent potential future challenges, all airport facilities should be planned and designed in such a way as to facilitate easier adaptation to changing circumstances (Kazda & Caves, 2000; Smuts & Brits, 1999; Ashford *et al.*, 1997; Horonjeff & McKelvey, 1994). A discussion of airport operations follows in Section 2.3.

Air traffic control and navigation services are the most important route services (ATNS, 2008c; Smuts & Brits, 1999; Nolan, 1994). Air traffic control is concerned with the safe and effective flow of aircraft at airports and in the air, particularly when air traffic is dense and visibility poor. The key requirements for effective air traffic control include equipment for observing traffic, navigational aids, weather data and the existence of rules and procedures. Air traffic control can issue commands that prevent airlines from departing or arriving at a specific airport (perhaps due to poor visibility), which potentially results in the occurrence of flight delays, or even cancellations. The role of air traffic control in the occurrence of flight delays will be discussed in Section 2.4.2.

Apart from the three major components (airport, airline/aircraft and users), the air transport system operates within a complex environment system, characterised by several complex sets of economic, technological, social and political relationships at national and international levels – as shown in Figure 2.2.

Figure 2.2: The Air Transport Environment System

Source: Smuts, CA & Brits, A. 1999. Air Transport: Study Guide for TRL303-6. Department of Transport Economics and Logistics/UNISA.

The rate of technological development in the airline industry has been far more rapid than in any other mode of transport. In aviation, innovation has centred mainly on the development of jet engines for civil use. Technological developments have made it possible to build larger and faster airliners, increasing the productivity of aircraft, decreasing the unit costs and

improving aircraft safety. This potentially aids in alleviating the occurrence of flight delays by reducing the number of aircraft in the system at any given point in time.

On the other hand, the introduction of large and wide-bodied aircraft could severely strain airport facilities, due to the larger amounts of cargo and passenger numbers that have to be managed. This scenario again demonstrates the interdependence of the various subsystems within the air transport system. A report released by the Airports Council International (ACI) indicated that, while worldwide passenger numbers grew by nearly 7%, the growth in aircraft movement was 2.4%, showing that the industry worldwide had moved to larger aircraft which were flying with higher load factors (ACI, 2008a; ACI, 2008b). Increased passenger numbers can put greater strain on ground handling operations, increasing the potential of delays on the land-side of the system. Changes to one sector of the system require careful consideration of other system components to ensure minimal disruptions.

Air transportation has become an integral part of our social and political environments. Despite the pragmatic view that transport merely performs a utility function in society, air transport has vastly improved the mobility of people and goods all over the world, aptly demonstrated by the impact of international tourism (SA Info, 2008a; Smuts & Brits, 1999). A total of 9.07 million foreigners visited South African in 2007, representing an 8.3% increase over 2006 (SA Info, 2008a). This increase in arrivals, especially by air, reflected not only a growing awareness of South Africa, but the success of allowing increased access to the South African market for foreign carriers (SA Info, 2008a). In this context, disruptions caused by flight delays could result in appointments having to be postponed or even cancelled, potentially fostering negative emotions that could damage future business relations or prevent the conclusion of vital contracts.

The political environment is particularly important to international airline operators (Forbes, 2006; Smuts & Brits, 1999; Hanlon, 1999). Since air transport takes place across national borders and through the airspace of sovereign states, any bilateral or multilateral agreements must clearly set out the rights and obligations of the parties involved. In some countries legislators have imposed certain take-off and landing constraints at airports, which effectively impose entry restrictions at most heavily congested airports and sometimes increase the occurrence of flight delays (Forbes, 2006). Many countries have since made an attempt to lift

these restrictions in order to improve the flow of traffic and allow new entry into the affected airports (Forbes, 2006).

The International airline industry operates within a changing regulatory environment, and constantly has to contend with institutional changes affecting air transport (Brueckner & Pels, 2003; Doganis, 2006; Doganis, 2001; Smuts & Brits, 1999; Hanlon, 1999). These regulations can severely restrict airlines' freedom of action (Smuts & Brits, 1999; Hanlon, 1999), market access, pricing policy and output decisions and, as a result, competition itself (Doganis, 2006; Doganis, 2001; Hanlon, 1999). One of the major problems faced by airlines is the need to comply with certain guidelines or procedures as well as regulations of both national and international control bodies, which may even extend to full and rigid control of certain operations (Smuts & Brits, 1999).

Aviation regulation can be either economic or non-economic (Duval, 2007; Smuts & Brits, 1999). Non-economic regulation is primarily concerned with ensuring passenger safety in the face of rapid technological innovation (ICAO, 2007; Doganis, 1991). It takes the form of a multitude of technical standards and regulations aimed at ensuring extremely high levels of safety in the airline industry.

Throughout the years, organisations have been established to regulate and oversee the economics and safety of air carriers, airports and passengers. These include the International Air Transport Association (IATA), the International Civil Aviation Organisation (ICAO) and the Civil Aviation Authority (CAA). The regulations instituted by these organisations are vital in ensuring the safe transfer of passengers. The ICAO promotes safe and orderly international civil aviation through safety certification and safe airport operations (Lubbe, 2008; ICAO, 2007). Safety is an important issue as far as flight delays are concerned. Yet some regulations may increase the likelihood of flight delays due to stringent safety procedures regarding pre-flight aircraft inspections, crew suitability, adequate weather conditions, runway suitability, and many more.

In 1944 the International Conference on Civil Aviation in Chicago spearheaded the creation of a competitive regime for international air transport with minimal regulation (Doganis, 2006;

Doganis, 2001; Hanlon, 1999; Smuts & Brits, 1999). The objective of the conference was to consider three critical issues in international aviation:

- The exchange of air traffic rights (freedoms of the air);
- Control of fares and freight tariffs; and
- Control of frequency and capacity (Smuts & Brits, 1999).

The management of frequency and capacity can greatly affect the management of flight operations and the occurrence of flight delays. If airline scheduling results in too many flights in the air transport system at any given point in time, there is a higher likelihood that flight delays will occur, as the capacities of both airports and airlines may be insufficient to manage the increased passenger numbers efficiently. Currently, the most important issues being debated in the regulatory environment include:

- The Single European Sky;
- Privatisation and liberalisation;
- Safety and security;
- Airport charges;
- Ground handling;
- Airport capacity (and the infrastructure improvements that follow);
- Slot allocations; and
- The impact of the aviation industry on the environment (Lubbe, 2008).

Many of these elements greatly affect the occurrence of flight delays. For instance, the issue of safety and security could result in more stringent rules and regulations that indirectly give rise to flight delays. Additionally, other elements such as ground handling operations, slot allocations and airport capacity can influence the management of flight operations and the potential occurrence of flight delays. Chapter 3 highlights the various reasons most often cited for flight delays and cancellations. Evidently, the regulation of the air transport system plays a role in the occurrence of flight delays, both directly and indirectly.

According to Mike Mabasa, Chairman of ATNS, the future period from 2008 to 2017 will be characterised by traffic growth, operational demands and environmental issues, which will require innovation involving new concepts and technologies (ATNS, 2008c). If not managed

effectively, some factors such as increased traffic growth and government regulations can significantly affect operations in the airline industry and potentially result in flight disruptions.

In this section, the basic structure and complexity of the air transport system were discussed. The major components of the air transport system were identified as airlines, airports and users. Also highlighted was the system's complex set of relationships – economic, regulatory, social, political, technological and ecological – and how they affect the occurrence of flight delays. As the subsystems are interdependent, deficiencies in one subsystem automatically affect the ability of the system as a whole to provide a satisfactory service. Slow ground handling services can result in passenger baggage/cargo not being loaded fast enough, and consequently delay flights. This has a ripple effect through the system and can result in other flights also being delayed. The air transport industry is a complex system, within which successful performance depends largely on how it interacts with the various environments and regulations impacting on it.

2.3 THE ROLE OF AIRPORT OPERATIONS IN THE AIR TRANSPORT SYSTEM

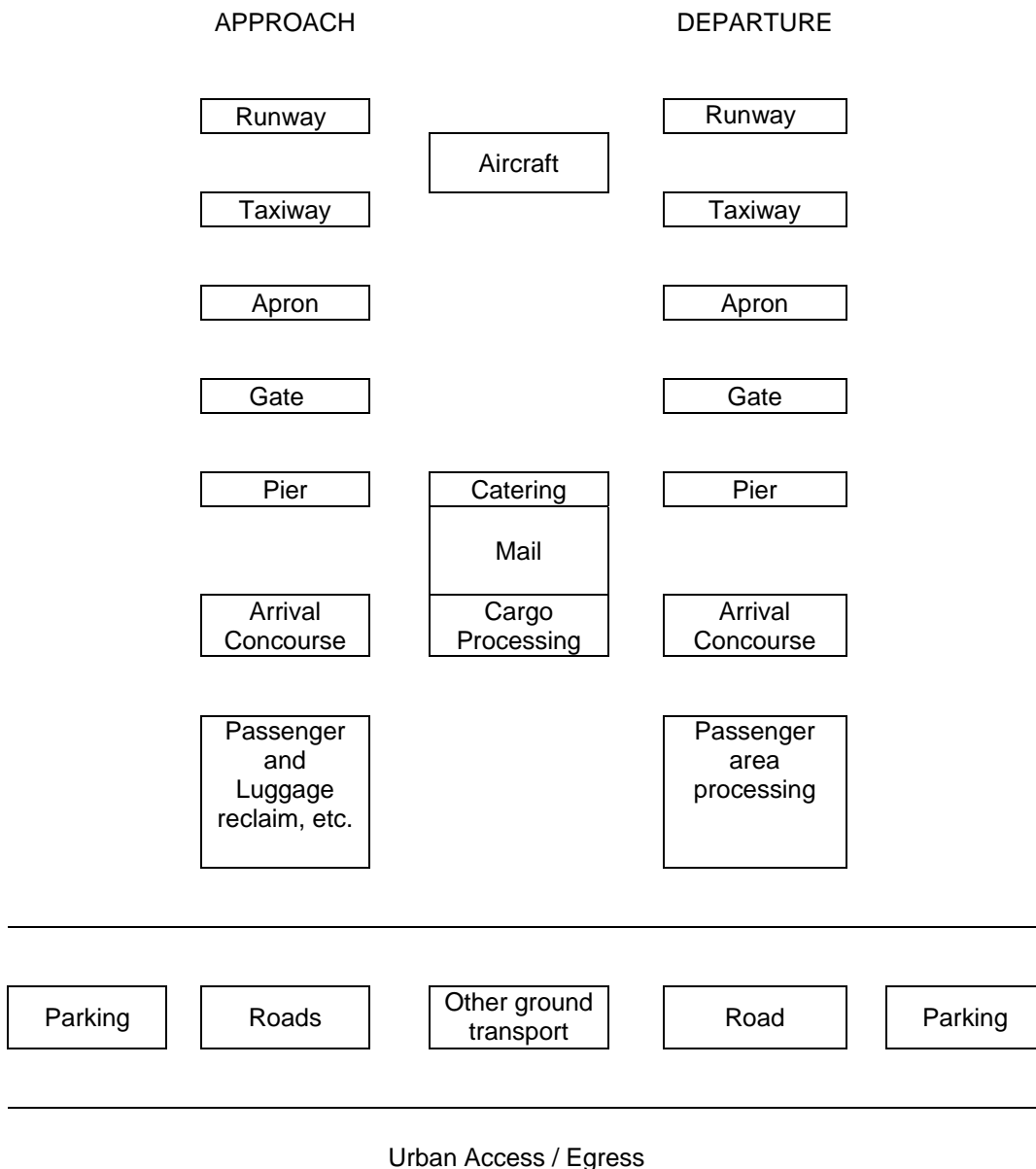
In the previous section it was indicated that the air transport system consists of three major components: the airport (including the airways control system), the airline, and the user (Smuts & Brits, 1999; Ashford *et al.*, 1997). This section discusses the role of the airport component. The airport subsystem plays a vital role in the management of flight operations and the consequent occurrence of flight delays. Airports can influence the management of flight operations through a variety of elements – capacity constraints, local rules and regulations, airport ground handling services and so forth – all which may contribute to the occurrence of flight delays. Air traffic delays directly affect airport operations and management, and all the airport users concerned (ACI, 2002).

Airports are understood to be the link of the air transport chain serving the locational change of persons, freight and post (Sulzmaier, 2001; Smuts & Brits, 1999; Ashford *et al.*, 1997). In essence, an airport consists of one or more runways together with the necessary buildings and terminal facilities for handling passengers, freight and aircraft (Wells & Young, 2004; Graham, 2003; Smuts & Brits, 1999; Ashford *et al.*, 1997). Airports serve as centres where

diverse kinds of resources and activities are brought together and coordinated to effect an efficient exchange between air and land transport of both passengers and goods (ACI, 2008c; ACI, 2006b; Smuts & Brits, 1999).

An airport is either an intermediate or a terminal operating point of an aircraft on a flight, and must be designed to meet the landing and take-off requirements of various different aircraft sizes and models. In between these two operations airports may, if required, load and unload passengers/cargo and crew, or service the aircraft. It is customary to divide airport operations into the air-side and land-side functions, as shown in Figure 2.3 (Smuts & Brits, 1999).

Figure 2.3: The Airport System



Source: Smuts, CA & Brits, A. 1999. Air Transport: Study Guide for TRL303-6. Department of Transport Economics and Logistics/UNISA.

In addition to the basic airport services, airports usually house route services such as air traffic control and navigational services that are an essential element of the air transport service (ACI, 2006b; Smuts & Brits, 1999). Airports serve as access points to domestic and international air transport services and in this way fulfil a major social, political and economic function for the communities or areas they serve (Smuts & Brits, 1999; Ashford *et al.*, 1997). An airport's success in performing this function depends on its ability to promote the safe and

efficient flow of air traffic between places served by the air transport network (Smuts & Brits, 1999).

The successful planning and operation of airports requires air transport to be regarded as an integrated system (ACI, 2008c; ACI, 2006a; ACI, 2006b; Sulzmaier, 2001; Smuts & Brits, 1999). Recognition must be given to the interaction between the airport, the airlines, the users of air transport and the environment in which the system operates (Kazda & Caves, 2000; Smuts & Brits, 1999; Ashford *et al.*, 1997). Research indicates that the airport system could be viewed as a hierarchical system of interdependent relationships (Sulzmaier, 2001; Smuts & Brits, 1999; Ashford *et al.*, 1997). A balance must be maintained between the various elements in the system. Failure to do so could result in suboptimal conditions, exemplified by a number of undesirable phenomena that are indicators of inadequate operations, including high flight delay levels (Sulzmaier, 2001; Smuts & Brits, 1999; Ashford *et al.*, 1997).

Although airports worldwide have many business characteristics in common, each airport operates within its own unique local context (ACI, 2008c; ACI, 2006b). All airports are required to implement the internationally accepted guidelines specified by the International Civil Aviation Organisation (ICAO), the UN body which regulates air transport, yet each must also respect the local culture, legal practices and regulatory requirements (ACI; 2006b). All airport operators need to work closely together with their aviation partners – the airlines, air navigation service providers, concessionaires, and local and national governments – to ensure efficient processes that minimise service failures such as flight delays (ACI, 2006b).

The management of a successful airport is a considerable task, especially with the tremendous change and growth being experienced over the last 20 years. Airports worldwide are currently experiencing a number of key challenges and opportunities:

- Privatisation and liberalisation;
- Airport/airline relationship;
- Airport capacity;
- Safety and security;
- Environmental impacts; and

- Open skies (Lubbe, 2008; ACI, 2007b; Jankovec, 2007).

The structure of the aviation industry has changed dramatically over the past few years (ACI, 2008c; ACI, 2006b). Route liberalisation and privatisation have moved airports to become, no longer mere infrastructure providers, but fully-fledged businesses (ACI, 2008c; ACI, 2006b). The airport business has become increasingly complex as the changing environment has affected traffic growth, capacity constraints, competition, financial results, revenue streams, employment, capital expenditure, ownership, relations with airlines, the regulatory environment and aviation industry cooperation (ACI, 2006b).

The deregulation of air transport (starting in 1978 in the US) represented a free, unlimited access to the market without any capacity and price limitations, unblocking the previously stringent regulation of the market (Doganis, 2001; Kazda & Caves, 2000; Smuts & Brits, 1999). However, it also brought about negative consequences for airport capacity due to the concentration of traffic at major hubs, and the gradual creation of extremely large airlines with the features of strong monopolies (Givoni & Rietveld, 2006; Kazda & Caves, 2000). Givoni & Rietveld (2006) have indicated that when an airport is bound by runway capacity limitations, it could nevertheless increase its number of passengers when larger aircraft are used, as long as the terminal's capacity is sufficient. In Europe, deregulation was approached with such caution that the term "liberalisation" was adopted for the policy. ACI did advocate that, during liberalisation negotiations, airport representatives should participate in national/multinational negotiating teams to ensure that airport capacity issues were appropriately addressed (ACI, 2006b).

Research has predicted that the world's airports will continue to serve growing amounts of passenger and cargo traffic. Flight traffic is estimated to double by 2025 (ACI, 2008c; ACI, 2006b). ACI forecast the demand for air travel at over 7 billion passengers by 2020 (ACI, 2006b), growing to over 9 billion passengers in 2025 (ACI, 2007a). By 2025, it is expected that over 60 European airports will be congested and the top 20 European airports will be saturated at least eight to ten hours a day (ACI, 2008c). Unless capacity can keep pace with traffic growth, passengers, airports and airlines will suffer from congestion, delays and

service reductions (Givoni & Rietveld, 2006; Kazda & Caves, 2000; Ashford *et al.*, 1997; Horonjeff & McKelvey, 1994).

Various factors, including the changing structure of air transport, the trend towards liberalisation, the continual growth in demand for air transport and the development of air transport technology, will continue to place greater pressure on airport capacity, and consequently on airports to continually extend and improve their facilities (ACI, 2008b; ACI, 2008c; ACI, 2006b; Kazda & Caves, 2000; Smuts & Brits, 1999, Ashford *et al.*, 1997). Taking into account the anticipated regulatory constraints, including political and environmental obstacles, to building new facilities, ACI has estimated that airport capacity to accommodate demand would fall short by nearly one billion passengers by 2020, resulting in severe congestion (ACI, 2006b), and consequently increased potential for the occurrence of flight delays, as indicated in Figure 2.4.

Figure 2.4: Annual Passenger Growth: Constrained vs. Unconstrained

QuickTime™ and a
TIFF (LZW) decompressor
are needed to see this picture.

Source: ACI. 2006b. Understanding Airport Business. [Online] Available from: <http://www.aci-europe.org> [Accessed: 2008-10-12].

The Director-General of ACI Europe, Olivier Jankovec (2005), discussed similar results in a report which forecast that the capacity gap could result in significant congestion at major European airports by 2025, as shown in Figure 2.5.

Figure 2.5: 2025 Forecast Capacity Need and Gap by European Airport Segments

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

Source: Jankovec, O. 2007. **How to Address the Capacity Challenge?** [Online] Available from: [http://www.aci-europe.org/upload/Aviation%20club%20Draft%204%20\[Lecture%20seule\].pdf](http://www.aci-europe.org/upload/Aviation%20club%20Draft%204%20[Lecture%20seule].pdf) [Accessed: 2008-11-10].

The surge in traffic will affect all aspects of airport service from car parking to check-in to security screening and baggage delivery, potentially increasing the time taken to pass through the airport, and thus increasing the potential for the occurrence of delays in the system (ACI, 2006b). Additionally, recent moves to liberalise air transport, such as the proposed EU/US open skies agreement, could boost traffic figures even more rapidly than foreseen in ACI's forecasts, resulting in increased disruptions in air traffic (ACI, 2006b; Kazda & Caves, 2000).

Airports are now competing more than at any time in the history of aviation (ACI, 2008c; ACI, 2006b). They compete for new air services, for low-cost carrier traffic, for transit traffic and for cargo services. In many parts of the world, the catchment areas overlap among major hubs that are working to capture and retain business (ACI, 2008c; ACI, 2006b). Even small and medium-sized airports have become accustomed to market pressures as they compete for no-frills and regional services (ACI, 2008c). In South Africa, Lanseria Airport has already attracted the services of the low-cost carrier kulula.com. Finally, airports are competing enthusiastically in the area of service quality (ACSA, 2008a; Makgale, 2008; ACI, 2006b).

Over 80 airports worldwide have enrolled in ACI's Airport Service Quality programme which measures passenger satisfaction on a wide number of airport parameters, including flight delays (ACI, 2006b).

The introduction of large and wide-bodied aircraft will also severely strain airport facilities, due to the larger amounts of cargo and passenger numbers that have to be dealt with as aircraft arrive and depart. The World Airport Traffic Report released by ACI in 2007 indicated that, while worldwide passenger numbers grew by nearly 7% in 2007, the growth in aircraft movement was 2.4%, showing that the industry worldwide had moved to larger aircraft that were flying with higher load factors (ACI, 2008a; ACI, 2008b). The Report also indicated that the 1200 ACI member airports had processed 4.8 billion passengers and 76.4 million aircraft movements. These figures provide glaring evidence of the strains being placed on current airport facilities in coping with the growing numbers of passengers arriving and departing, as shown in Figure 2.6.

Figure 2.6: Total Worldwide Passengers (Billions)

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

Source: ACI (Airports Council International). 2008a. Airports welcome 4.8 billion passengers in 2007. [Online] Available from: http://www.airports.org/cda/aci_common/display/main/aci_content07_c.jsp?zn=aci&cp=1-5-54_666_2 [Accessed: 2008-10-03]

Besides the need for funding for reconstruction and the building of new terminals, the biggest problem for many large airports is the lack of capacity of the runway system, leading to a requirement for new runway construction (Jankovec, 2007; Kazda and Caves, 2000). Not only can the lack of runway capacity be a major influence in the occurrence of flight delays, but the construction of new runways can also cause disruptions to service delivery resulting in further flight delays. To increase airport capacity, solutions could include the construction of completely new international airports or the development of existing airports. In general, the development of existing airports could be problematic as they are unlikely to have reserved sufficient land for further development (Kazda and Caves, 2000). However, compared with other means of transport, investments in the infrastructure of air transport are relatively small and can be obtained relatively quickly (Kazda and Caves, 2000). New standards and the growing transport volumes have made it necessary to completely reconstruct some airport terminals, such as those at the OR Tambo International Airport in Johannesburg, South Africa.

No progressive region can sustain growth and prosperity without good airport infrastructure and convenient connections to the global marketplace (ACI, 2006b). The nature of networks and how they are involved in providing accessibility is therefore vital in allowing airlines to make critical decisions as to where and how often they fly into and out of certain destinations and types of airports (Duval, 2007). The three primary types of networks in passenger air transport are:

- Hub-and-spoke networks;
- Grid networks; and
- Line networks (Duval, 2007; Hanlon, 1999).

It is anticipated that the hub-and-spoke system will continue to be preferred in many countries, so causing further pressure on capacity (Kazda & Caves, 2000). Hub-and-spoke networks involve a central hub into which traffic from outlying spokes feeds, in both domestic and international networks (Duval, 2007; Hanlon, 1999). With this system air carriers can arrange schedules and routes so that a large number of aircraft will, over a short period of time, arrive from outlying *spoke* airports at a hub facility where passengers deplane to transfer to aircraft bound for their final destinations (Lubbe, 2008).

Since deregulation in the late 1970s in the US, the use of hub-and-spoke networks has grown increasingly popular, largely due to the effect they have in multiplying by permutation the number of city pairs an airline can serve (Lubbe, 2008; Duval, 2007; Brueckner & Pels, 2003; Hanlon, 1999). Figure 2.7 depicts the flow of a hub-and-spoke network.

Figure 2.7: Hub-and-spoke Network Design

Source: Duval, D.T. 2007. Tourism and Transport: Modes, Networks and Flows. Great Britain: Channel View Publications.

The hub-and-spoke system tends to increase air traffic to a specific central point, the hub. Some research found that hubs are prone to longer delays than non-hubs, whilst airport concentration had a negative effect on the length of delays (Janic, 2005; Mayer and Sinai, 2003). The hub-and-spoke system tends to increase air traffic to a specific central point (the hub). Also, the use of larger aircraft allows for the movement of greater numbers of passengers, which increases strain on capacity at airports worldwide, adding to the occurrence of flight delays (Lubbe, 2008; Duval, 2007; Hanlon, 1999). On the other hand, greater airport concentration could provide more departure and arrival points, thereby distributing flight traffic and possibly reducing the occurrence and extent of flight delays. The following section will look at the structure of air transport operations specifically in South Africa.

2.4 AN OVERVIEW OF AIR TRANSPORT OPERATIONS IN SOUTH AFRICA

According to the 2006 Airlift Strategy, the 1996 White Paper on National Transport Policy, defines South Africa's mission for air transport as follows (SA Department of Transport, 2006):

“To maintain a competitive civil aviation environment which ensures safety in accordance with international standards and enables the provision of services in a reliable and efficient manner at improving levels of service and cost while contributing to the social and economic development of South Africa and the region.”

The mission makes specific reference to the elements of “*safety*” and “*reliable and efficient service*”, both elements being relevant to the occurrence of flight delays. The influence of passenger “*safety*” through rules and regulations has already been mentioned. Also, the desire to provide a “*reliable and efficient service*” would include the minimisation, or even prevention, of flight delays. To achieve the above mission, the South African Department of Transport has launched a five-year South African Airlift Strategy for the regulation of air transport (SA Department of Transport, 2006).

The strategy aims to facilitate operations in the South African civil aviation industry so that it will function in a more efficient manner through the implementation of various measures to better manage local air transport capacity. For example, one of the key issues on which the strategy will focus is the unblocking of capacity constraints through negotiating air service capacity ahead of demand. Additionally, the strategy will allow for better control over airline slot allocations through a “use-it-or-lose-it” principle: airport slots not used at least 80% by airlines (foreign and South African) will be withdrawn and re-allocated. By implementing such measures to better manage airline movements and capacity, the strategy could aid the better management, or reduction, of flight delays.

At times the various rules, regulations and Acts tend to hamper the efficient flow of air traffic and result in flight delays. As in other countries, apart from the legal mandates imposed by government, the South African air transport sector is regulated by a number of organisations focused on the implementation of technologies, standards and regulations to ensure the safe

and efficient flow of air traffic through South African airspace. These organisations include the Airports Company of South Africa (ACSA) and the Air Traffic and Navigation Services Company of South Africa (ATNS).

2.4.1 Airports Company of South Africa (ACSA)

South Africa's airports were owned and operated by the state until 23 July 1993, when ACSA was officially established and nine airports were transferred to the company (Lubbe, 2008; ACSA, 2008a; South African Consulate General, 2008). ACSA's sole shareholder was the state from then on until partial privatisation in 1998, when 25,4% of the shareholding was sold to foreign and South African private sector shareholders. In 2005, the 20% foreign shareholding was sold to a South African investment company. Since then, the Ministry of Transport has been the major shareholder. Although ACSA is thus majority-owned by the South African government, the company is legally and financially autonomous and operates under commercial law (ACSA, 2008a).

Currently ACSA operates the ten principal airports of South Africa, handling over 98% of the country's commercial air traffic (ACSA, 2008a; SA Online, 2008). The three major international airports are Johannesburg (OR Tambo), Cape Town and Durban. The domestic airports include Bloemfontein, East London, Port Elizabeth, George, Nelspruit,, Kimberley and Upington (SA Online, 2008; SA Info, 2008b).

The semi-privatised ACSA is responsible for overseeing infrastructure expansion at the country's airports. In 2007, ACSA proposed a five-year capital expenditure programme of just under R20 billion, both to accommodate new generation aircraft and to handle growing passenger numbers (SA Info, 2008b). ACSA's flagship development, the new R750 million domestic terminal at OR Tambo International Airport, Johannesburg, will increase its capacity to serve more than 18 million passengers annually. ACSA has also committed R1 billion to the upgrading and development of Cape Town International Airport, in addition to a R10 million interim expansion project to extend the domestic terminal that was completed in May 2003 (SA Online, 2008). The various capacity upgrades are partly to provide for the increasing growth in passenger numbers that put a strain on current facilities and, at times, result in service failures such as flight delays.

In the 2008 financial year, the network processed more than 36 million departing and arriving passengers and 291 thousand aircraft landings from nearly 50 international destinations connecting Africa with all other continents (ACSA, 2008a). According to ACSA (2008a), the sustained growth in traffic over the years has greatly contributed to ACSA's financial performance over time. On the other hand, the growth in traffic could also have contributed to the occurrence of flight delays.

ACSA's Aviation and Operational Services influence the occurrence of flight delays and cancellations (ACSA, 2008b). The **Aviation Services** are responsible for airport planning, infrastructure development management, operational safety and compliance, environmental policy and standards, traffic analysis and research, as well as service standards monitoring and geographic information systems. These elements, which include timely infrastructure development, implementing safety policies and conducting traffic analysis and research, are vital in effectively managing the continuous growth in air traffic. The **Operations Division** is responsible for ensuring adequate and effective management of operations across ACSA's network of airports. It focuses on ensuring that passenger and aircraft activity are facilitated smoothly through the airports on a daily basis. Aviation security forms an important part of this Division. Ground handling services such as baggage handling are also vital in ensuring the smooth flow of traffic through airports. Ground service failures too can result in the occurrence of flight delays.

One of the main challenges experienced recently by ACSA has been a transition in ground handling services at all ten airports owned and managed by ACSA, to two new companies, BidAir Services and Menzies Aviation (Makgale, 2008; Van der Merwe, 2008). Even though the switchover has been a positive move for the South African aviation industry, on the actual switchover day there were some instances in which passengers were delayed either at baggage reclaim or bussing gates. However, this was mainly because some ground-handling staff of the previous company, Equity Aviation, did not arrive for their last day of work, or because those employees who did show up worked slowly. Bongani Maseko, Director of Operations at ACSA, predicted that, even though there were some start-up challenges, the partnership would be able to minimise turnaround times and improve overall passenger experience (Makgale, 2008). Both companies have committed to improvement of

services to passengers, with specific reference to the improvement of on-time departures by reducing flight delays caused by poor logistical arrangements (Van der Merwe, 2008).

While ACSA plays an important role in regulating airport operations, the company is itself regulated by the Airports Company Act. The Act provides for an independent statutory body – the Regulating Committee – to oversee the economic regulation of ACSA (Lubbe, 2008). Some of the principal objectives of the Regulating Committee are: promoting the reasonable interests and needs of ACSA airport users, focusing on the safety of operations, and encouraging the timely improvement of facilities at ACSA airports (Lubbe, 2008). The implementation of certain safety regulations can at times hamper the smooth flow of air traffic and consequently result in service disruptions such as flight delays. On the other hand, the timely improvement of airport facilities is vital in addressing current or potential capacity constraints, particularly in light of the strong growth in passenger numbers. Yet, during the actual construction of infrastructure improvements, there may be increased disruptions in service such as flight delays and cancellations.

In accordance with the regulations, improving service levels has been a key focus area for ACSA. In line with international standards, the company is now monitoring both passenger perceptions and actual operational and commercial performance. Passenger perception surveys are conducted monthly during peak operational periods and evaluated quarterly through an independent research institution (ACSA, 2008a). ACSA can thus better monitor what passengers perceive and require during positive and negative flight experiences (such as flight delays), so as to respond to their needs more effectively (ACSA, 2008a).

2.4.2 Air Traffic and Navigation Services (ATNS)

The Air Traffic and Navigation Services Company of South Africa (ATNS), is the sole provider of air traffic navigation, training and associated services in South Africa (ATNS, 2009a; ATNS, 2008a; ATNS, 2008c). ATNS operates within a strict regulatory environment. From an economic perspective, ATNS is regulated by the Regulating Committee, including the capping of the company's tariffs and prescription of the minimum service standards.

ATNS currently manages about 650 000 aircraft arrival and departure movements per year (ATNS, 2008a; ATNS, 2008c), with air traffic continuing to grow at a phenomenal pace (SITA, 2008; ATNS, 2008a; ACI, 2008a; ACI, 2008b; IATA, 2007). ATNS is responsible for air traffic control (ATC) services in approximately 10% of the world's airspace (ATNS, 2009a; ATNS, 2008c); it manages 22 000 000 km² of airspace extending all the way down to the South Pole and approximately halfway to both South America and Australia, as shown in Figure 2.8 (ATNS, 2008c).

Figure 2.8: Managing Ten Percent of the World's Airspace

QuickTime™ and a
TIFF (LZW) decompressor
are needed to see this picture.

Source: ATNS (Air Traffic and Navigation Services). 2008c. Air Traffic and Navigation Services Annual Report 2007. [Online] Available from: <http://www.atns.co.za/> [Accessed: 2008-09-30].

Apart from the familiar ATC services and the provision of vitally important aeronautical information used for all flight planning purposes, ATNS's operations further include (ATNS, 2009a; ATNS, 2008a; ATNS, 2008c):

- The supply of aeronautical information services, technical maintenance and aerodrome services;

- Alert, search and rescue coordination services;
- Management of the flexible use of airspace through the Central Airspace Unit (CAMU);
- National slot coordination;
- Support for special requirements such as test flights, demonstration flights, etc;
- Pre-flight information services;
- The implementation and maintenance of a terrestrial-based navigational structure;
- Radar services for aircraft in distress;
- ATC services at appropriate levels, depending on the airspace of operation;
- A flight coordination service with adjacent Air Traffic Service (ATS) providers;
- The training of licensed air traffic controllers and technical staff through the ATNS Training Academy (ATA); and,
- The African Indian Ocean (AFI) Regional Monitoring Agency (ARMA), acting on behalf of the International Civil Aviation Organisation (ICAO), is delegated to South Africa and hosted by ATNS.

The numerous operations are central to managing the consistent flow of air traffic and the prevention of service failures such as flight delays. Apart from focusing on improving performance through infrastructure renewal and increasing capacity, ATNS has implemented numerous strategies focused on improving services, not only by itself, but also in cooperation with various industry stakeholders including airlines and airports. Due to an imbalance between the demand for air transport and the availability of adequate airport facilities/ infrastructure and airspace systems, to meet the demand at OR Tambo (Cape Town) and Durban International Airports, a system issuing arrival and departure slots has been applied (ATNS, 2008). With the cooperation of airlines, airports, ATC and Industry experts, IATA (International Air Transport Association) has developed a comprehensive set of procedures that are intended to provide guidance on managing the allocation of scarce resources at congested airports on a fair, transparent and non-discriminatory basis. In South Africa, ATNS is the appointed and approved IATA slot coordinator, with input on airport constraints by ACSA.

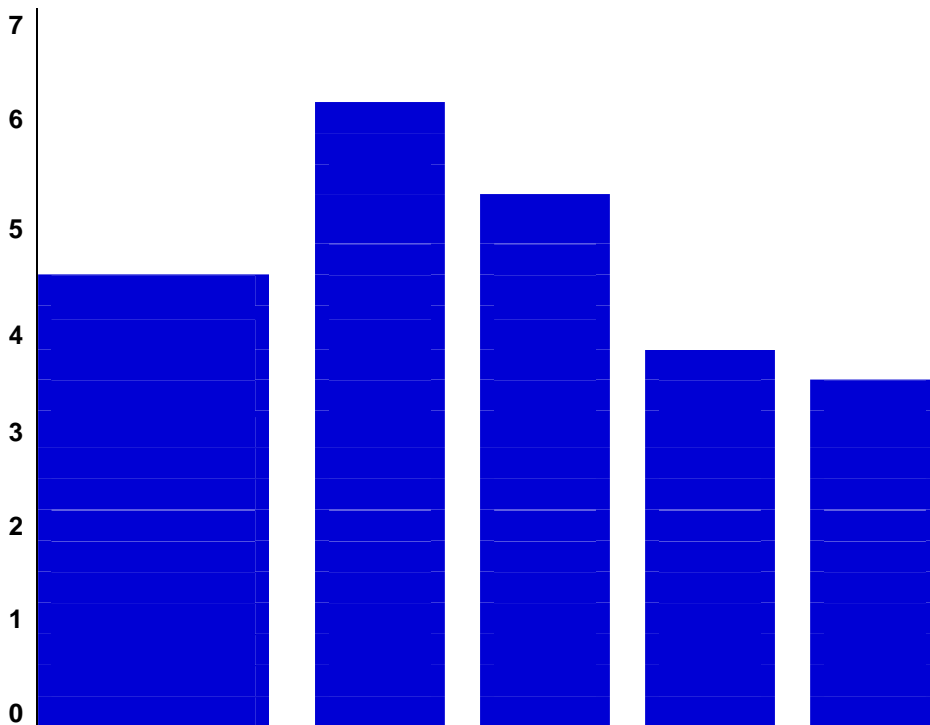
ATNS recently completed the upgrade of its radar display and processing systems and is planning to increase its capacity at OR Tambo International Airport from 52 to 72 aircraft

movements per hour (ATNS, 2008b). It has already successfully achieved an increase to 56 aircraft movements per hour, and has successfully taken over the slot allocation system in South Africa (ATNS, 2008c). The airspace, route structure, arrival and departure procedures have also been completely restructured. These initiatives have largely been in response to the need to manage the growth in air traffic, and reduce the occurrence of incidents such as flight delays.

Over the past ten years ATNS has been able to respond effectively to a 160% increase in air traffic movements and the recent downturn in the aviation market, as well as an increased demand for efficiency and safety in the South African market. Apart from managing 649 539 air traffic movements in 2007, compared with 608 930 in 2006, which represented a 6.7% increase, ATNS has managed to do so in a safe and efficient manner by reducing the safety ratio (ATNS, 2008a, ATNS, 2008c). As indicated in Figure 2.9, in 2007 ATNS recorded an average incident rate of 3.54 incidents per 100 000 movements, a slight improvement on 3.61 at the end of 2006 (ATNS, 2008c).

Figure 2.9: Incident Rate per 100 000 Aircraft Departure and Arrival Movements

Per 100,000 movements



2003 2004 2005 2006 2007 Period

Source: ATNS (Air Traffic and Navigation Services). 2008c. Air Traffic and Navigation Services Annual Report 2007. [Online] Available from: <http://www.atns.co.za/> [Accessed: 2008-09-30].

Additionally, to further ensure a safe and efficient service, ATNS implemented a new retention scheme, which allowed it to increase the air traffic service staff complement by 10% in 2007, and there has already been an 83% uptake of the retention scheme. This retention scheme enabled the company to respond safely to a planned 5.4% annual increase in air traffic in South Africa, as well as compete for a scarce global commodity in an environment where there is currently a 13% shortage (ATNS, 2008c). The issue of safety can have a strong influence on the occurrence of flight delays, e.g. poor weather may result in unsafe conditions, resulting in flights (arrival or departure) being delayed.

ATNS plays a valuable role in monitoring flight delays through Traffic Flow Management Systems (TFMS). Quite separate from Air Traffic Control, in which the safe air navigation and traffic separation services are the primary objectives, the objectives of a TFMS are to provide services that focus on cooperative planning and minimisation of delays (ATNS, 2008b). With regard to flight delays, the operational benefits of a TFMS are providing enhanced services for airspace users and Air Traffic Controllers through:

- The centralised management and allocation of available capacity;
- Forward notice of abnormal capacity situations such as extreme weather conditions;
- Tools to implement delay programs that limit cost implications for airspace users due to abnormal capacity situations;
- Relieving Air Traffic Controllers of a significant part of their workload and consequently reducing stress levels during control operations;
- Providing airline operators with timely and accurate information on any event affecting the flow of air traffic and the capacity of the airspace, and proposing effective solutions to minimise delays or re-route traffic;
- Improving capacity, sector productivity and support costs;
- Improving information distribution and coordination with the ATC system and other users, thus improving “system-wide” decision making;
- Expediting airport arrival, departure, taxiway and aircraft turnaround processes;

- Integrating all airspace users in ATM processes;
- Optimising flight profiles and routes during adverse weather conditions that affect airspace operations (ATNS, 2008b).

ATNS reports (2008b) that it is currently performing some of the above processes, and is in the process of co-developing software to automate all the proposed services. Apart from coordinating air traffic movements to ensure safety, air traffic controllers are vital in directing planes efficiently to minimise delays (BLS, 2008). ATNS is central in organising the flow of aircraft into and out of airports, and in doing so reduces the potential for service failures such as flight delays.

2.4.3 South African Government

In most countries, air transport services are defined by law. In South Africa, these definitions can be found in the Air Services Act (Act No. 51 of 1949) (Smuts & Brits, 1999). An “air service” is defined in the Civil Aviation Regulations (as amended) as “a service provided by means of an aircraft for reward”. This includes an “air transport service”, which is a service provided by aircraft for the transport of passengers and cargo for remuneration, and on charter terms.

A number of government instruments represent the legal mandate for the regulation of air transport services in South Africa, including:

- **The Constitution of the Republic of South Africa, 1996;**
- **The Convention on International Civil Aviation (Chicago Convention) of 1944**, which regulates international civil aviation worldwide;
- **The Aviation Act (Act No. 74 of 1962)**, which gave effect to South Africa’s legal adoption of the Chicago Convention;
- **Civil Aviation Policy**, which guides South Africa’s participation in the rapidly changing aviation market;
- **The Air Services Licensing Act (Act No. 115 of 1990)**, which regulates access to the domestic air services market, based on airlines’ ability to operate safe, secure and reliable air services;

- **The International Air Services Act (Act No. 60 of 1993)**, in terms of which the International Air Services Council was established, and which empowers the Minister to enter into air services agreements with other states, subject to the approval of the President;
- **The National Freight Logistics Strategy of 2005**, which focuses specifically on infrastructure issues;
- **Bilateral Air Services Agreements**, which are negotiated on an equal basis between equal partners, reflecting the mutually agreed best-fit between the national interests of the negotiating partners, and through which since 1992 South Africa has embarked on a review and modernisation of all its bilateral air services arrangements in terms of the International Aviation Policy;
- **Multilateral and Regional Agreements**, including the World Trade Organisation (WTO) Yamoussoukro Decision and the South African Development Community (SADC) Protocol (SA Department of Transport, 2006).

In 1993 airport and air traffic and navigation services in South Africa were commercialised (South African Consulate General, 2008). Following commercialisation, in February 1998 the Cabinet approved the *Green Paper on National Policy on Airport and Airspace Management*, which laid down the principles for the development of airports and established criteria for matters ranging from economic activity to the implementation of air traffic control. The Green Paper also called for the sustainability of public-owned airports to be assessed and for action to be taken where necessary (South African Consulate General, 2008).

The South African body tasked with commercialising certain elements of the Government's aerial operational activities is the South African Civil Aviation Authority (CAA). Effectively, the CAA controls civil aviation in South Africa (South African Consulate General, 2008). The CAA was established on 1 October 1998, following the enactment of the South African Civil Aviation Authority Act, No.40 of 1998. The Act provided for the establishment of a stand-alone authority charged with promoting, regulating and enforcing civil aviation safety and security.

In South Africa, the CAA is responsible for establishing aviation security standards and monitoring compliance by ACSA and airports, airlines and other civil aviation bodies as part of licensing requirements (CAA, 2006). The varying rules and regulations from different countries often influence the occurrence of flight delays. Flights may be delayed, or even cancelled, for numerous reasons related to safety and security, including local flight regulations, mechanical problems, poor weather conditions, or even temporary measures related to airport safety such as the increased security measures following the 09/11 terrorist attacks in the US, which resulted in severe service disruptions.

In addition, a number of regulatory mechanisms in the current system have increasingly come into conflict with the objectives and aspirations of the airlines themselves (SA Department of Transport, 2006; Hanlon, 1999). Ownership clauses in bilateral air service treaties have restricted the granting of relevant freedoms of the air to some airlines (Hanlon, 1999). Many airlines are seeking to break free from the constraints that bilateral negotiations have imposed on their route networks. In 1992, South Africa embarked on a review and modernisation of all bilateral air services agreements in terms of the International Aviation Policy, which has since then ensured the presence of unprecedented numbers of airlines flying to and from South Africa (SA Department of Transport, 2006). However, the majority of countries prefer to limit the GATS Annex on Air Transport to what are termed soft rights and exclude traffic rights (“hard rights”) (SA Department of Transport, 2006).

Flight delays resulting from unexpected circumstances (e.g. poor weather conditions) may cause some crew members to reach their flight hour limits (in terms of certain regulations), resulting in further delays as new crew first need to be sourced. Safety measures can likewise result in flight delays; for example, aircraft scheduled to depart may be detained due to mechanical problems. In unsafe weather conditions aircraft departures may be delayed or cancelled, while arriving aircraft may also be delayed or have to be rerouted to a different airport, which can result in serious logistical challenges for passengers.

Raising safety standards in South Africa is a key initiative, as President Thabo Mbeki pointed out at the 2005 African Union transport ministers' conference: *“Airlines are often unreliable, with frequent cancellations that are not only inconvenient but also unproductive. Raising safety standards is a key challenge for improving the transport infrastructure of the continent.*

Although Africa only accounts for 3% of global air traffic, 27% of all fatal air accidents occurred on the continent in 2004. We have committed ourselves to reduce accidents by 50% by 2010, but this requires steadfast decisions in the areas of upper airspace management, maintenance, and operations on the ground" (CAA, 2006).

Apart from various projects to upgrade air transport facilities in South Africa, in a bid to further secure a safe airspace over Africa, the Department of Transport, in collaboration with the CAA, has presented flight safety seminars in South Africa, starting in February 1999. These seminars were organised under the auspices of the Convention for International Civil Aviation (South African Consulate General, 2008).

South Africa's aviation policy was reviewed to move away from protectionism and introduce greater openness and competition (South African Consulate General, 2008). It is widely believed that the reform of Africa's aviation industry should be speeded up through the implementation of the 1999 agreement by African leaders in Yamoussoukro (CAA, 2006), to which South Africa is party. This agreement provides for the opening up of African skies over the next few years.

2.4.4 South African Weather Service

The South African Weather Service (SAWS) is the meteorological service under the South African Government Department of Environmental Affairs and Tourism, and a member of the World Meteorological Organisation (Wikipedia, 2009a). Under the South African Weather Service Act (No. 8 of 2001) the SAWS became a public entity with effect from 15 July 2001. The SAWS operates a significant number of weather stations in South Africa, as well as stations at Gough Island and Marion Island, and in Antarctica, in cooperation with the South African National Antarctic Programme.

The SAWS provides meteorological information for commercial and private flights using ICAO standards and codes (SAWS, 2009). The SAWS owns three aircraft that are used as mobile platforms in atmospheric science studies (Aviation Weather, 2008). The aircraft used to gather this information include two Rockwell Aerocommander 690As capable of operating up to 30 000 feet (10 km), and a Piper Twin Comanche. The Information is then compiled and

distributed by the Aviation Weather Centre at OR Tambo International Airport and the main forecasting centres in Bloemfontein, Cape Town, Durban and Port Elizabeth. The role of these aircraft cannot be over-emphasised as they form an integral part of SAWS instrumentation used in atmospheric research; without its advanced in-house monitoring and cloud seeding facility, the SAWS would not have achieved the success it has (Aviation Weather, 2008).

Moreover, through the use of these aircraft, the SAWS is actively involved in weather control research under the South African National Precipitation Research and Rainfall Enhancement Programme, and specifically with the Bethlehem Precipitation Research Project (Wikipedia, 2009a; Aviation Weather, 2008). So far, the SAWS aircraft are regarded as the most effective vehicles to deliver hygroscopic cloud seeding material. In 2005, the South African National Research and Rainfall Enhancement Programme was awarded the UAE Prize for Excellence in weather modification, in recognition of the design and execution of a successful weather modification experiment involving a revolutionising concept. It is essential that this facility remains available to enable the better management of weather in South Africa, especially with regard to recording and predicting flying weather conditions for the aviation industry.

The SAWS plays an important role in the better management of flight delays through the timely forecasting of bad weather conditions. Weather radar is a type of radar used to locate precipitation, calculate its motion, estimate its type (rain, snow, hail, etc.) and forecast its future position and intensity. Modern weather radars are mostly pulse-doppler radars, capable of detecting the motion of rain droplets in addition to the intensity of the precipitation (Wikipedia, 2009b). Both types of data can be analysed to determine the structure of storms and potential to cause severe weather. Such information could greatly aid in the management of flight operations, with the aim of preventing flight delays through various strategies such as better selection of airline schedules, routes, etc. However, it should be noted that radar data interpretation depends on many hypotheses about the atmosphere and the weather targets, including the volume scanned, attenuation, amplification, the outgoing and returning waves, and many more (Wikipedia, 2009b). As such, these hypotheses are not necessarily met in many circumstances, and airline operators have to recognise that weather cannot always be predicted to a 100% certainty.

However, the digital systems now used allow for thunderstorm tracking surveillance. This gives the SAWS the ability to acquire detailed information with each storm cloud being tracked. Once a thunderstorm cell is identified (after meeting strict definitions of intensity and shape), the speed, distance covered, direction and Estimated Time of Arrival (ETA) can all be tracked and recorded to be utilised, thus providing aviation operators, including air traffic controllers, airlines and airports, with valuable weather-related information to better manage air traffic movements.

To effectively manage air traffic movements, the various stakeholders in the aviation industry are greatly dependent on the weather predictions provided by the SAWS. If air transport operators can be timeously warned of poor weather conditions, flight schedules could potentially be adjusted to minimise flight disruptions such as delays. In addition, if airline staff can be warned in good time of poor weather, they could perhaps put strategies in place to better manage customer experiences and expectations during flight delays.

2.4.5 An Overview of Airline Operations in South Africa

More than 50 airlines, making around 230 000 aircraft landings and carrying about 33 million passengers, move through South Africa's 10 principal airports every year. These include the three major international airports in Johannesburg, Cape Town and Durban, as well as airports in Port Elizabeth, East London, George, Kimberley, Upington, Bloemfontein, Nelspruit and the Pilanesberg (SA Info, 2008b). As regards ownership, South African airlines can be categorised as government-owned or privately owned, including listed companies (SA Department of Transport, 2006; Smuts & Brits, 1999; Hanlon, 1999). Currently, the South African Government owns South African Airways (SAA), SA Express and Mango airlines (ICAO, 2008b). While these airlines are powerful tools for achieving government goals, they also pose unique challenges in respect of the regulatory framework and competition environment. Privately owned airlines providing scheduled air services in South Africa include BA/Comair/kulula.com, Interair, 1Time and Pelican Air Services.

Conventionally, the terms "national airline", "national carrier" or "flag carrier" refer to the national, state-owned airline of a country. This concept, which is as old as commercial

aviation itself, is a direct result of the high cost of capital associated with this industry, leaving governments as the only entities able and willing to source the vast amounts of capital required for the establishment of airlines (Department of Transport, 2006). South African Airways (SAA), South Africa's national carrier, serves over 700 cities, including 20 destinations in Africa, and provides maintenance locally for many of the world's airlines (SA Info, 2008b).

The number of foreign airlines serving South Africa seems to be increasing year on year (SA Department of Transport, 2006). As shown in Table 2.1, it appears that the number of foreign airlines serving South Africa has gradually increased since 2000. During 2002, twelve new airlines entered the South African market while only six operators left the market. In 2003, four new airlines entered the market, balanced by four airlines that left, thus keeping the total at 67. There are various reasons why airlines exit a market: some have withdrawn due to strategic changes to their networks, while others have been liquidated, such as Swissair and Khalifa Airways (SA Department of Transport, 2006). The number of airlines operating in a market obviously has a significant effect on the flow of air traffic. Great numbers of scheduled flights can put increased strain on air transport facilities, resulting at times in service failures such as flight delays.

Table 2.1: Foreign Airlines Serving South Africa

	Foreign Scheduled Airlines	Passenger/Cargo Combined - actual operations	Code Sharing - Market Airline Only	Dedicated Cargo Services
2000	61	49	6	10
2001	61	44	8	14
2002	67	46	9	16
2003	67	47	8	15
2004	71	51	9	14
2005	75	54	9	17

Source: Department of Transport. 2006. Airlift Report 2006. [Online] Available from: <http://www.transport.gov.za/library/docs/aistr/part1.pdf> [Accessed: 2008-09-30].

According to the Massachusetts Institute of Technology (MIT), when the volume is too high in a sector, flights are slowed down or delayed on the ground (MIT, 2003). Additionally, there are numerous rules regulating airline operations in regard to aircraft maintenance checks, pilot/crew work rules, aircraft/flights and passengers (MIT, 2003). Some flight regulations have to do with the need for a feasible aircraft and crew to operate a flight, availability of airport slots, and at times the implementation of certain regulatory programmes, such as ground delay programmes (GDPs), in the event of flight disruptions (MIT, 2003). When capacity is too limited, air traffic controllers issue recovery programmes such as GDPs to prevent the airborne holding of arriving aircraft for many reasons, including safety, crew workload and aircraft fuel limitations. It is considered safer to let aircraft wait on the ground than to have them delayed in the air while waiting for available runway slots.

Airline operations involve a significant amount of randomness, and consequently there is often a notable discrepancy between a schedule's planned and actual performance (Sarmadi, 2004; MIT, 2003; Rosenberger *et al.*, 2000). The most familiar examples of randomness include weather and mechanical failures, which can disrupt the planned schedule (Rosenberger *et al.*, 2000). Rosenberger *et al.* define a *disruption* as an event that prohibits the airline from operating as scheduled (Rosenberger *et al.*, 2000). Optimised schedule designs have resulted in squeezed schedules with little slack for either aircraft or crews, so that flight plans are more inclined to be disrupted, even by small influences (AhmadBeygi *et al.*, 2008; MIT, 2003). For example, a routine maintenance check may identify a mechanical fault which may require more complicated maintenance, resulting in delays. Because of this, there is often a notable discrepancy between a schedule's planned and actual performance (Rosenberger *et al.*, 2000).

Recovery is how an airline reacts to a disruption (Rosenberger *et al.*, 2000). The primary aim of recovery programmes is to return airline operations to the planned schedule. Recovering from disruptions such as flight delays poses a number of challenges to the airline. Airlines' plans are generally based on sophisticated predetermined schedules with little slack (MIT, 2003; Rosenberger *et al.*, 2000). Aircraft, crew and passengers often have different route schedules (MIT, 2003). Additionally, the objective of planning is to minimise operating costs while maximising resource utilisation, leaving very little slack to recover from disruptions (MIT, 2003).

In recovery, flights may be delayed or cancelled, and pilots or planes may be rescheduled – different recovery policies will give different performance results (Rosenberger *et al*, 2000). The general recovery priority of traffic control is generally as follows: aircraft > crews > passengers (MIT, 2003). Traffic control may first implement aircraft route swaps with no crew schedule disruptions, enabling the system to absorb certain flight delays. In the case of a flight cancellation, the hub-and-spoke schedule may almost always enable the system to find a cancellation tour with only two flights, which however becomes especially interesting when the two flights belong to the same planned crew duty. If crew disruptions are inevitable, airlines may have to call in reserve crews.

MIT (2003) states that correct schedule recovery is vital. According to their research, in the US estimates of the cost of airline disruptions ranged from 2% to 3% of annual airline revenues. However, following a disruption, choosing the best operation decisions is difficult owing to:

- The size of the decision space;
- Real time – if a wait is too long, solutions may become obsolete;
- Existing complex restrictions; and
- Existing interdependencies between airline resources and passengers (MIT, 2003).

Additionally, MIT (2003:) asserts that the impact of a delay depends on the state of the complex multilayer plan at a given time: a 30-minute flight delay may result in crew disruptions, flight cancellations and severe passenger disruptions, the effect of which may last for more than a day. Flight delays, especially early in the day, tend to propagate in passenger airline networks (AhmadBeygi *et al.*, 2008), as demonstrated in the delay chain (MIT, 2003). The propagation of flight delays through the delay chain will be discussed in Chapter 3. Conversely, a 30-minute delay may benefit crews and passengers, as both could have been disrupted at the arrival airport had the flight departed on time.

Despite being heavily regulated and expected to act in the public interest, air carriers still have to make a profit (Smuts & Brits, 1999; Hanlon, 1999). Therefore a primary objective of airlines is to minimise operating costs, including flight delay and cancellation costs

(AhmadBeygi *et al.*, 2008; MIT, 2003). To a large extent the long-term profitability of an airline is dependent on higher service reliability, which ultimately improves customer retention and long-term revenues (MIT, 2003; Smuts & Brits, 1999).

2.5 CONCLUSION

To gain a better understanding of the circumstances relating to flight delays and their impact on all stakeholders, Chapter 3 will discuss the flight delay chain, including the various sources of flight delays and the propagation of flight delays through the delay chain. Sources of flight delays include many elements such as airport congestion, baggage handling, adverse weather conditions and airline scheduling, to name but a few.

CHAPTER 3

THE FLIGHT DELAY CHAIN

3.1 INTRODUCTION

The previous chapter discussed the various companies and organisations that help to regulate the South African aviation industry, and mentioned the role of each in the tendency of flight delays to propagate through the delay chain. Organisations such as ACSA, ATNS and the South African Government were highlighted in terms of their role in the management and regulation of flight operations. Finally, Chapter 2 concluded with a discussion on airline operations in South Africa, and how they could potentially influence the occurrence of flight delays. This chapter presents a discussion on the various sources of flight delays that can occur along what is termed the flight delay chain.

3.2 THE FLIGHT DELAY CHAIN

According to the Bureau of Transportation Statistics (BTS, 2009), in 2008 21.45% of flights were delayed. For the BTS statistics, a flight is classified as delayed if it arrived 15 minutes or more after the scheduled arrival time. The Massachusetts Institute of Technology (MIT: 2003) noted that passengers who experienced substantial delays of more than 15 minutes accounted for 40% of the total passenger delays.

Airline scheduling is primarily focused on achieving high levels of utilisation (AhmadBeygi *et al.*, 2008; Sarmadi, 2004). The resulting plans often allow little slack, limiting the airline's ability to absorb disruption. Instead, initial flight delays may propagate to delay subsequent flights as well. The term "delay propagation" refers to the inability of airlines to absorb an initial delay, thereby resulting in delays on subsequent flights. Arrival delays, especially those that occur early in the day, tend to propagate through the network (AhmadBeygi *et al.*, 2008; MIT, 2003). Figure 3.1 is a graphical representation of the flight delay chain and indicates the potential of early flight delays to propagate through the system and influence subsequent flights (MIT, 2003).

Figure 3.1: The Flight Delay Chain

QuickTime™ and a
TIFF (LZW) decompressor
are needed to see this picture.

Source: MIT. 2003. Airport Operations: Lecture 1. [Online] Available from: http://ocw.mit.edu/NR/rdonlyres/Civil-and-Environmental-Engineering/1-206JAirline-Schedule-PlanningSpring2003/582393E6-2CA6-4CC1-AE66-1DAF34A723EA/0/lec11_aop1.pdf [Accessed: 2009-05-10]

The flight delay chain refers to the manner in which initial flight delays may delay subsequent flights as well, resulting in more disruptions later during the day (AhmadBeygi *et al.*, 2008; MIT, 2003; Bhat, 1995). Furthermore, delay propagation can result in passengers incurring additional costs. Passengers whose flights have been delayed, or even cancelled, due to an earlier delay may incur additional costs from unplanned accommodation or meals (AhmadBeygi *et al.*, 2008; Aviation Consumer Protection Division, 2008). MIT (2003) indicated that delays accumulate through the day, resulting in a relatively high percentage of overnight passengers among those whose journey had been disrupted, although this still represents a small percentage (0.7%) of passengers. Moreover, connecting flights may be missed, resulting in passengers having to seek alternative flights or means of transport, often at an additional cost. MIT (2003) stated that connecting itineraries have a much higher risk of being disrupted than local itineraries, noting that 48% of delayed passengers missed a connecting flight.

Minimising the sum of disrupted passengers while recovering the schedule should be regarded as imperative (MIT, 2003). In fact, cancelling flights if necessary to prevent the propagation of delays and minimise the total sum of disrupted passengers could at times be a feasible solution.

Even though it is commonly known that flight delays result from a variety of causes and could result in additional costs to travellers, both business and leisure, there is still a lack of accountability among all the parties involved. The issue of accountability could be at the forefront of many inefficient service recoveries, resulting in low levels of recovery from service failures. The effect of this on business travellers will be demonstrated in greater detail in Chapter 4. Bauer (2000) suggested that the cooperation of airline industry stakeholders to work together to find a solution for the problem would be vital.

Each party has its own agendas and problems which it regards as more urgent than and distinct from those of all other role players: ACSA's problem is finance, or the lack thereof. Airlines need to satisfy customers, and air traffic controllers have to deal with the aging infrastructure within the system. Some parties may even disagree on what actually constitutes a delayed flight. Bauer (2000) indicated that it could even be advisable to attribute the responsibility for certain delays to certain parties prior to their occurrence, thereby creating a model of accountability and minimising the potential of parties to "pass the buck". The following section will discuss what constitutes a flight delay in the aviation industry, as well as what this study considers to be a *delayed flight*.

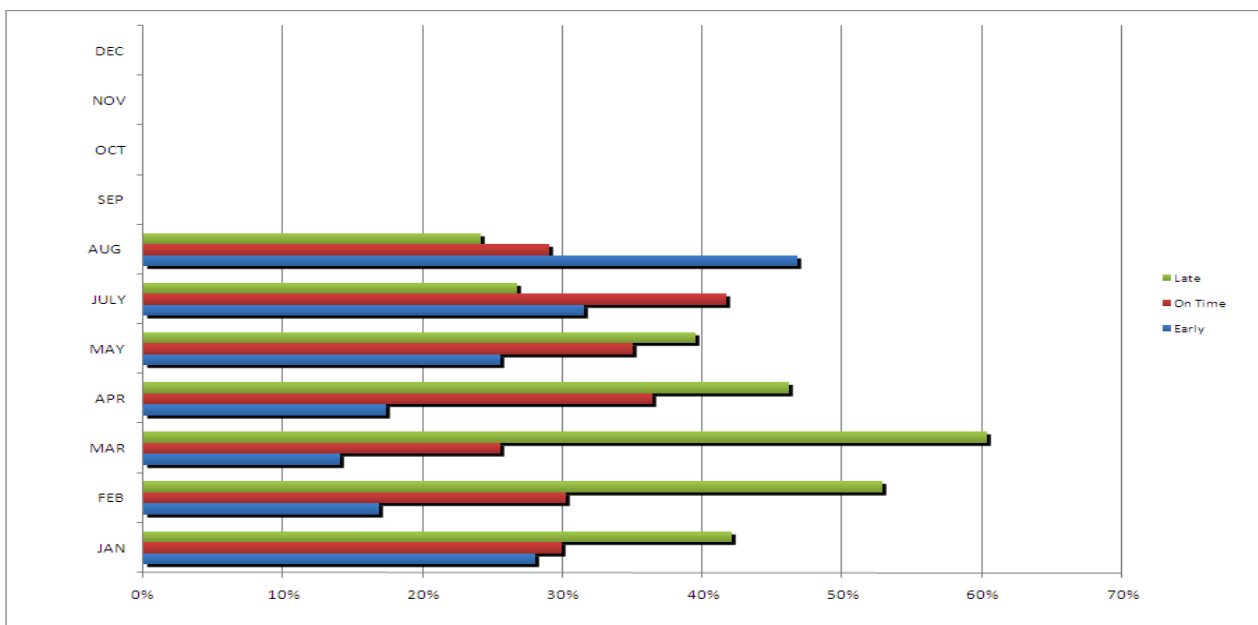
3.3 WHAT CONSTITUTES A FLIGHT DELAY

Congestion typically occurs when the numbers of people travelling at specific times during the day, week and/or year exceed the available transport capacity at the time (Givoni & Rietveld, 2006; Janic, 2005). The airline industry is experiencing a "lack of accountability" regarding the occurrence of flight delays and cancellations: a "passing the buck" scenario (Knowler, 2008; Bauer, 2000). Airlines are blamed for their scheduling practices. Airlines in turn blame airport regulating companies such as ACSA for inefficient scheduling of runway slots and recovery procedures, while ACSA blames the weather. In general, it is largely three

main partners that are regarded as sharing the responsibility for delays at local level: airlines, airports and air traffic control (Skyguide, 2005).

Data supplied by ATNS provide an overview of the slot compliance for the entire SA aviation industry from January–August 2008. *On slot* means that the aircraft’s requests for departure/arrival start in the start window, which is measured two minutes before and two minutes after the slot time allocated. Figure 3.2 indicates the slot compliance levels for the OR Tambo Airport in Johannesburg for the stated time period (FAJS is the ICAO code for OR Tambo; JNB is the IATA code). The green lines indicate the percentage of late departures, red the percentage of on-time departures, and blue the percentage of early departures.

Figure 3.2: FAJS (JNB) Aircraft Operator Slot Compliance



Source: ATNS (Air Traffic and Navigation Services). 2008d. AE Report August 2008. ATNS.

Figure 3.2 shows a significant increase in early starts for August 2008. While this may appear to reflect efficiency, it in fact does not, as the success of a slot allocation system is based on flights operating on schedule, not early or late but as close to the allocated slot as possible (ATNS, 2008d). Flights should generally not be allowed to start early, but it is accepted that some aircraft will be permitted to start early for tactical reasons (ATNS, 2008d).

In the airline industry there are differing interpretations of what actually constitutes a flight delay. A flight is often regarded as being on time if it arrives at, or departs from, the “gate or passenger loading area” less than 15 minutes after its scheduled arrival or departure time (Janic, 2005; Bauer, 2000; Bhat, 1995). In the US, the Department of Transportation (DOT) suggests that an aircraft could feasibly land at an airport within 15 minutes of its scheduled arrival, but could be reported as late if it does not reach the gate in time. Also, an aircraft which had left the gate within 15 minutes of its scheduled departure time but was delayed for an hour or more on the runway waiting for clearance from the tower for takeoff, could also be reported as having departed on time (Ratcliff, 2008; Bauer, 2000).

Furthermore, airlines can report departure times by four different methods: in terms of the rolling of the wheels, the release of the parking brake, the closing of the passenger and/or cargo doors, or a combination of closing the aircraft doors and releasing the parking brake (DOT, 1999, in Bauer, 2000). These differences in reporting methods can result in one aircraft being reported as departing on time, while another aircraft in the same situation could be reported as delayed. Also, because humans are prone to error, and some carriers still rely on their flight crews to report departure times accurately, some flights may be documented as reporting or arriving on time when in actuality they did not (Bauer, 2000). It may be suggested that this confusion regarding the reporting of delays can actually contribute to the “passing the buck” scenario. If there is no clear definition of what constitutes a delay, then there can be a great deal of confusion in the actual attribution of the responsibility for the delay.

For the purposes of this study, any flight arriving at its destination 15 minutes later than its scheduled arrival time will be regarded as a significantly delayed flight. If a flight does depart later than its scheduled departure time but still arrives at the designated airport within 15 minutes of its scheduled arrival time, it will not be regarded as a delayed flight. Additionally, if a flight has arrived earlier than originally scheduled, this does not constitute a gain in time as business travellers often make appointments according to prior arrangements. An early arrival will then often result in business travellers simply spending the additional time waiting at the airport for the next leg of their transport.

Bauer (2000) indicated that the modernising of the airspace industry would be a monumental and long-term task, as it would require many different programmes and initiatives because flight delays are caused by many different circumstances. The following section will discuss the various sources potentially contributing to the occurrence of flight delays.

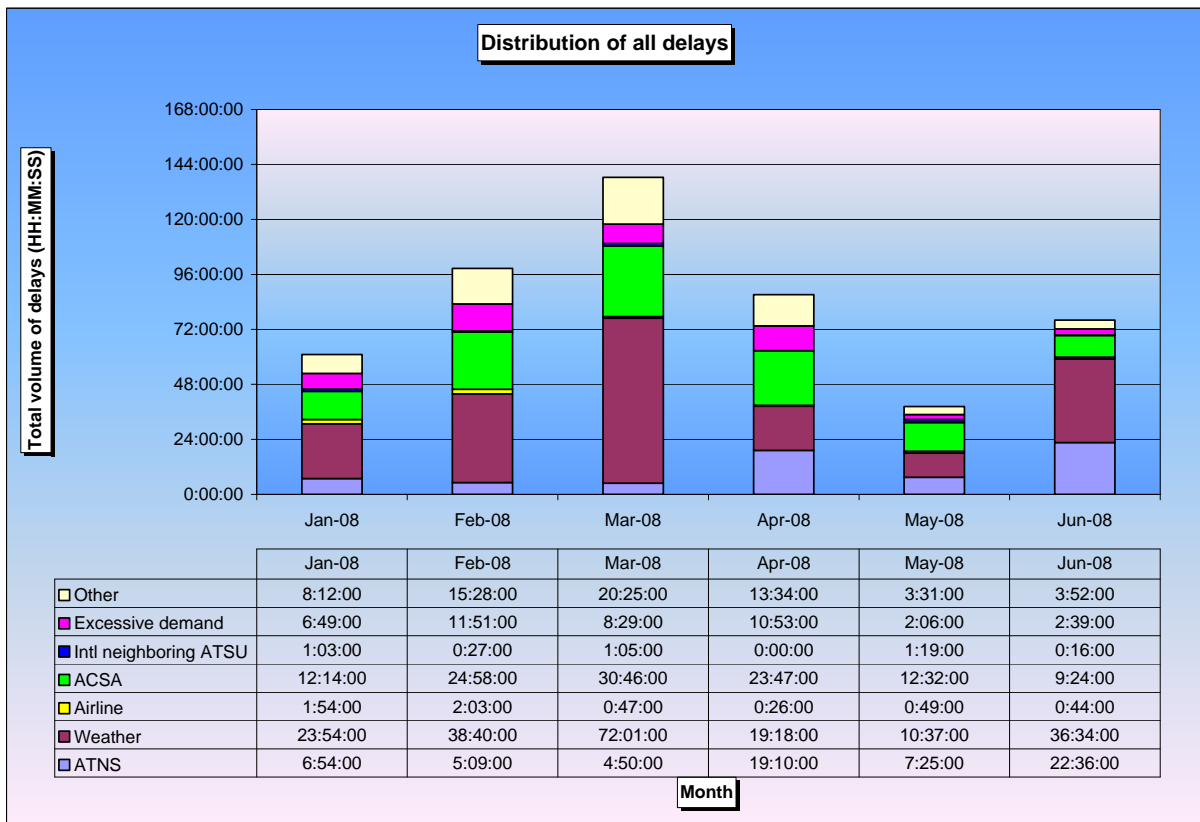
3.4 THE REASONS FOR FLIGHT DELAYS

Air traffic delays are the most common source of customer complaints by airline passengers (US Department of Transportation, 2000, in Bauer, 2000). Because each organisation in the commercial aviation system has its own interests and agendas, each may have a very different view of the delay problem (Bauer, 2000). Various studies have shown that there is not only one specific reason for the occurrence of flight delays and cancellations, but rather a multitude of factors:

- Government bureaucracy, including Infrastructure improvements, abuse of Aviation Trust Funds, FAA/ATNS punishment procedures and numerous trail restrictions (limitations on air routes and airport operating times, conflicts, etc.)
- Infrastructure improvements
- Airline scheduling
- Airport inefficiency
- Air traffic control (traffic density, staff capacity)
- Mechanical problems
- Environmental impacts
- New smaller jets in the system
- Adverse weather conditions (Bhat, 1995; Bauer, 1999; Suzuki, 2004; Skyguide, 2005; Wilber, 2006; Stander, 2008).

The Air Transport Association reported that the dramatic rise in delays was primarily caused by inefficient and outdated air traffic control systems coupled with inadequate management of the system by the federal government (Bauer, 2000). Yet management cannot narrow the problem down to one specific cause. Figure 3.3 indicates the distribution of delays among ATNS, weather, airline, ACSA, international neighbouring Air Traffic Services Units (ATSU), excessive demand and other factors (ATNS, 2008e).

Figure 3.3: Distribution of All Delays



Source: ATNS (Air Traffic and Navigation Services). 2008e. Average delay per delayed flight 2008. ATNS.

In June 2008, the level of overall delays went up by 98.6% as compared with the level in May 2008 (ATNS, 2008e). Figure 3.3 indicates that all categories went up, except international neighbouring ATSU, ACSA and Airline. Weather and ATNS had a major impact on the number of delays owing to bad weather and staff shortages at OR Tambo Airport in Johannesburg. The breakdown for each category in June 2008 was as follows:

- Other : 5.1 %
- Intl neighbouring ATSU : 0.4 %
- Excessive demand : 3.5 %
- ACSA : 12.4 %
- Airline : 1.0 %
- Weather : 48.1 %
- ATNS : 29.7 %

Some delays result from problems such as bad weather, air traffic delays, and mechanical repairs, which are hard to predict and often beyond the airline's control (AhmadBeygi *et al.*, 2008; MIT, 2003; Bauer, 2000; Bhat, 1995). Additionally, the duration of a delay is often difficult for an airline to estimate (MIT, 2003; Bauer, 2000). Developments may occur that may not have been anticipated when the airline made its initial estimate of the length of the delay: weather that was forecast to improve may instead deteriorate, or a mechanical problem may turn out to be more complex than initially estimated (Bauer, 2000).

Unfortunately, many customers are not aware that some service failures, such as flight delays in particular, are often not solely due to the airline's misconduct. Airport regulating companies such as ACSA, and even weather conditions, often play a significant role in affecting an airline's on-time performance, as evidenced in the figures above (Bauer, 2000). The various factors influencing the occurrence of flight delays will receive greater attention in the following sections.

3.4.1 The Demand for Air Transport

The airline industry has seen considerable growth in the past few years (ACI, 2008b; ACI, 2008c; IATA, 2008; Muller & Santana, 2008; Givoni & Rietveld, 2006; Frost & Sullivan, 2006; UNESCAP, 2003; Kazda & Caves, 2000; Hanlon, 1999). The World Airport Traffic Report 2007, released by the Airports Council International (ACI) in July 2008, provided airport-by-airport and country-by-country traffic results (ACI, 2008a). The report, based on 1200 ACI member airports worldwide, confirmed that they had processed 4.8 billion passengers and 76.4 million aircraft movements. This meant that in 2007, total worldwide passenger traffic reached an all-time high, increasing by 6.8% over 2006 (ACI, 2008a; ACI, 2008b). Long-term traffic forecasts predicted that by 2025 this number would double to over 9 billion passengers (ACI, 2007a).

Similarly, research conducted by the Official Airline Guide (OAG) in May 2007 noted the biggest number of flights so far recorded worldwide (Travelmole, 2007). The new record – a 5% increase over April 2007 – topped the previous industry high of 2.49 million recorded in August 2006, and represented an additional 113 827 flights (Travelmole, 2007). This growth

has also been evident in the low-cost carrier sector. OAG's Quarterly Airline Traffic Statistics showed that the low-cost sector had achieved a 22% increase in flights, with over 70 000 more flights year-on-year and an extra 12 million low-cost seats, an increase of 26% (Travelmole, 2007).

In South Africa, ATNS (2008c) recorded an increase in air traffic movements from 608 930 arrival and departure movements in 2006 to 649 539 in 2007 – up by 6.7%. Ultimately, ATNS recorded a 5.4% annual increase in air traffic, which could require significant airport capacity improvements (ATNS, 2008c). IATA's latest forecast, based on a comprehensive survey of the airline industry, showed that passenger and freight demand growth would continue to provide a positive boost to airline revenues over the five years from 2007 to 2011, as shown in Figure 3.4 (IATA, 2007).

Figure 3.4: International Passenger Growth and Global GDP

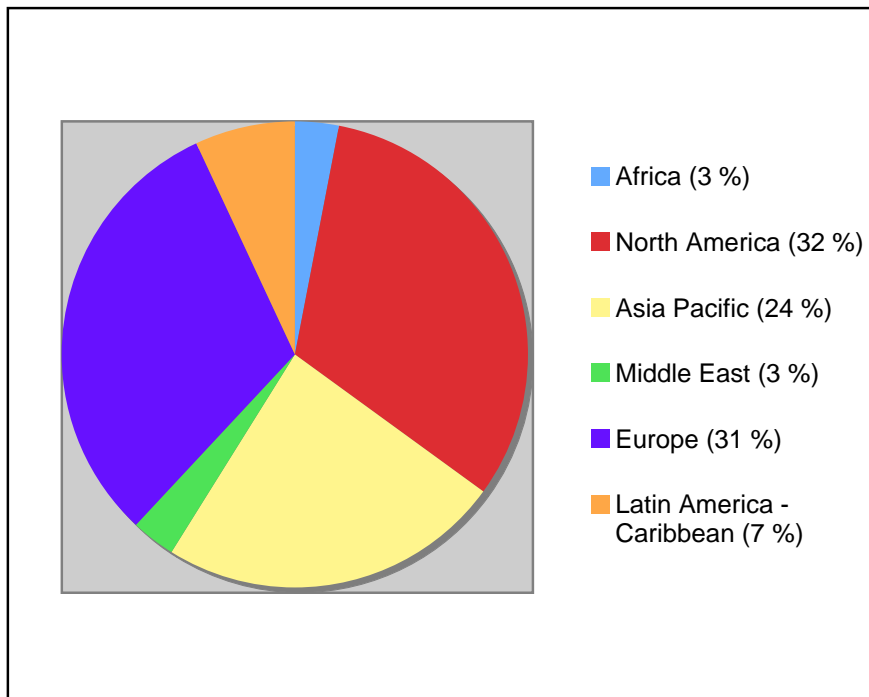
QuickTime™ and a
TIFF (LZW) decompressor
are needed to see this picture.

Source: IATA (International Air Travel Association). 2007. IATA Economic Briefing: Passenger and Freight Forecasts 2007 to 2011. Online: http://www.iata.org/NR/rdonlyres/E0EEDB73-EA00-494E-9408-2B83AFF33A7D/0/traffic_forecast_2007_2011.pdf (Accessed: 2008-09-21)

However, research has shown that the profile of growth would differ. Compared to 2006 growth levels, international passenger growth was expected to slow slightly, and domestic passenger growth to improve slightly (IATA, 2007; UNESCAP, 2003). ACI found that the

regional profile of growth would differ, as demonstrated by the global traffic figures in Figure 3.5 (ACI, 2008a). The report released by ACI showed that, in 2007, the fastest growth in passengers occurred in the Middle East with an 11.3% increase, followed by Africa with 11.2% and Asia-Pacific with 9.1% (ACI, 2008a; ACI, 2008b). North America showed the slowest growth at 3.5%, indicating the region's maturity as well as the capacity and congestion issues it faces. Europe showed growth of 7.4%, with 31% of world passengers, and looked set to overtake North America (currently at 32%) as the largest region for air traffic in the next few years if similar growth patterns were experienced.

Figure 3.5: Regions as a Proportion of Global Traffic



Source: ACI (Airports Council International). 2008a. Airports welcome 4.8 billion passengers in 2007. Online: http://www.airports.org/cda/aci_common/display/main/aci_content07_c.jsp?zn=aci&cp=1-5-54_666_2 (Accessed: 2008-10-03)

Similar trends were published by IATA (2007), as seen in Table 3.1, which indicates by region the average annual growth rate (AAGR) estimated from 2007 to 2011. The research indicated that passenger figures would grow from just over 2 billion in 2006 to 2.75 billion by

2011 (SITA, 2008b; IATA, 2007). Figures for the Middle East, developing economies in Asia, and to a lesser extent Africa, would be boosted by expected strong GDP growth, along with significant new capacity and new routes, because they showed the fastest average annual growth rates in passengers, with the Middle East (6.8%) followed by Asia Pacific (5.9%) and Africa (5.6%). European growth would be close to the average, although Eastern Europe would see a more rapid expansion. Once again, North America was expected to be the slowest growing region, reflecting both mature markets and cyclically slower growth in the US economy (IATA, 2007).

Table 3.1: Average Annual Growth Rate (AAGR) 2007 to 2011

	Average Annual Growth Rate (AAGR) 2007 to 2011	
	Passenger Numbers	Freight Tonnes
TOTAL DOMESTIC	5.3%	-
TOTAL INTERNATIONAL	5.1%	4.8%
Africa	5.6%	4.6%
Asia Pacific	5.9%	5.4%
Europe	5.0%	4.3%
Latin America/Caribbean	4.4%	4.2%
Middle East	6.8%	5.0%
North America	4.2%	3.9%

Source: IATA (International Air Travel Association). 2007. IATA Economic Briefing: Passenger and Freight Forecasts 2007 to 2011. Online: http://www.iata.org/NR/rdonlyres/E0EEDB73-EA00-494E-9408-2B83AFF33A7D/0/traffic_forecast_2007_2011.pdf (Accessed: 2008-09-21)

Reasons for the regional differences in passenger growth rates largely reflected differences in regional economic growth and the structure of each regional market (IATA, 2007; Hanlon, 1999). One reason suggested by Hanlon (1999) for the variation in growth rates by region, was that regions were at different stages in the life cycle of the industry. Even though some markets would experience slower growth patterns, the fact was that all areas would experience some measure of growth, a phenomenon which, if not monitored properly, could lead to passenger dissatisfaction due to increased flight delays as airports and airline capacity struggled to manage the growing demand. According to Braun (2004) the Federal Aviation Administration (FAA) forecast that the demand for domestic airline services in the US would increase by 3.5% annually through the year 2009, potentially resulting in 62%

increases in passenger enplanements (as well as delays/cancellations) for the period. In South Africa, events such as the FIFA 2010 Soccer World Cup could result in significant passenger number increases, and potentially lead to greater numbers of flight delays (Hill, 2007).

3.4.2 Government Bureaucracy

The political environment is particularly important to international airline operators for a number of reasons:

- Since air transport takes place across national borders and through the airspace of sovereign states, any bilateral and multilateral agreements must clearly set out the rights and obligations of the parties involved; and
- The political environment determines the degree of competition permitted in the country, since the existence of a national airline is a political status symbol (Duval, 2008; Forbes, 2006; Smuts & Brits, 1999).

In the international sphere, the system of government regulation was largely established by the Chicago Convention signed in 1944 (Department of Transport, 2006; Doganis, 2006; Doganis, 2001; Hanlon, 1999). This led to a complex web of bilateral agreements between pairs of countries, in terms of which government officials and airline representatives are almost continuously involved in negotiating the exchange of traffic rights. These inter-government agreements have had a profound influence on the development of air transport (Department of Transport, 2006; Hanlon, 1999). In certain instances, government protection of flag carriers has often produced “artificial” markets in which the profitability of individual airlines was determined more by the number of competitors allowed on particular routes than by the quality and pricing of their services (Hanlon, 1999).

However, numerous factors, including industry privatisation, the Single European Sky initiative, new technologies and so forth, have led to many countries moving away from the state ownership of their air navigation service providers (ANSPs) and adopting a variety of forms of corporate or private ownership, bringing a need for appropriate regulatory structures (Button & McDougall, 2006).

The occurrence of flight delays at airports worldwide has been reported to be on the increase. In 2004, the rate of delay at the Zurich-Kloten airport increased by 28% to 0.64 minutes, a development that was primarily caused by the many restrictions suffered by the airport (Skyguide, 2005). In many countries, air traffic control is a government-controlled function, and therefore there is a certain amount of bureaucracy that the industry deals with regularly (Button & McDougall, 2006; Skyguide, 2005). Government-implemented regulations are often aimed at controlling capacity and competition (Bettini & Oliveira, 2008). Governments have often been blamed for wasting large amounts of taxpayers' money on failed air traffic control (ATC) upgrades that resulted in basically no benefit to the flying public (Skyguide, 2005). In South Africa, ACSA is responsible for airport management and is a combination of both state and private shareholders (ACSA, 2008a).

In some countries legislators have introduced certain take-off and landing constraints at airports, which have effectively imposed entry restrictions at most heavily congested airports (Duval, 2008; Forbes, 2006). Many countries have since made an attempt to lift these restrictions and to allow new entry into the affected airports. In the US restrictions were lifted on routes to non-hub and small hub airports, but not on routes to larger hub airports. However, while new legislation allowed entry only into some markets, no mechanisms were provided to alleviate congestion, resulting in increased congestion and flight delays (Forbes, 2006).

Economists have long proposed solving congestion problems at capacity-constrained airports through peak-load pricing (Smith, 2008; Forbes, 2006; Johnson & Savage, 2006). However, the most probable result would be higher fares, with a minimal effect on congestion (Smith, 2008), and legislators have not yet fully embraced this solution. Instead, some have chosen to impose landing and take-off restrictions that, once adopted, proved to increase congestion and flight delays because no effective mechanisms were put in place first. In 2000, the US Congress made an attempt to lift restrictions and allow new entry into certain airports, without providing a mechanism to alleviate congestion. Whilst some routes experienced new competitor entry and significantly lower prices due to the new competition, all routes suffered from increased congestion and a dramatic increase in flight delays (Forbes, 2006).

However, like Mazzeo (2003) and Rupp *et al.* (2001), Forbes (2006) found that there were shorter and fewer flight delays on routes and at airports with more competition. This could potentially suggest that the relationship between competition and product quality, such as efficient airline scheduling, could prove more important in the occurrence of flight delays than initially expected. Also, this could indicate that government intervention to limit competition could have a negative effect as regards flight delays.

However, there is nothing inherently contradictory in having state ownership on the one hand, and efficient operation and commercial viability on the other (Department of Transport, 2006). Within the context of a properly structured regulatory and legislative environment, state-owned airlines can continue to operate effectively without taking advantage of unfair competition. However, governments should ensure that the national carrier, while operating in line with clearly defined national strategic objectives, does not impinge on the ability of privately owned entities to operate fairly either.

The main goal of any legal framework for air travel should be to create a system of slot allocation that makes the most efficient use of limited airport capacity in order to maximise the benefits for passengers, airlines and airports (ACI, 2001). In Europe and the US, the allocation of slots when potential demand outstrips capacity is based on historical precedence. Provided that an airline actually makes use of its slots, it retains “grandfather rights” to them (ACI, 2003; Johnson & Savage, 2006). Within the European Union (EU), the allocation of slots is guided by Regulation 793/2004, which ensures that unused slots are made available for new entrants rather than being monopolised by the dominant carrier(s) at the airport concerned (Johnson & Savage, 2006). Some governments also have bilateral agreements specifying the availability of a certain number of slots at particularly congested airports (Johnson & Savage, 2006).

The revision of slot allocation rules is a highly complex technical measure (ACI, 2003). Solutions addressing the complex issue of slot reform will require some creative thinking, because airports and airlines need to develop an equitable system that fully leverages an airport’s infrastructure for all stakeholders (ACI, 2003; ACI, 2001). Airport capacity is a limited resource and finding an effective and efficient slot allocation system is essential for safeguarding the growth of the industry as a whole (ACI, 2001).

Governments also have a vital role to play in aviation infrastructure improvements, not only through valuable monetary inputs, but also through the setting of prescribed regulations and standards that require the installation of improved technologies and improvements in infrastructure (South African Consulate General, 2008).

3.4.3 Infrastructure Improvements

As mentioned, the airline industry has seen considerable growth in the past few years, and is likely to continue experiencing some level of growth (ACI, 2008b; ACI, 2008c; IATA, 2008; Muller & Santana, 2008; Givoni & Rietveld, 2006; UNESCAP, 2003; Kazda & Caves, 2000; Hanlon, 1999). The increased number of flights has resulted in greater numbers of passenger traffic arriving and departing at airports (ACI, 2008b; IATA, 2008; Muller & Santana, 2008; Givoni & Rietveld, 2006; UNESCAP, 2003; Kazda & Caves, 2000). However, this growth in traffic is often not matched by an appropriate increase in capacity (Muller & Santana, 2008; Givoni & Rietveld, 2006).

Capacity problems often lead to flight delays (Muller & Santana, 2008; Braun, 2004; Bauer, 2000). Airport capacity is generally measured by both the number of air transport movements (atm) and the terminal capacity, which is based on the number of passengers where passenger transport is concerned (Givoni & Rietveld, 2006). Airport capacity can play a vital role in the occurrence of flight delays, as has been discussed in Section 2.3.

Essentially, the airline industry is facing an airport capacity crunch (ACI, 2008c). The queues of aeroplanes have been lengthening, both on the ground and in the air (Kazda & Caves, 2000). Airports now have to respond to a different challenge: the need to finance and build much-needed infrastructure to cope with the expected passenger and cargo traffic demand of the next 20 years, set to double by 2025 (ACI, 2008c; Jankovec, 2007).

Unless airport capacity can keep pace with traffic growth, passengers, airports and airlines will suffer from congestion, flight delays and service reductions (ACI, 2008c; ACI, 2008d). Olivier Jankovec, Director General of ACI Europe, has stressed that airport capacity needs to become a top-priority issue to cope with expected demand (Jankovec, 2008). There will have

to be a significant increase in infrastructure if all the extra traffic is to be accommodated – especially if South Africa is to successfully host 25 million passengers a year by 2010 (Hill, 2007).

When flight delays start recurring frequently, owing to inadequate resources/infrastructure, one of the few options available is to engage in infrastructure improvements (Muller & Santana, 2008). According to Muller and Santana (2008) two possible macro-solutions are often considered: an increase in capacity, and more effective management of demand. In practice, it seems that some combination is inevitable to cope with the short- and long-term problems. Short- and medium-term measures are focused more on demand management through the better management of air traffic flow and changes in airport slot allocation, which can be introduced quickly, tend to be low-cost, and have a direct and easily measurable impact.

On the other hand, long-term measures tend to focus more on increasing capacity and include the construction of new airports, additional runways at existing airports, and investment in new technologies (Muller & Santana, 2008). However, these measures are costly and benefits materialise only after 5–10 years (Muller & Santana, 2008; Smith, 2008). Additionally, some airports have been engulfed by their parent cities to such an extent that enlarging their physical runway capacity is almost impossible without huge investments (Muller & Santana, 2008).

According to Olivier Jankovec, Director General of ACI Europe, addressing the capacity challenge requires airport management to address some obstacles (Jankovec, 2007):

- Building new airports or expanding current facilities, which has become increasingly difficult, due to both the cost and the length of construction time required;
- Obtaining adequate finance;
- Securing permission from local and national authorities; and
- Environmental challenges to growth.

Additionally, while infrastructure improvements are in progress, flight delays and inconvenience to customers may still continue or even increase. Infrastructure

improvements, such as the construction of new runways and the extension or improvement of existing runways, are some of the most direct and significant actions used to improve capacity at existing airports (ACSA, 2008c; Muller & Santana, 2008). In the US, the Air Line Pilots Association (ALPA) regards the construction of new runways, taxiways, terminals and other infrastructure as the best ways to alleviate capacity problems that lead to delays (Bauer, 2000). However, it may occur that the number of delays actually increases during these times of construction, when previously used runways become unavailable during improvements and extensions. Yet, even though this is a negative experience, the future benefits of increased capacity could outweigh current inconveniences. The subject of future capacity often becomes a glaring reality when countries are faced with impending increases in passenger numbers which the current capacity will be unable to accommodate.

In South Africa, large strides have already been made in the area of infrastructure renewal and increasing capacity (ACSA, 2008c). ATNS (2008c) has increased the number of aircraft movements per hour at OR Tambo International Airport from 52 to 56. A significant further increase in infrastructure would be required if all the extra traffic were to be accommodated. For this purpose, ATNS planned capital expenditure of R218.7 million for 2007. ATNS has already opened a third approach sector to increase TMA (Terminal Area) capacity and ensure optimal spacing on the final approach at OR Tambo International airport (ATNS, 2008c). Due to the number of improvements, the airport should be able to host 25 million passengers a year by 2010 (Hill, 2007). These investments in infrastructure aimed to ensure increased airspace capacity, further enhancement of their air traffic management systems, and the continued maintenance of the highest safety standards (ATNS, 2008c).

The World Cup in 2010 is projected to result in a substantial increase in passenger traffic, a situation that could require numerous improvements in infrastructure at major airports (Hill, 2007). A study commissioned by the South African Department of Transport (SADoT) indicated that airports in Gauteng would be under severe pressure to handle the visitors to the Province in the period leading up to and during the FIFA World Cup (City of Tshwane, 2006). According to the OR Tambo Airport's General Manager, Chris Hlekane, passenger volumes at this airport are expected to rise by 28% by 2010 (Hill, 2007). The airport has forecast that 20-22 million travellers will pass through the airport during 2010 – a 15% to 28% increase in passenger volumes compared with 17,2 million travellers in 2006. Currently, the

OR Tambo is undergoing a R3 billion overhaul to gear up for 2010. In addition to ever-increasing passenger numbers, provision must be made for new-generation aircraft, additional runway aprons, terminal area upgrades, additional parking areas and a Gautrain link (ACSA, 2008c; Spadavecchia, 2007; sa2010, 2006).

Johannesburg is not the only city experiencing a significant increase in infrastructure improvements. Improvements to the International Terminal of the Cape Town International Airport are already progressing fast. The revamping of the Domestic Terminal has also been planned and scheduled (ACSA, 2008c). Improvements to secondary airports, such as the Lanseria and Wonderboom Airports in Gauteng – thereby helping to alleviate considerable traffic at major airports – could also be considered a potential solution.

Even though infrastructure improvements will ultimately increase an airport's capacity and alleviate the need to reduce operations in particular conditions, such improvements will often lead to an increased occurrence of delays during construction (Johnson & Savage, 2006). Some research has indicated that, ultimately, the issue was not so much an airspace problem as a ground-space problem (Smith, 2008). Taxiways are already easily saturated, and in spite of all the infrastructure improvements in runway and airport capacities, if airline scheduling practices are not regulated then the increased capacity will simply be taken up by the airlines once it is available (Smith, 2008; May, 2007).

3.4.4 Airline Scheduling

Airline scheduling is another factor often blamed for the occurrence of flight delays (AhmadBeygi *et al.*, 2008; Muller & Santana, 2008; Smith, 2008; Forbes, 2006; Skyguide, 2005; Suzuki, 2004; Bauer, 2000). Forbes (2006) suggested that airlines could better control arrival delays by choosing the scheduled duration of the flight. This implies that flight delays could be better managed, or even prevented, through more efficient airline scheduling. According to Kahn (2001, in Johnson & Savage, 2006), 120 airports worldwide face some form of capacity constraints that require airlines to coordinate their schedules.

Increased traffic figures have had significant impacts on airline scheduling. Previous research indicated that there were shorter and fewer flight delays on routes and at airports

with more competition, suggesting a positive relationship between competition and product quality (Forbes, 2006). Yet, in order to satisfy the demands of the flying public, a system has been created that allows more aircraft into the same environment at the same time than the system can efficiently handle, even on days when everything goes right (Woerth, 1999, in Bauer, 2000). In general, when carriers decide how to schedule costly resources, their focus is primarily on achieving high levels of utilisation (AhmadBeygi *et al.*, 2008; Smith, 2008; Givoni & Rietveld, 2006). However, the resulting plans often have little slack, limiting the schedule's ability to absorb disruption: Instead, initial flight delays may propagate to delay subsequent flights as well (AhmadBeygi *et al.*, 2008; MIT, 2003), as discussed in Section 3.2 above.

Yet Bauer (2000) indicated that, according to FAA compiled data relating to flight delays for the first eight months in 1999, even if all delays in the volume category were attributable to airline schedules, delays caused by volume in the system accounted for only 7.5% of total delays. He further indicated that of the 1 291 average daily delays, almost 1 200 had nothing to do with airline scheduling. However, with the significant growth in air traffic the past few years, understanding the relationship between planned schedules and delay propagation has become a precursor to developing tools for building more robust airline plans (AhmadBeygi *et al.*, 2008).

Airlines are often blamed for differences between official schedules and flight plan times filled in by the pilot, resulting in a situation where there may simply not be enough flight slots available for the airline to efficiently coordinate its various flights departing from and arriving at the airport (Skyguide, 2005). Airports have pointed out that airlines often schedule flights beyond the capacity of the airports they serve and then tell passengers that air traffic control is responsible (R. Schwitz in Bauer, 2000).

Scheduling decisions are the sole province of the airlines (R. Schwitz in Bauer, 2000). In flight scheduling, airlines usually determine optimal timing for their flights so as to meet time-dependent demands, as well as the requirements of frequency plans of available fleets and aircraft routings. Inevitably, however, some flights cannot actually operate at their expected times owing to the capacity limits of airport runways (Cao & Kanafani, 2000). Adjustments then have to be made by diverting some flights from their optimal times. The result is both a

loss in profit to the airline and damage to its public image through flight delays and cancellations.

Thus it seems that airlines' desire to maximise profits may cause them to overload the system. Their inefficient scheduling then results in flight delays at most major airports (Bauer, 2000). ALPA agreed that airlines create a false level of expectation in the flying public by promising people that they can fly where they want, when they want. As indicated, the system allows more aircraft into the same environment at the same time than the system can efficiently handle (Woerth, 1999, in Bauer, 2000).

The charging of congestion fees at airports is one method used to give airlines an incentive to move some flights out of the peak period and to alter the scheduled departure times of other flights slightly, to avoid the rush of departures that can occur at specific times (Johnson & Savage, 2006; Janic, 2005). Even though airlines may, at times, be responsible for flight delays due to inefficient scheduling, airport operations also have a role to play in the possible prevention or occurrence of flight delays.

3.4.5 Airport inefficiency

Airport inefficiency generally refers to airports' inability to manage the large numbers of flight traffic owing often to inefficiency in regard to hub-and-spoke systems, runway availability, runway incursions, baggage handling operations and long check-in queues (Givoni & Rietveld, 2006; Bauer, 2000; Bhat, 1995).

The influence of airports on flight delays is further demonstrated by the issue of availability of airport runway time slots (Suzuki, 2004). Runway availability is considered to be an influencing factor in flight delays (Muller & Santana, 2008; Givoni & Rietveld, 2006; Bauer, 2000; Bhat, 1995). Runway capacity is a key determinant of airports' capacity, and it is measured by the number of aircraft that can safely be handled during a specific period of time (Givoni & Rietveld, 2006). The system adopted in most airports for the allocation of (scarce) runway capacity is still the "grandfather-rights" rule (see 3.4.2) – therefore giving airlines an incentive to continue using their allocated slots at the airport concerned.

Even when an airport's runway capacity is limited, the number of passengers handled can be increased if larger aircraft are used, as long as the terminal capacity is sufficient (Givoni & Rietveld, 2006). However, this is now considered to be a much more technical issue than suggested by previous research (Bauer, 2000; Bhat, 1995).

Even when there are a number of runways, not all of them may be available for use in certain circumstances. Some factors that significantly affect runway availability are aircraft type, weather conditions, runway length, lighting, type of instrument approach available, the configuration of the runway itself (crossing, intersecting or parallel), proximity to other runways, and wake turbulence problems (Bauer, 2000). Runways that are generally useable in good weather may not necessarily be useable during adverse weather conditions. When an airport loses the use of some of its runways, its capacity will obviously be adversely affected and delays may result (Givoni & Rietveld, 2006; Woerth, 1999 in Bauer, 2000).

Closely related to runway availability is the issue of runway incursions. Runway incursions are defined as the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designed for the landing/takeoff of aircraft (FAA, 2007). According to Bauer (2000) greater air traffic congestion equates to more possibilities for conflict with aircraft trying to use the same runway or taxiway at the same time. One of the FAA's key safety goals is the prevention of runway incursions (FAA, 2007), and implementing runway management strategies has greatly aided in reducing the occurrence of runway incursions (FAA, 2007).

Unmanaged ground operations such as baggage handling can also add to airport inefficiencies. The large number of passengers passing through the system puts increased strain on all employees, ranging from airline ground personnel manning the check-in desks to non-airline personnel such as baggage operators. For example, a large amount of passenger luggage and cargo to be processed for a specific flight can result in a flight delay when baggage handlers are unable to load all the baggage by the scheduled departure time. Furthermore, flight delays may also result when passengers are delayed in long check-in queues because airline personnel are unable to process all of them by the scheduled flight departure time. Ultimately, any delay, no matter how small or where it occurs in the chain, can propagate to become larger (AhmadBeygi *et al.*, 2008; MIT, 2003).

Additionally, some changes to improve airport inefficiency could be planned with the right intentions, but ultimately fail on implementation (Muller & Santana, 2008; Givoni & Rietveld, 2006). A case study conducted by Muller & Santana (2008:1) on the Sao Paulo Terminal in Brazil found that even though arrival and departure routes and their control were changed for all aircraft to follow standardised descent profiles into the area, which could have reduced traffic controllers' workload, this initiative ultimately failed to increase the effective capacity of the airport and airspace. It is therefore of vital importance to adequately understand the root of a problem in order to truly improve airport inefficiency (Muller & Santana, 2008). Effective demand management, through better management of air traffic flows and changes to the way airport slots are allocated, is one of the most effective methods of addressing airport inefficiencies arising from capacity problems (Muller & Santana, 2008; Johnson & Savage, 2006). The role of air traffic control in the occurrence of flight delays will be discussed in the following section.

3.4.6 Air Traffic Control

Apart from preventing aircraft collisions, both in the air and with obstructions on the ground, air traffic control (ATC) also seeks to expedite and maintain an orderly flow of air traffic and, within the broader notion of air traffic navigation, to provide services involving meteorology, charts and telecommunications, as well as search and rescue services (Button & McDougall, 2006). Air traffic control is one element in a longer value chain that ultimately aims to provide smooth air transportation services to consumers (Button & McDougall, 2006). One reason often cited by airlines for increased flight delays is that air traffic controllers have exacerbated the occurrence of flight delays and cancellations through the scheduling of numerous flights during periods of peak traffic at some of the busiest airports (Robert Crandall in Bauer, 2000). Research by Wu & Caves (2003) regarding on-time flight performance at London's Gatwick Airport revealed that airport and air traffic control related reasons were responsible for 53% of all delayed flights. Yet, the ATNS 2007 Annual Report indicated that flight delays attributable to air traffic control were marginal (ATNS, 2008c).

ACI Europe (2002) suggested that airspace needs to be used in a flexible way to ensure fairness and transparency for all users, while taking into account security and defence. The

safe usage of airports and airspace is a major deciding factor in the decisions implemented by air traffic control (ATNS, 2009; ATNS, 2008c; Skyguide, 2005; ACI, 2002). Air traffic control ensures the safety of all users by maintaining adequate distances between aircraft in line with international safety standards (Skyguide, 2005). Additionally, to guarantee safety, air traffic control will not issue takeoff authorisation until the state of the airways allows for the smooth and safe conduct of the flight (Skyguide, 2005). In such instances, flight delays can be attributed to the overcoming of an unforeseen circumstance.

To cope safely with the substantial growth in air traffic, various strategies have been developed by air traffic control companies (ATNS, 2008c; Muller & Santana, 2008). In response to the growth in air traffic movements in South Africa, ATNS implemented a new retention scheme, enabling them to respond safely to a planned 5.4% annual increase in air traffic in this country, as well as to compete for a scarce global commodity in an environment where there is currently a 13% shortage (ATNS, 2008c).

One question that arises quite frequently is whether or not ATC systems are antiquated and inefficient, and need to be modernised (Smith, 2008). Smith (2008) noted that even though a system-wide upgrade to satellite-based technology would be beneficial, it would primarily benefit the higher-altitude en-route airspace sectors, with minimal impact where it was needed most – in and around airports. Even though the benefits would include shorter flight times, fuel savings, reduced emissions and somewhat better traffic management during inclement weather, it would still ignore the fact that a runway could accept only so many arrivals and departures per hour (Smith, 2008).

3.4.7 Mechanical Problems

Some delays occur as a result of problems that may be hard to predict and are often beyond the airline's control, such as the need for mechanical repairs (Bhat, 1995; Bauer, 2000; Suzuki, 2004; Skyguide, 2005; Wilber, 2006;). In such cases, it is often difficult for the airline to predict the length of the delay in its early stages. With so-called "creeping delays", unanticipated developments may occur, for example a mechanical problem may turn out to be more complex than initially expected (Aviation Consumer Protection Division, 2008).

The Aviation Consumer Protection Division (2008) has suggested that if airlines identify mechanical problems as being the reason for the delay, and when traveller schedules are tight – as is often the case with business and corporate travellers – it could be beneficial to book on an alternative flight. However, the question of who would be responsible for paying for the alternative flight would arise, and the issue of accountability amongst the various parties involved in, or affected by, flight delays would once again emerge.

However, according to the then South African Transport Minister Jeff Radebe, a review of accidents in 2008 identified mechanical defects and maintenance as only a minor causal factor (Defence Web, 2009). Regular inspections by the South African Civil Aviation Authority (CAA) are conducted to ensure that airlines/owners of aircraft adhere to prescribed inspection and maintenance requirements (CAA, 2009a). The occurrence of flight delays due to mechanical problems is generally strongly related to ensuring the safety and security of crew and passengers.

3.4.8 Environmental Impacts

All over the world, increasing importance is being attached to conservation and other environmental issues (ATNS, 2008c; Doganis, 2001; Smuts & Brits, 1999). Though air access can be crucial for regional economic development, in the relationship of air transport to the environment, a number of conflicts have been identified (Kazda & Caves, 2000). Ecological disturbances have been attributed to aircraft, such as noise and air pollution through carbon emissions, which could lead to politically motivated calls to reduce air traffic levels (Wittmer & Laesser, 2008; Kazda & Caves, 2000; Smuts & Brits, 1999).

The issue of global warming has become an increasingly sensitive environmental concern. Critics are increasingly aiming to identify exactly which industries are responsible for carbon emissions, also known as greenhouse gases, a factor considered by many to be one of the largest influencers of global warming (Armstrong, 2007; BBC, 2007; Bauer, 2000). The aviation industry in particular has felt the brunt of such criticisms. The rise in disposable income has increased the capacity of humans to travel, which has led to increased flight traffic – ultimately resulting in a rise in greenhouse gas emissions. The European Environment Commissioner, Stavros Dimas, indicated in 2007 that the boom in flying was

bringing with it a rapid rise in greenhouse gas emissions, that the aviation industry was responsible for 3% of EU carbon emissions, and that the figure was rising (BBC, 2007). Forecasts suggested that aircraft could make up 25% of the UK's total contribution to global warming by 2030 (BBC, 2007). The impact of aviation is considered to be especially strong, as the gases and water vapour caused by aircraft are deposited directly into the upper atmosphere.

The International Air Transport Association (IATA) has, however, defended the aviation sector against criticism that it is among the worst offenders in emitting man-made carbon dioxide. Andrew Drysdale, IATA's regional Vice-President, indicated that electricity use and heat production accounted for 35% of global carbon dioxide emissions, while the aviation section only accounted for 2% (iafrica, 2007). Yet the issue of CO₂ emissions has already impacted aviation operations in a number of ways:

- Large amounts of money have been spent on purchasing newer, quieter, yet smaller aircraft;
- Pilots are often compelled to fly highly complex procedures at less than optimal operational performance standards to comply with ground-based environmental concerns about noise;
- The European Commission has recommended that airlines should be included in the carbon dioxide trading scheme, which puts limits on the emissions of 12 000 big industrial carbon emitters across the EU, with the aim of curbing global warming. Carbon trading is designed to be a cheap method of achieving emissions cuts by ensuring that the cheapest efficiency savings are made first (Armstrong, 2007; BBC, 2007; Delta, 2007; Bauer, 2000).

The reduction of CO₂ emissions does not directly impact the occurrence of flight delays, but certain of the measures involved may do this, such as the increased use of lighter, smaller jets (Armstrong, 2007; Bauer, 2000). Virgin Atlantic Airways indicated that they would attempt to reduce carbon emissions by buying at least 15 Boeing 787 Dreamliners, planes made from light composite materials that Boeing is promoting for their fuel efficiency (Armstrong, 2007). To meet the increased demand for air transport, greater numbers of

smaller jets may then be required, which could result in flight delays due to the increased strain placed on aviation facilities.

3.4.9 New Smaller Jets in the System

Even though smaller jets may be considered more fuel efficient, they are often responsible for rapidly increasing the volume of traffic in the high altitude jet route structure (Muller & Santana, 2008; Smith, 2008; Givoni & Rietveld, 2006; Johnson & Savage, 2006). At many of the world's largest airports there are fewer than 100 passengers per air transport movement, although congestion and delays are growing (Givoni & Rietveld, 2006). Furthermore, demand for air transport is expected to continue growing, but aircraft size is not (ACI, 2007a; IATA, 2007; Givoni & Rietveld, 2006). It is often expected that as traffic volumes increase transport services will be provided by larger-capacity vehicles, i.e. vehicle capacity is expected to be positively correlated with demand. This does not seem to hold true in the operation of air transport services, however (Givoni & Rietveld, 2006).

Leading aircraft manufacturers predicted that demand for air transport services would continue to rise in the next 20 years, but they also predicted that the average size of the world's aircraft fleet would not change much, despite the already high levels of congestion and delays (Airbus, 2004; Boeing, 2005, in Givoni & Rietveld, 2006). Some of the primary reasons why airlines opt to use relatively small aircraft have to do mainly with the benefits of high frequency service, the competitive environment in which airlines operate and the way capacity is allocated and priced. Yet, from the perspective of the system, high-frequency service (and the small aircraft size this implies) could have potentially adverse effects such as congestion and higher operating and environmental costs (Givoni and Rietveld, 2006).

Smaller jets tend to have a slower cruising speed than the bigger jets that share the same airspace (Bauer, 2000). These large cruising speed differences greatly complicate the job of air traffic controllers in high-altitude sectors, and create a slowing-down effect that ripples throughout the system (Cubin, K.A. in Bauer, 2000). The use of smaller aircraft increases the possibility of flight delays, because they will greatly impact terminal space, as well as extend routes for all jet aircraft and increase flying time and in some cases flow control restrictions as well (Givoni & Rietveld, 2006; Woerth, 1999, in Bauer, 2000).

One possible solution could extend to the use of separate airports for the different types of aircraft. A study conducted by Muller & Santana (2008) found that the removal of small planes from the larger airports considerably reduced congestion and delays. Smith (2008) reiterated this view, stating that in some instances it was not the total volume of passengers that slowed the process down, but the inefficient way in which they were divided up. Effectively small regional jets accounted for up to half of all takeoffs and landings in the US.

However, the use of smaller airports could also not necessarily reduce the congestion at hub airports, as it could in fact, further increase the amount of aircraft in the system (Smith, 2008; Givoni & Rietveld, 2006). Large airline companies would simply keep their current flight slots as well as introduce the new flight slots, in essence adding more capacity, but also more flight traffic, to an already full system. Solutions need to be implemented as inter-related strategies; for example moving smaller aircraft to smaller airports without adjusting slot allocation procedures could result in unintended effects including flight delays.

3.4.10 The Influence of Weather as a Flight Delay Factor

Some delays occur as a result of problems that may be hard to predict and are often beyond an airline's control, such as bad weather (Bhat, 1995; Bauer, 2000; Suzuki, 2004; Skyguide, 2005; Wilber, 2006; CNNMoney.com, 2007). John Hansman, Aeronautics Professor at the Massachusetts Institute of Technology, noted that air traffic control systems were under stress due to high demand and unusual weather (CNNMoney, 2007). Furthermore, the FAA (2007) indicated that adverse weather such as thunderstorms, low cloud ceilings and snow had a significant impact on flight operations and added to the increasing unpredictability of flight operations.

In 2007, 66% of US delays were due to weather-related events (FAA, 2007). Similarly, research conducted by Abdelghany *et al.* (2004) indicated that bad weather accounted for 75% of system delays. If a delay is due to bad local weather, all arriving and departing flights from that particular airport will undoubtedly be affected. Additionally, in the early stages of a delay, it may be difficult for the airline to estimate the duration of the delay because weather

that has been forecast to improve may instead deteriorate. In such situations, options available to airlines to speed up departures could be severely limited.

The anticipation of adverse weather conditions has resulted in flight schedules being subjected to numerous sources of irregularity (Abdelghany *et al.*, 2004). In some cases, to ensure safe operations, the FAA in America would issue a ground delay program (GDP) at a specific airport, which increased the gap for successive flight arrivals. In most cases, this resulted in fewer slots being available for flight arrivals than were required in the original planned schedule (Ball *et al.*, 2000, in Abdelghany *et al.*, 2004). This led to flight delays (or even cancellations), and subsequently dissatisfaction, for the travellers concerned, whether leisure, business or corporate travellers.

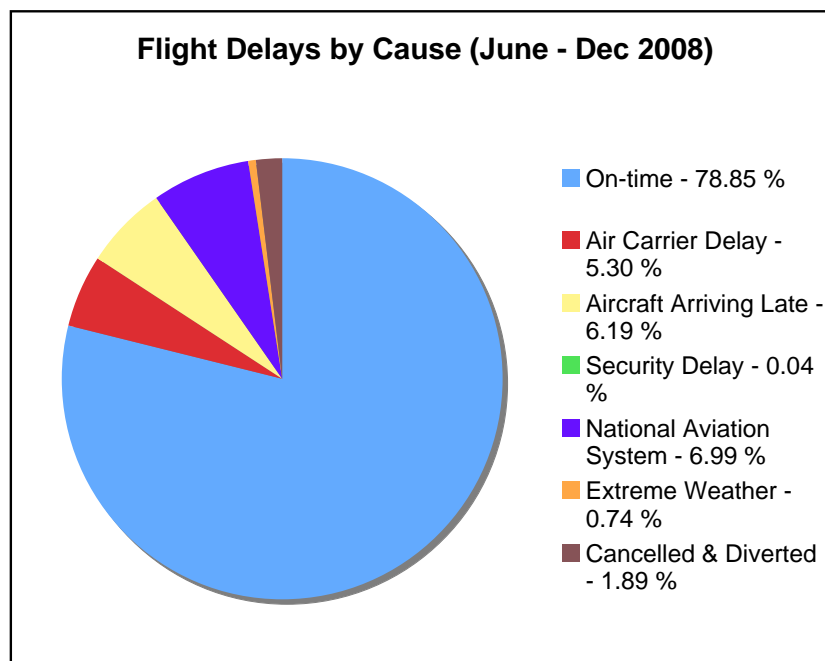
Bad weather is often blamed for the occurrence of flight delays (Kjelgaard, 2007; CNNMoney, 2007; Wilber, 2006; Bauer, 2000). At times such an observation is justifiable, but at other times, placing the blame solely on the weather could be viewed in a somewhat dubious light. Many airports are nowadays equipped with the necessary equipment to manage most weather conditions, including severe cold, snow, ice, and more (Stander, 2008). However there are times when the weather will prove to be a formidable force, such as during severe thunderstorms, snowstorms, wind conditions, etc. In South Africa, the Gauteng Province often experiences severe late-afternoon thunderstorms in summer, potentially resulting in a greater occurrence of flight delays and cancellations for flights departing or arriving at OR Tambo International. This study will also aim to identify any patterns in the occurrence of flight delays and cancellations in terms of time of day, months, seasons, and so forth.

Adverse weather conditions have a significant run-on effect. In many countries, once the weather conditions drop below visual minimums, especially at airports with limited instrument landing capability, the impact of one single storm begins a ripple effect throughout the system. Once an airport has to restrict the use of its runways because bad weather has precluded the proper use of Instrument Meteorological Conditions (IMC), the airport acceptance rate falls and departure rates are cut. Such adverse conditions result in ground delays at departure airports, the holding of inbound airborne aircraft, and subsequently in ground delays for departures at the arrival airport – a domino effect causing delays to the airlines' primary markets: leisure, business and corporate travellers (AhmadBeygi *et al.*,

2008; Woerth, 1999 in Bauer, 2000). Chapter 4 will provide a more comprehensive overview of the characteristics that define each market.

Airport regulating companies often give adverse weather conditions the blame for delays. However, Bauer (2000) suggests that this inhibits authorities from focusing on the real issue: weather management. According to Bauer (2000), the Air Transport Association of America noted in 1999 that the majority of delays were not caused by severe weather, but by the air traffic control systems' and airports' mismanagement (Bauer, 2000). The Research and Innovative Technology Administration (RITA) at the US Bureau of Transportation, indicated that, during June 2008 and December 2008, only 0.74% of delays in the US have actually been attributed to extreme weather as shown in Figure 3.6.

Figure 3.6: Flight Delays by Cause (June – Dec 2008)



Source: RITA. Research and Innovative Technology Administration. Bureau of Transportation Statistics. [Online] Available from: http://www.transtats.bts.gov/OT_Delay/ot_delaycause1.asp?type=21&pn=1 [Accessed: 2009-02-01].

Through the proper use of weather forecasts, the number of weather-related delays could be reduced. Additionally, for a relatively small investment, the implementation of certain

measures such as low-cost surface movement radars, runway stop bars, runway guard lights, centreline lights, signs and markings could greatly aid both air traffic controllers and pilots in navigating around an airport in adverse weather conditions – ultimately safety would be improved and time wastage that could lead to delays would be alleviated (Bauer, 2000).

The ATA has also aimed to identify methods to better manage the influence of severe weather. According to the FAA (2007), in 2007 the number of Airspace Flow Program (AFP) locations to help manage traffic were more than doubled across much of the country. Airlines could choose the option of either accepting the delay of flights scheduled, to fly through thunderstorm locations or, if possible, flying longer routes to manoeuvre around storms. As weather cannot be controlled, the FAA (2007) suggested aiming to improve the management of traffic during bad weather and minimising the impact of weather on on-time performance.

To aid in mitigating delays due to weather and to improve safety at certain airports at times of low visibility such as bad weather and at night, ATNS planned the implementation of an advanced surface movement guidance and control system (A-SMGCS) at two airports in South Africa (ATNS, 2009b). By 2009, all infrastructure development work for the system and site acceptances tests (SAT) were completed (ATNS, 2009a). According to ATNS (2009a) the system is ready for use, and once all operation training has been completed, it will enhance safety at OR Tambo airport and provide more reliable information at the Cape Town airport by replacing the existing surface movement radar (SMR).

However, James May, President and CEO of the Air Transport Association of America, stated that airways had become saturated, and that even in good weather, the system was only able to handle the current traffic demand (May, 2007). When severe weather disrupts an airway system, the impact on airline operations is immediate and often widespread. May indicated that the FAA had developed a number of programmes to ensure safe operation in these conditions, but that the effect of these programmes was often flight delays, which inexorably lead to unhappy customers, including leisure, business and corporate travellers (May, 2007).

3.5 POSSIBLE SOLUTIONS FOR REDUCING THE IMPACT OF FLIGHT DELAYS

Increasing numbers of delays could result in increased aircraft operating costs to airlines, which would inevitably end up being passed along to the flying public (Forbes, 2006). Ideally airlines would seek solutions to keep from losing time and money, as well as to manage customer expectations more efficiently (SITA, 2008a; Forbes, 2006). Some of the potential solutions available to airlines are:

- “De-hubbing” some of the busier airports and simply “hubbing” some of the less busy airports;
- Establishing reasonable standards of performance and placing responsibility for their enforcement on air traffic controllers;
- Alleviating capacity problems through airport infrastructure improvements;
- Peak-load pricing;
- Implementation of congestion charges/slot auctioning;
- Consolidation of multiple departures through the use of larger aircraft;
- Improving service levels by involving the public, i.e. passenger perception surveys;
- Better communication with passengers during flight delays (AhmadBeygi *et al.*, 2008; Muller & Santana, 2008; Smith, 2008; Forbes, 2006; Johnson & Savage, 2006; Janic, 2005; Bauer, 2000; Bhat, 1995).

In Forbes (2006), Mayer and Sinai (2003) found that flight delays were significantly longer at hub airports than at non-hub airports, raising the possibility that airlines could “de-hub” some of the busier airports and simply “hub” some of the less busy airports (Smith, 2008; Forbes, 2006). The major airlines could bypass the main hubs and fly more direct flights to different destinations. Alternatively, airlines could try to transfer some of their traffic by scheduling some flights to/from secondary airports that tend to be less busy, as demonstrated in South Africa by kulula.com, which schedules flights from secondary airports such as Lanseria Airport (kulula.com, 2008). This option seems not only to hold scheduling benefits for airlines, but also to be a good alternative for passengers. Secondary airports are often situated in areas with less road traffic, resulting in shorter travel times to/from the airport, as well as shorter check-in queues, thus ultimately reducing the time spent in travel and allowing more time for business activities. In addition, the smaller number of flights scheduled for

departure and arrival reduces the chance of the occurrence of flight delays due to volume and scheduling.

Robert Crandall proposed a solution that would place the priority on performance by establishing reasonable standards of performance and then holding the air traffic controllers (ACSA/FAA) responsible for those standards (McKenna in Bauer, 2000). According to Bauer (2000), the US Congress is already in the process of debating a “passengers’ bill of rights” that would hold air carriers accountable for maintaining minimum service standards. The issue of flight delays is included in one of the bills being debated. The bill could result in lawmakers obliging carriers to compensate travellers for certain disruptions, such as being stuck on a runway for more than two hours. The EU Consumer Protection Act, which is now also applicable in South Africa, could lay the groundwork for the implementation of regulations specifically promoting passenger rights and protection in the event of flight delays. On the other hand, some say that a provision that would fine airlines for flight delays could encourage carriers to take off in unsafe weather (Woellert, 1999 in Bauer, 2000).

Capacity problems are one of the reasons for flight delays. The improvement of airport infrastructure through the construction of new runways and the extension or improvement of existing runways has been identified as one of the most direct and significant actions used to improve capacity at existing airports (AhmadBeygi *et al.*, 2008; Muller & Santana, 2008; Bauer, 2000). It was, however, noted that while these improvements were vital to address capacity problems, during construction periods the number of flight delays could actually increase when previously used runways became unavailable while undergoing improvements and extensions. However, even though this is a negative aspect, the future benefits of increased capacity generally outweigh current inconveniences. Airport improvements are currently under way at all ten major airports in South Africa, in preparation for the large amounts of passenger traffic due to move through the airports during the 2010 Soccer World Cup (ACSA, 2008). The optimisation of capacities has been shown to have a positive influence on delay statistics (Skyguide, 2005).

Congestion typically occurs when the numbers of people travelling at specific times during the day, week and/or year exceed the available transport capacity at the time. Peak-load

pricing has been suggested as a method of potentially solving congestion problems at capacity-constrained airports (Smith, 2008; Forbes, 2006). Peak-load pricing involves charging higher prices for flights during peak hours than for flights at other times, so as to persuade passengers to choose flights that cost less at less busy times. As a result the amount of passenger traffic passing through the airport during specific times is reduced, creating a more constant flow throughout the day, and ultimately reducing the potential for delays due to capacity problems. The US carrier Delta Airlines has already developed a plan for spreading some of its evening overseas departures into earlier or later non-rush-hour slots, when JFK Airport is much quieter (Smith, 2008).

However, Smith (2008) has indicated that the most probable result would be higher fares with a minimal effect on congestion, because many of the costs would simply be passed along to passengers. He suggested that, for the scheme to encourage any measurable consolidation, fees would need to be fairly radical, i.e. very expensive. However, airlines are generally too strong, and regulators too timid. Instead, the probable result would be more expensive tickets with the same amount of delays. Furthermore, business travellers are often unable to select alternative flights as their travel arrangements are largely dictated by their schedules. Apart from price-based initiatives such as peak-load pricing, better monitoring of airport capacity and more efficient use of existing capacity could potentially aid in addressing the capacity crunch, and reducing the occurrence of flight delays (Jankovec, 2007; Skyguide, 2005).

Another potential method of solving congestion problems that cause flight delays at capacity-constrained airports could be through slot auction and congestion charging (Forbes, 2006; Janic, 2005). The auctioning of slots could enable efficient use of existing slots and provide for a more efficient distribution of new slots (Johnson & Savage, 2006; Janic, 2005). The implementation of congestion fees is one method used to provide airlines with the incentive to move some flights out of the peak period and to slightly alter the scheduled departure time of other flights to avoid the rush of departures that can occur on the hour – thereby helping to reduce delays in both good and bad weather (Johnson & Savage, 2006; Janic, 2005). Charging congestion fees seems to be able to regulate price-sensitive demand when other demand-management measures are regarded as inefficient (Janic, 2005).

The issue of how, and how much, to charge by way of congestion fees is still being debated as numerous factors can influence delays, some of which are uncontrollable, such as bad weather. Johnson & Savage (2006) noted that congestion fees would tend to be much higher on bad-weather days, owing to longer aircraft delays, than on good-weather days. This raised the question of whether a congestion price schedule should be based solely on the recurrent congestion experienced on a good-weather day, or whether it should be based on some weighted average of the actual operations at the airport over the course of a year. However, on the positive side, congestion charges could lead to increased flight rescheduling, which could reduce the spikes in departures and arrivals, and consequently the delays that occur during peak hours (Johnson & Savage, 2006).

It has been suggested that one potential solution would be for airlines to use larger aircraft to consolidate multiple departures (more efficient airline scheduling) and to wean themselves from the use of smaller regional jets (AhmadBeygi *et al.*, 2008; Smith, 2008; Johnson & Savage, 2006). Such a process could be done voluntarily, or through government-imposed caps (Smith, 2008; Forbes, 2006; Johnson & Savage, 2006). Smith (2008) noted that some examples of caps could include:

- At major airports, no aircraft with fewer than 100 seats would be allowed to take off or land between peak traffic periods;
- During peak traffic periods, each carrier serving the airport would have to reduce its schedule by a certain prorated percentage that reflected its share of total passengers.

Improving service levels has been identified as a key focus area (Bhat, 1995; ACSA, 2008). Unlike a tangible product, a dissatisfied customer can neither ask for a refund, nor exchange a flight, once it is over (Bhat, 1995). In line with international standards, both airlines and airports are increasingly monitoring both passenger perceptions and actual operational and commercial performance. ACSA (2008a) has implemented Passenger Perception Surveys that are conducted monthly during peak operational periods and evaluated quarterly by an independent organisation. This allows ACSA to focus on what passengers require and perceive as challenges, which helps all the service providers involved to respond to passenger needs more effectively.

Better communication with passengers during delays could help to reduce passenger frustration levels. The passengers' bill of rights includes a clause that airlines would update passengers at 15- to 20-minute intervals during flight delays (Bauer, 2000). The use of mobile technology such as SMSes, could also enable airlines to communicate better regarding the occurrence of flight delays. The use of mobile technology in communicating about flight delays to passengers will be discussed in Chapter 4.

Lastly, the modernisation of air traffic control systems will not fix the problem of increased congestion and flight delays (Smith, 2008). In fact, the use of innovative technologies and procedures has been shown to be of limited effect (Smith, 2008; Janic, 2005). Neither will it help to “scapegoat” private jets, to patronise small airports or even to fantasise about the construction of new runways (Smith, 2008). Evidence suggests that there are potential solutions available for addressing flight delay problems. However, each scenario is unique and needs to be addressed as such – a solution that worked at one airport may not work at another. For example, some airports may simply not have the necessary space available for certain infrastructure improvements, and will have to identify alternative solutions.

3.6 CONCLUSION

Airlines need to take greater cognisance of how flight delays influence business and corporate travellers. As the retaining of existing customers has become critical to maintaining market share, it is vital for airline managers to be aware of and address the constantly changing needs of their customer base – especially with regard to recovery from service failures and how such experiences could affect corporate travellers. The manner in which delays are managed and communicated to passengers can greatly aid in either reducing or increasing passenger dissatisfaction. To better understand the possible influence of flight delays, the characteristics and travel patterns of business and corporate travellers need to be discussed. Chapter 4 will provide a comprehensive review of the characteristics and travel patterns of business and corporate travellers and ultimately discuss the influence of flight delays on corporate travellers.

CHAPTER 4

THE CHARACTERISTICS AND TRAVEL PATTERNS OF BUSINESS AND CORPORATE TRAVELLERS

4.1 INTRODUCTION

The previous chapter looked at the various factors potentially influencing the occurrence of flight delays. While flight delays affect both leisure and business travellers, in this study the focus is on the effect of flight delays on the business travel market.

To gain a greater understanding of the travel patterns of South African business and corporate travellers, this chapter will discuss the characteristics of the general business travel market. The fact that few studies have been done concerning the specific characteristics of business travellers makes it necessary to draw certain inferences, allowing a more comprehensive view of the South African business traveller (Fourie & Lubbe, 2006; Fourie, 2004). A discussion on the occurrence of flight delays and how they can influence the business and corporate traveller will follow in this chapter.

4.2 THE SOUTH AFRICAN BUSINESS TRAVEL MARKET

4.2.1 The Size of the Business Travel Market

Business travel involves professionals travelling to a destination in order to conduct business, which may include making sales or purchases, attending meetings or participating in conferences (Douglas, 2009; Douglas, 2005; Swarbrooke & Horner, 2001; Palapies, 2001 in Douglas, 2005; Lubbe, 2000). This is generally non-discretionary travel, as business travellers cannot usually decide when, where, how and how long to travel (Lubbe, 2003b). The main distinction between business and leisure travel is that there is little or no emphasis on touring or sightseeing when business travel is undertaken. Some part of the journey often involves aircraft, whether this is for international or domestic travel (Douglas, 2005).

The business travel market can be divided into two segments (Douglas, 2009; Douglas, 2005; Lubbe, 2000). The first segment includes individual business travellers travelling on behalf of their companies, which are usually small to medium-sized business enterprises with relatively small travel budgets, and no specific travel department or corporate travel policy. This segment may also be referred to as unmanaged travel. The second segment is corporate travel, also referred to as managed travel. Corporate travel is the segment of the business travel market that can be described as travel undertaken by the employees of a particular organisation which has a substantial travel volume, where travel arrangements are generally consolidated into a centralised function and there is also an established corporate travel policy (Lubbe, 2003b; Lubbe, 2000). As this study will analyse the travel of a specific company with a corporate travel management programme, the focus of further discussion will be the corporate traveller.

The economic size and value of the business travel market is not easily measured (Douglas, 2009). Barometers generally used to predict growth trends in business travel include global, regional and domestic economic indicators, air travel demand and business travel surveys (Douglas, 2009). According to the UN World Trade Organisation (2008), business travel accounted for 15% of the total international arrivals. The World Travel and Tourism Council (WTTC) estimated that global business travel was an \$843 billion industry in 2008, and expected this figure to increase to \$1,443 billion by 2018 (WTTC, 2008).

In South Africa it is difficult to provide an accurate assessment of the value and size of the business travel market (unmanaged and managed). While Statistics South Africa reports on the number of passengers travelling in and out of South Africa for business purposes, there are no statistics available on the economic value of the business travel market, and no distinction is made between managed and unmanaged travel. However, some estimates have been made. According to Palapies (2001 in Douglas, 2005), approximately 40% of the total South African travel market could be classified as corporate or business-related. According to Gavin Stevens, CEO of Tourvest Retail Travel, this figure could even be as high as 55%. He also surmises that the current market size of corporate travel in South Africa is between R20 and R25 billion (Douglas, 2009). South African Tourism only reports on the inbound business travel; the 2007 Annual Report of South African Tourism indicated that,

even though leisure remained the primary purpose of visit of tourists to South Africa, 30% of arrivals in South Africa were for business, as shown in Figure 4.1 (SA Tourism, 2008a).

Figure 4.1: Purpose of Visit for all Foreign Tourists

QuickTime™ and a
TIFF (LZW) decompressor
are needed to see this picture.

Source: SA Tourism. 2008a. Annual Report 2007. [Online] Available from: <http://www2.southafrica.net:80/satourism/research/viewResearchDocument.cfm?ResearchDocumentID=477> [Accessed: 2009-01-17]

4.2.2 Corporate Travel Expenditure

Those travelling for business purposes need a range of services. These include:

- accommodation, from hotels and guesthouses to bed-and-breakfasts;
- transport, such as taxis, rented cars and airlines to transport them to and from, as well as within, their destinations; and
- services such as restaurants and bars, which often depend for their economic survival through their business clientele's expense accounts (Davidson & Cope, 2003, in Douglas, 2009).

According to Lubbe (2003b), a typical breakdown of travel expenditure for a large organisation in South Africa would be divided into airline tickets, accommodation, car rental and sundries, as shown in Figure 4.2. This division of expenditure was based on Gomes-

Costa and Birns (2003) and a summation of figures derived from a number of corporate travel management company sales. From Figure 4.2 it is evident that airlines accounted for 80% of corporate travel expenditure. As airlines account for such a large percentage of expenditure, it could be important for travel managers to identify the possible cost to the company resulting from flight delays.

Figure 4.2: A Typical Pattern of Corporate Travel Expenditure

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

Source: Lubbe, B.A. 2003b. A study of corporate travel management in selected South African organisations and a Conceptual model for effective corporate travel management. *Research Report*. South Africa. Department of Tourism Management / University of Pretoria.

In many instances travel may constitute a company's second largest item of expenditure (Douglas, 2009; Ravenall, 2000 in Douglas, 2005; Uniglobe Travel, 2004). Corporate travel spending for large organisations in South Africa may range between R5 million and R300 million per annum (Lubbe, 2003b). An organisation with such a substantial travel budget needs to manage its travel expenditure in order to achieve all the possible benefits, the most important of which relate to cost saving (Douglas, 2009; Douglas 2005; Lubbe, 2003b). Cost saving has become an area of increasing concern to companies (ACTE, 2009; Douglas, 2005). South African corporations with substantial travel expenditure have been faced with two main issues: the first is the management and control of travel expenditure, and the second is the management of the travel process to ensure required service levels at an optimum cost-benefit ratio (Lubbe, 2003b). Corporations look at various ways of decreasing travel costs, ranging from decreasing the amount of travel, which may well reduce expenses

but will often have a negative impact on a company's ability to service, sell or maintain a presence with its customer base, to more effectively managing the travel management programme. This includes proper planning and management of the travel budget, a solid travel policy and innovative ways of negotiating deals with suppliers such as airlines.

One of the primary functions of a Corporate Travel Department is to consolidate the travel volume to obtain leverage from travel providers (such as airlines, hotels and car rental firms) in the negotiation of contracts at reduced prices – thus aiding the better management of the travel process (Bell & Morey, 1995 in Lubbe, 2003). Knowing the costs resulting from flight delays could be vital when negotiating mutually beneficial agreements.

Additionally, most corporate travel policies do not provide strategies to allow for flight delays. When confronted with increasing numbers of unexpected disruptions in flight schedules, how would corporate travellers be expected to behave with regard to spending additional company money? The occurrence of flight delays could in fact affect business travellers to such an extent that they might choose to contravene corporate travel policies (Suzuki, 2004). Some research has been done to assess the influence of negative service failures, such as flight delays, on business travellers (AhmadBeygi *et al.*, 2008; Muller & Santana, 2008; Janic, 2005; Suzuki, 2004; Bauer, 2000). These studies suggest that service failures negatively affect business travellers' future airline choices (Suzuki, 2004; Bhat, 1995), but none have yet addressed the potential cost to corporations resulting from flight delays.

4.3 THE INFLUENCE OF FLIGHT DELAYS ON BUSINESS AND CORPORATE TRAVELLERS

The various factors responsible for flight delays were discussed in detail in Chapter 3. In Section 4.2 certain characteristics and travel patterns of the South African business travel market were briefly discussed and mention was made of the potential for better management of corporate travel to achieve desired benefits such as cost savings. The section noted that even though corporate travel policies could be beneficial in reducing corporate travel spend, they did not provide strategies in the event of flight delays, and consequently did not take into account their potential effect on corporate travel.

In a recent survey conducted by Orbitz Travel on the American travel market, respondents were asked to specify which factors caused the most trouble during their travels. The majority of respondents indicated flying as being the most problematic (Hotelmarketing.com, 2007). More specifically, 40% of those surveyed cited flight delays as their “most problematic” trip experience. This section will focus on discussing the influence of flight delays on corporate travellers, irrespective of the reason for their occurrence.

Theoretically, two interpretations are possible for the expected effect of service failures (Suzuki, 2004; Bhat, 1995). First, that service failure experiences would negatively affect travellers’ future airline choices. If, for example, a traveller experiences a significant flight delay at a specific time, the traveller’s choice probability for this airline on a subsequent trip may become substantially lower than previously. The underlying theory for this behavioural pattern is that travellers are loss-averse with respect to airline service qualities so that they are less likely to choose the same airlines after bad experiences (e.g. flight delays) than after good experiences.

Secondly, that service failures may have no impact on travellers’ airline choices. According to Bhat (1995) and Suzuki (2004) in reality, the probability of a service failure occurring in the future is independent of the service failure outcomes of the past. If a traveller has experienced a significant flight delay in the past, this does not mean that the traveller is more (or less) likely to experience flight delays in the future with the same airline. This condition therefore implies that if travellers are “rational” decision-makers who understand that the probability of experiencing service failures on any trip occasion is not conditional on their past service failure experiences, they may simply select the airline that maximises their utilities (best schedule, best price, in-flight services, etc) on each trip occasion, without regard to their past service failure experiences. This behavioural pattern is consistent with the random utility theory (Suzuki, 2004), which is based on the assumption that consumers apply the decision rule of *maximum utility* to a brand (Pazgal *et al.*, 2005; Louvière, 2004).

On the other hand, some research does suggest that certain flights, at certain times, are simply more prone to delays (Wilber, 2006). Such evidence could suggest to customers that being selective of certain flights at certain times could be beneficial. One of the objectives of this study was to identify any patterns in flight delays over a specified period. Flight delays

result in increased waits for service, costing people time and money (AhmadBeygi, 2008; Muller & Santana, 2008; Janic, 2005; Bauer, 2000). The following section addresses the cost of flight delays to corporate travellers.

4.3.1 The Influence of Flight Delays on Corporate Travellers' Costs and En-Route Productivity

The lack of airspace slots into which a flight can be accepted by prior arrangement has been worsening, and queues of aircraft have been lengthening, both on the ground and in the air (Kazda & Caves, 2000). Delays in the commercial airline industry cost travellers both time and money. In 1998, air traffic delays cost airlines \$2.9 billion and the travelling public \$1.6 billion, a total cost of \$4.5 billion (Bauer, 2000). The US Air Transport Association (ATA) predicted that the number of airline passengers would rise by 43% through 2008, that an additional 2 500 aircraft would be required and that this additional traffic load would result in a 250% increase in flight delays by 2008 (Bauer, 2000). Furthermore, US airlines calculated that the average length of an en-route delay would increase by 75% in the year 2008, and that of a terminal delay by 114 % (ATA, 1999 in Bauer, 2000). Recent statistics show that flight delays have, in fact, increased (ATA, 2008; May, 2007).

According to James May (2007), CEO of the Air Transport Association of America, the US Department of Transport (DOT) estimated the cost of delays to US passengers in 2005 at \$9.4 billion. At a rate of \$62 in direct operating costs per minute of flight delay, DOT estimated that in 2005 delays cost airlines an additional \$5.9 billion. Additionally, ATA estimated that in the twelve-month period ending September 2008, 138 million system delay minutes were recorded, which resulted in an estimated \$10 billion in direct operating costs for scheduled US passenger airlines (ATA, 2008). Delayed aircraft also drive the need for extra gate and ground personnel. Flight delays further impose costs on airline customers in the form of lost productivity, wages and goodwill.

Suzuki (2004) suggested that traveller reactions to service failures such as flight delays could differ depending on the trip purpose, and specifically that service failure experiences may have stronger impacts on choices when the trip purpose is business rather than leisure. This

could be because leisure travellers choose airlines on the basis of airfares, while business travellers might not be willing to sacrifice service quality for lower airfares. Research suggests that business travellers value their time at about the rate of their hourly earnings. In other words, employers tend to view travelling time as working time lost, and hence assign to their employees' time a value that equals the foregone output (UK Department of Transport, 2003; Gronau, 1970). According to the UK Department of Transport (2003) the time spent waiting for public transport services is commonly valued much more highly than time spent actually travelling. In fact, there is consistent evidence that people will pay more to save walking and waiting time than they will for an equivalent saving in travel time. The FAA has recommended an estimated \$35.70 per hour as the average value of a passenger's time (ATA, 2008). ATA consequently estimated that the total US delays experienced in the twelve-month period ending September 2008 cost air travellers \$4.5 billion (ATA, 2008).

Apart from the value of time lost, flight delays could result in significant run-on implications and affect corporate travellers' costs and en-route productivity, owing to the loss of potential business opportunities resulting from missed flights (AhmadBeygi *et al.*, 2008; Diaz & Ruiz, 2004). Sometimes delays may be so extensive that travellers are forced to seek alternative transport, miss connecting flights or even to pay for additional accommodation, thereby incurring additional costs in time and money (Bauer, 2000). A few run-on costs to business travellers could include:

- The missing of connecting flights;
- Booking of additional accommodation;
- Additional costs due to change fees charged by operators for making changes; or
- Even the loss of deposits in the event of cancellations and so forth (Bauer, 2000).

Disruptions to planned flight schedules do not come as an inconvenience and cost to airline customers alone, but to the airline itself as well (Abdelghany *et al.*, 2004). Airlines also lose profits through having to reimburse travellers in the event of certain delays (Abdelghany *et al.*, 2004). However, the process of actually obtaining the necessary monies could often be a long and arduous battle for travellers or their employers. Furthermore, if a scheduled flight is perhaps held at its original airport, diverted to another airport, or in the worst case even cancelled, this may impact the availability of crews and aircraft for subsequent scheduled

flights. For instance, if a flight is delayed, its crew members may fail to connect with their next scheduled flights. Furthermore, they may exceed their maximum allowed (legal) duty period, and may then not be available to complete the remaining flights in their planned schedule (Abdelghany *et al.*, 2004).

According to Janic (2005), the estimation of the total social cost of delays during a congested period would include (1) the private cost of delay of each flight, and (2) the cost of the marginal (additional) delays that each flight could impose on another subsequent flight. Such modelling would require the development of three components or sub-models: (1) a model of congestion, (2) a model of system delays and their costs, and (3) a model to assess the likelihood of a flight taking place during a congestion period once a charge has been imposed. The cost per flight could include the cost of both aircraft and passenger delay.

Kazda and Caves (2000) indicated that the costs incurred by delayed flights reached hundreds of millions of US dollars annually. Forbes (2006) found that airline prices fell in response to longer flight delays. Forbes (2006) also found that prices fell much more in competitive markets, which shed some light on the link between service quality and competition in airline markets. This suggested that time performance is better on routes and at airports with more competition. Consistent with these results, Suzuki (2000) found that market shares were positively related to on-time performance. An airline's on-time performance significantly affected its market share by changing the retention rate (or switching rate) of passengers for that airline. Suzuki (2000) found that the switching rate of passengers with delay experiences was significantly higher than that of passengers without delay experiences.

Even though it is commonly known that flight delays result in additional costs, there is still a lack of accountability among all parties involved (The Boyd Group, 2008; Knowler, 2008; Wilber, 2006; Bauer, 2000; Bhat, 1995). This lack of accountability could be the reason for the frequent low levels of service failure recoveries. As the various parties involved often aim to shift the blame for the occurrence of flight delays, travellers are seldom sufficiently remunerated. For example, even though airlines do sometimes remunerate travellers for some immediate costs involved, by perhaps not charging for flight changes, they do not remunerate business travellers for any run-on costs incurred, such as missing connecting

flights or any alternative transport or accommodation costs. Bauer (2000) suggests that the additional costs to the consumer are never completely recovered.

The EU Consumer Protection Act 2007 (now also applicable in South Africa) has incorporated regulations specifically designed to promote and protect the interests and welfare of consumers (National Consumer Agency, 2007; OFT, 2006). According to the Act, a trader/service provider shall not engage in any unfair commercial practice. A commercial practice is deemed unfair if:

- It is contrary to the principle of good faith in the trader's field of activity;
- It is contrary to the standard of skill and care that the trader may reasonably be expected to exercise in respect of the consumer;
- It would be likely to cause appreciable impairment of the average consumer's ability to make an informed choice in relation to the product concerned; and
- It would be likely to cause the average consumer to make a transactional decision that the average consumer would not otherwise make (National Consumer Agency, 2007).

In considering whether a commercial practice is unfair, the Act stipulates that the practice shall be considered in its factual context, taking into account all of its features and the circumstances, and be assessed in the light of numerous factors, including the method or date of the product's delivery; the availability, without limitation, at a particular time/place/price; the results expected; the handling of consumer complaints in relation to the product; and, finally, the after-care customer assistance available to consumers (National Consumer Agency, 2007).

As to whether flight delays could possibly be deemed unfair, the cause and extent thereof would be considered in the light of all the various factors leading thereto, i.e. weather, inefficient aircraft schedules, air traffic control, etc. Some of the regulations suggest that flight delays, in some circumstances, could be regarded as unfair practice in that a previously specified service did not occur as advertised, resulted in complaints, and in some cases resulted in unexpected costs that required after-sale customer service recovery. However, for costs to be recovered, the issue of accountability would first need to be addressed.

4.3.2 The Influence of Flight Delays on Business Travellers' Contract Negotiations with Airline Companies

It is common practice in the industry to conclude certain arrangements (often referred to as barter agreements) between airlines and businesses (Douglas, 2005; Bauer, 2000). These arrangements are concluded on the premise of being mutually beneficial – providing benefits to both parties (Douglas, 2005; Bauer, 2000). The airline would perhaps benefit through having a predetermined number of seats used on a regular basis by the organisation and being a “preferred supplier”, thus reducing the risk of unsold seats during low season periods. Companies, on the other hand, may benefit from reduced rates and consistent availability, thus ensuring that excess expenditure is kept to a minimum.

These barter agreements are most often set out in a company's corporate travel policy, and most companies depend heavily on the numerous interactive relationships between the travellers, top management, travel suppliers and travel management companies (Douglas, 2005; Cochrane & Mackenzie, 2004; Lubbe, 2003b). Airlines are one of the key travel suppliers in the corporate travel industry (Douglas, 2005), and generally represent the highest cost to a company in terms of its travel expenditure. Travel managers are increasingly exploring opportunities to combine their corporate contracting and preferred supplier relationships with customer service elements by negotiating service level agreements (ACTE, 2009; Jonas, 2004). One of the areas not generally covered in these types of agreements is on-time performance by airlines. This study takes a first step in looking at this problem since very little, if any, research has been done regarding the influence of flight disruptions such as flight delays on contract negotiations between airlines and companies.

According to the National Business Travel Association (NBTA) it is essential for an airline to foster a relationship with travel buyers that benefits both parties (Douglas, 2005). As already mentioned, corporate travel buyers are focusing more and more on cost savings and adequate service levels, but in today's negotiating environment airlines have become more demanding in defining what constitutes a good programme for an account (Koetting & Gillespie, 2004). Thus the value of a long-established partnership between corporations and airlines has diminished (Douglas, 2005). Formerly, volume alone was considered enough leverage for a travel buyer to secure a good deal from an airline, but that has now changed.

For an airline the ability to move market share is fundamentally more important than size of spend (Douglas, 2005). Therefore, a programme with the clear ability to move business away from or toward a given airline has more leverage and can secure better pricing than a larger programme that cannot move its market share (Koetting & Gillespie, 2004, in Douglas, 2005).

The tactic of moving market share is an attempt to lure business travellers and revenue away from a competitor. Most airlines use the same common tactics to support their marketing strategy, including corporate contract market share agreements. Such agreements provide companies with a corporate discount based on volume, but also primarily on the company's ability to continuously shift more travel away from competing airlines (Douglas, 2005).

On the other hand, delays in the commercial airline industry cost travellers and companies time and money (Bauer, 2000). The question then arises as to whether or not the occurrence of flight delays may influence business travellers' arrangements to such an extent that the added costs incurred as a result of these delays (in both time and money) may render such agreements less beneficial than initially suggested.

Technological developments such as the Internet have prompted airlines to deal directly with their corporate customers, bypassing the travel agency and reducing costs to both parties. South African Airways (SAA) has already implemented a programme aimed at redefining the way it does business with its corporate market. By realigning its structures and processes to suit corporate needs, SAA hopes to negotiate more effective contracts that suit client profiles and satisfy needs (Douglas, 2005).

When such contracts are implemented, it is essential for the airlines to maintain good relations with the corporate travellers concerned, should problems such as flight delays arise. Accordingly, the manner in which flight delays are communicated to corporate travellers has become increasingly important. Developments in mobile technology may offer some solutions to the problem of providing timely and reliable flight status updates.

4.4 THE USE OF MOBILE TECHNOLOGY IN COMMUNICATING WITH AIRLINE PASSENGERS

4.4.1 The Characteristics of Mobile Technology

Mobile commerce, or m-commerce, has been defined as “any electronic transaction or information interaction conducted using a mobile device and mobile networks (wireless or switched public network) that leads to transfer of real or perceived value in exchange for information, services or goods” (MobileInfo.com, 2006; Sadeh, 2002, in Okazaki, 2006). Despite the rapid proliferation of Internet-based mobile handsets, empirical research has been undertaken only in a limited number of research areas (Gould *et al.*, 2006; Okazaki, 2006). This is largely due to the considerable uncertainties involved in mobile research:

- One major problem in m-commerce research is the lack of standards in terms, concepts, and theories. Although the infrastructure of wireless technology varies across markets, researchers tend to use the term “m-commerce” without considering the specific conditions and prerequisites of what they are examining.
- Industry participation in academic research is at best occasional, and in many cases rapidly developing mobile technology may not be accepted as much as practitioners expect, either owing to the higher cost per service ratio, or simply because these services can easily be replaced by the wired Internet (Wikipedia, 2007a; Okazaki, 2006).

One key characteristic of mobile commerce is that it requires partnerships (Gould *et al.*, 2006; MobileInfo.com, 2006; Alcatel, 2003). Mobile commerce is built on strategic business partnerships – one player cannot do everything (MobileInfo.com, 2006). Therefore industry dynamics are predicted to become more complex as business models for m-commerce evolve. Figure 4.3 shows the various types of services available, as well as the sector to which they respond, customer or business (MobileInfo.com, 2006).

Figure 4.3: M-Commerce Players

	Goods	Services	Information
Business to Consumer	<div style="border: 1px solid black; padding: 10px; text-align: center;"> Shopping Vending Trading </div>	<div style="border: 1px solid black; padding: 10px; text-align: center;"> Gaming & Gambling </div> <div style="border: 1px solid black; padding: 10px; text-align: center; margin-top: 10px;"> Ticketing </div>	<div style="border: 1px solid black; padding: 10px; text-align: center;"> Paid-for Information Advertising </div>
Business to Business	<div style="border: 1px solid black; padding: 10px; text-align: center;"> Procurement Trading </div>	<div style="border: 1px solid black; padding: 10px; text-align: center;"> E-cash Banking Discounts & loyalty schemes </div>	

Source: Wikipedia, 2007a. Mobile Commerce. [Online] Available from: <http://en.wikipedia.org/wiki/M-commerce> [Accessed: 2007-08-14].

From Figure 4.3 it can be seen that mobile ticketing, along with the dissemination of information, spans both the Business-to-Consumer and the Business-to-Business services sectors, an indication of the flexibility of the medium as well as the opportunities achievable through the use of mobile technology. Communications to mobile phones could be done in a variety of ways:

- Text messaging (SMS);
- Text messaging with WAP push;
- Picture messaging; and
- Device RFID (Wikipedia, 2008, Wikipedia, 2007b).

However, very few phones outside Japan have RFID tags so this method of delivery is largely unsupported. Picture messaging is supported by almost all phones and is generally the

delivery method of choice (Wikipedia, 2008), but requires the sender to know the recipient's phone model in advance so that the picture is rendered at the correct resolution. WAP push allows for a multimedia ticket to be linked to the text message, yet once again the issue of knowing the recipient's phone model does come into play. Text only messaging is supported by all mobile phones and is the simplest method of delivery (Wikipedia, 2008). There is no need to send differently formatted messages to different phones and it is simple to deliver text-based messages to all phones (SITA, 2008a; Wikipedia, 2008; Wikipedia, 2007b).

Mobile Internet service adoption and SMS-based marketing are two service types that are considered "mainstream" in m-commerce research (Okazaki, 2006; May, 2002). According to the Société Internationale de Télécommunications Aéronautiques (SITA, 2008a), not all types of services have grown equally in popularity, for numerous reasons including consumer uncertainty, product affordability, user knowledge and so forth. Mobile-based services, such as SMS, could become important to airlines in communicating the occurrence of flight delays to business travellers (SITA, 2008a). SITA are considered specialists in air transport communications and IT solutions by delivering and managing business solutions for airlines, airports, GDS, government and other customers worldwide to form the communications backbone of the global air transport industry (SITA, 2009).

While there is inevitably a certain amount of hype about any new technology, there are clear signs that mobile technology has something to offer the air transport industry. Surveys consistently reveal that 90% or more of airline passengers carry a mobile device with them when they travel, indicating that there are few people who now transit an airport without being connected (SITA, 2008a). Mobile devices have become vital to the successful social networking of a person (Steinbock, 2005). According to SITA (2008a) this is not surprising, as by the end of 2007 mobile penetration had surpassed 100% in over 59 countries, with some 3.3 billion mobile subscribers in 224 markets worldwide. At current rates of growth there would be 5 billion cellular subscribers worldwide by the year 2011.

By 2011, most mobile phones will combine the functionality of communication devices with that of computers, TVs, personal navigation systems and other sophisticated software for browsing and searching the Internet. This is a continuation of a trend that has seen communications move beyond voice towards data-oriented "conversations", whether via

SMS, email, instant messaging, or the Web. For travellers these mobile devices will also carry frequent-flyer profiles, itineraries and e-ticket information, boarding passes and biometrics (SITA, 2008a).

There is increasing interest from airports and airlines in tapping into this trend. Airports want to maximise revenues, as well as to keep airport visitors happy, and mobile services can provide an opportunity to do both. With strong competition in air travel markets, many airlines have also sought to reduce costs in establishing direct contact with their customers (Yoon *et al.*, 2006). Airlines are also expected to leverage mobile devices to deliver passenger service benefits in situations where this can be achieved at little added cost (SITA, 2008a). According to SITA's 2008 Airline IT trends survey (2008b), check-in via mobile phone was expected to become a real alternative by 2009, with approximately 6% of passengers using this option to check in. However, the main drivers for large-scale investment in mobile technology are likely to be access to new revenue streams or incremental improvements in operational efficiencies, such as reductions in passenger processing costs or flight delays. IT's top investment drivers lie in reducing costs and improving customer service (SITA, 2008a; SITA, 2008b). The airline process areas that are most likely to see these improvements are: passenger processing and services (63%), aircraft management/operations (44%) and passenger security (43%).

The SMS has become a low-cost easy alternative to telephoning customers. As the use of the SMS limits the amount of personal interaction required, airlines would be able to limit the number of employees used for the specific task. In fact, mobile technology has now been incorporated with IT technology, allowing companies to send the same message to a large number of customers (Steinbock, 2005). Many companies already use the SMS as a marketing channel to advertise events and special deals, or even to inform customers of service disruptions. Airlines are busy considering additional "value-added" services for mobile phones such as passenger notification services (SITA, 2008b). As airlines already have all passenger contact details, an airline could script a single message, using only one employee, and send essential flight information to all passengers of a delayed flight, including valuable information such as the estimated length of the delay or possibly the new time of departure.

In 2006, delays were responsible for some US\$7.7 billion in direct operating costs to US-based airlines. If even a small percentage could be avoided by getting passengers to the departure gate on time, this would have an immediate effect on the bottom line and improve customer satisfaction (SITA, 2008a). For time-pressed business travellers, the timely communication of delays could also mean less time wasted in airports (SITA, 2008a), thereby helping to alleviate passenger frustration levels as well as to reduce congestion at airports (Steinbock, 2005). The timely communication of flight delays through text-based notifications such as SMS could become a necessity (SITA, 2008a; Steinbock, 2005).

4.4.2 Communicating Service Disruptions through Mobile Technology

Lack of information has always been a major source of frustration for passengers, particularly at times of disruption. In the 2007 SITA Passenger Self-Service Survey, “staying informed” came third on a wish-list of travel elements passengers most wanted to change about the travel experience, with 79% of passengers wanting to receive an SMS notification service. According to SITA (2008a), one of the most likely manners in which mobile devices will impact on the air travel experience is through keeping passengers informed.

The survey indicated that passengers were highly concerned about delays (SITA, 2008a). Yet, particularly in times of disruption, it had been difficult to get accurate information to passengers quickly. With almost all travellers now carrying a mobile device, airlines and airports are able to deliver effective communications to passengers, and in this way, to provide a valued customer service benefit (SITA, 2008a). Rapid dissemination of information via mobile devices could reduce frustration and also give passengers a degree of personal control over the recovery process though using self-service technologies (SITA, 2008a; SITA, 2008b). It was expected that by the end of 2009 over 90% of the world’s airlines would offer SMS notification as an optional service to their passengers.

Additionally, mobile technologies could help airlines to manage passenger flow better (SITA, 2008a). Should a plane depart earlier than scheduled, timely communication via mobile devices could inform passengers and reduce delays caused by waiting for late boarding passengers. Currently, barely discernible public address announcements for late passengers are a common feature of the airport experience. Direct communication through mobile

devices will allow airlines to guide passengers quickly to the aircraft. With the consent of users, airports and airlines could use location-sensing applications that will make it possible to determine the physical location of any mobile device within the airport environment, and send a message directly to the person with directions to the boarding gate (SITA, 2008a; Gould *et al.*, 2006). A study conducted at Cambridge University's Auto-ID Lab suggested that location-based technology could reduce "passenger to gate" flight delays by as much as 6%, saving airlines at least US\$600 million a year (SITA, 2008). However, Gould *et al.* (2006) point out that this aspect has significant implications for personal privacy and security, and will require user "buy-in".

Mobile self-service applications will offer passengers greater control throughout their journey (SITA, 2008a). Additionally, mobile technologies will provide a channel for one-to-one marketing (SITA, 2008a; Gould *et al.*, 2006; MobileInfo.com, 2006). Marketers will be able to send targeted content to passengers' mobile devices (SITA, 2008a). According to SITA (2008a), a trial at Manchester Airport in the UK saw recipients of vouchers sent to their mobile phones spend 45% more than ordinary shoppers at retail outlets.

Currently the range of information transmitted is limited, consisting mainly of routine flight status notifications, but mobile technology will increasingly allow richer information to be delivered to passengers wherever they are (SITA, 2008a). This will include both "nice to know" information such as flight status and frequent flyer mileage, but also more important information that will keep passengers informed of any disruptions to their journey, including:

- Flight delays – possibly saving an unnecessary journey to the airport;
- Changes to a departure gate;
- Failure of baggage to be loaded or transferred – saving unnecessary waiting at the destination carousel and allowing instant initiation of the reclaim process.

Once informed about a particular event, passengers could then follow the status of the recovery process or use self-service technologies to take some control of the situation, through services such as interactive baggage tracking, or onward check-in (SITA, 2008a). Preliminary results from trials taking place at a number of airports around the world, including Geneva, Manchester and several airports in the Asia-Pacific region, indicate that mobile-

based services are effective in helping reduce delays for airlines by improving the flow through the airport, as well as being popular with passengers (SITA, 2008a).

In realising the possible benefits of m-commerce, the travel industry is working on technologies that would allow for the sale of travel arrangements and personalised passenger updates on flight status, as well as offering to make new arrangements based on preset user preferences requiring no further input from the user (SITA, 2008a; Wikipedia, 2007b; Gould *et al.*, 2006). With the continuous growth in passenger numbers, the use of mobile technology to limit delays through better passenger flow management, as well as the better management of passenger expectations following the occurrence of delays, could become a crucial success factor for airports and airlines (SITA, 2008a). From the passengers' point of view, keeping them informed could allow for a much greater degree of mobility, a benefit greatly desired by business travellers (Gould *et al.*, 2006).

4.4.3 The Future Use of Mobile Technology in the Airline Industry

Over the next five years, delivering mobile-based services and applications to travellers will create new opportunities and benefits for stakeholders in the passenger's journey, including:

- Cost savings
- Operational efficiencies
- Personalised relationships with customers
- Higher customer service and satisfaction levels, and
- Additional revenue opportunities (SITA, 2008a).

However, to bridge the gap between now and then requires new challenges to be recognised and addressed (SITA, 2008a; Gould *et al.*, 2006; Okazaki, 2006; MobileInfo.com, 2006). The delivery of mobile-based services to passengers will require a strategy rethink for airlines as well as for airport information and communications technology (ICT) and infrastructure (SITA, 2008a). Not only can SMS text messages be unreliable, but network limitations can affect reliability (Gould *et al.*, 2006; Okazaki, 2006). The challenge will be to create a platform that can integrate data located in dispersed systems, some local, others remote, and then deliver

it in a reliable, secure and efficient manner to provide “real-time” information and context-aware services (SITA, 2008a; Gould *et al.*, 2006).

The task is made harder by the heterogeneous nature of the mobile world, with a diverse set of mobile devices running a variety of software and operating over a fragmented network infrastructure (Gould *et al.*, 2006; Okazaki, 2006; Alcatel, 2003). Airlines in particular need to assess their overall mobile infrastructure requirements at airports, including the needs of their workforce and travellers (SITA, 2008a).

As stated in Section 4.4.1, one major problem in m-commerce is the lack of standards in terms, concepts and theories (Okazaki, 2006; MobileInfo.com, 2006). If mobile technology is to be used throughout the air transport industry, then a key requirement is cross-industry collaboration with the IT community to develop standardised processes and applications to allow interoperability (SITA, 2008a).

Theft and loss will be ever more disruptive as passengers become increasingly dependent on their mobile devices. According to the Institute for Security Studies, in 2004 nearly 600 000 mobile phones were stolen in South Africa, making it South Africa’s most reported crime (Business Day, 2006). Additionally, estimates indicate that up to half a million mobile phones are left in airports worldwide every year, with a quarter of these having no security on them (SITA, 2008a). According to mobile security company Pointsec, at London’s Heathrow Airport around 3 500 phones and up to 1 800 laptops are left in the airport annually. Airlines and airports will need to ensure that there are back-up scenarios available to communicate with the passengers concerned.

Finally, passenger acceptance will be the ultimate criterion of success for mobile-based services, making the need to address passenger requirements the driving force for mobile innovation (SITA, 2008a; MobileInfo.com, 2006; Cellular, 2004; Alcatel, 2003). Some of the benefits provided by m-commerce, such as location-based services, could raise some privacy and security issues and will require passenger “buy-in” (Okazaki, 2006). In particular, if widespread adoption is to occur, airlines and airports will need to persuade passengers that the benefits of the services would far outweigh any perceived or actual loss of privacy (SITA, 2008).

4.5 CONCLUSION

In Chapter 4 it has been noted that in some instances travel costs can account for a company's second largest expenditure. Many South African corporations are therefore looking at various ways of decreasing travel costs, ranging from decreasing the amount of travel to operating the travel management programme more effectively. Knowing the costs resulting from flight delays could be vital during the negotiation of mutually beneficial agreements with airlines. However, flight delays do not only influence business travellers in terms of cost. Time spent waiting at the airport could result in significant run-on implications due to missing scheduled meetings, which could lead to missed business opportunities, and also foster negative emotions.

Better management of passenger expectations through the timely communication of flight delays is therefore vital. Mobile technology could play an important role in the timely communication of flight delays, and even allow travellers to make alternative arrangements if necessary. Even considering some system limitations, with almost all travellers now carrying a mobile device, airlines and airports would be able to deliver effective communications to passengers, and in so doing provide a valued customer service benefit. In Chapter 5 the methodology used in the empirical research is discussed and an overview of the research design of the empirical study provided.

CHAPTER 5

METHODOLOGY

5.1 INTRODUCTION

The preceding chapters presented the context for the question of the influence of flight delays on business travellers by discussing three main aspects. First, the air transport system and the organisations in the system, as well as the environment in which they operate, were discussed, particularly in relation to flight delays. Flight delays as such were discussed, beginning with an overview of what constitutes a flight delay, the reasons for flight delays, the issue of accountability and finally some possible solutions to flight delays. Secondly, a discussion on the business travel market and business and corporate travellers was provided. Specific mention was made of agreements concluded between corporations and airlines, highlighting the situation that flight delays are currently not taken into account in any service level agreements. Finally, an overview was given of the potential use of mobile technology in the airline industry, and particularly of text messages as a medium for communicating flight delays. The discussion provided a theoretical framework for measuring the influence of flight delays on business travellers.

This and the next two chapters describe the empirical work done. There are many considerations to be taken into account when measuring the impact of flight delays on travellers. Flight delays to business travellers in particular can result in both direct and indirect costs to the company. Direct costs of substantial delays could include expenses in regard to alternative flights, transport, accommodation or meals, while indirect costs could result from missed business opportunities. Only direct costs in terms of man-hours lost were measured and historical flight data supplied by Philips and ATNS were used to identify the occurrence and extent of any flight delays. No respondent surveys or interviews were used to identify any run-on implications or indirect costs.

It is important to note that there are certain limits to the research conducted. The results of the study are limited to travel undertaken by corporate travellers from Philips South Africa (Pty) Ltd over the six months from January to June 2008. These results may differ from

those for other companies over different periods. Furthermore, as ATNS was the partner used to supply the flight data, only flights with a South African arrival or departure leg were analysed. Finally, even though the monetary value of time provided by Philips was in accordance with previous research, the cost of flight delays experienced is applicable only to Philips South Africa (Pty) Ltd. The limitations inherent in this study are fully discussed in Section 5.5. However, regardless of these limits and limitations, the study nevertheless provides a valuable foundation for future research.

As discussed in Chapter 1, in the analysis of the effect of flight delays on the Philips corporate travellers, the following research objectives were identified:

- To describe the concept of flight delays and the factors potentially contributing to their occurrence;
- To determine if a substantial percentage of business travellers are affected by flight delays;
- To assess man-hours lost due to the flight delays experienced by travellers of an organisation over a specified period;
- To quantitatively measure the direct cost in terms of man-hours lost as a result of flight delays in regard to corporate travellers of an organisation;
- To identify any patterns in the occurrence of flight delays as experienced by business travellers of a specific organisation in terms of routes flown, seasonality (particular month travelled), departure days (weekdays vs weekends) and arrival times (workdays vs night flights).

This chapter will include a comprehensive discussion on the methodology and research design used in the empirical research. The following sections will also provide a discussion on the population and data used for statistical analysis to address the objectives and hypotheses identified. In conclusion, the limitations and ethical considerations inherent in the study are addressed.

5.2 METHODOLOGY

Bogdan and Taylor (1975) refer to the term methodology in a broad sense as the processes, principles and procedures by which we approach problems and seek answers. As in everything we do, our assumptions, interests and goals greatly influence our choice of methodological procedures.

This chapter provides an overview of the research design and techniques used in this study to assess the influence of flight delays on corporate travellers. Section 5.2 describes the overall approach used to test the main problem statement. Following the research design discussion of Section 5.3, Section 5.4 explains the data sampling and analysis techniques used. Section 5.5 addresses the limitations of the study and the subsequent findings. Section 5.6 provides an overview of the ethical procedures relevant to the study, and Section 5.7 concludes with a brief summary.

5.3 RESEARCH DESIGN

The purposes of research include exploration, description and explanation (Cooper & Schindler, 2003). Exploration is an attempt to develop an initial, rough understanding of some phenomenon. Exploratory studies are useful in generating new research questions and problems. Description is the precise measurement and reporting of the characteristics of some phenomenon associated with a subject population under study. Explanatory study goes beyond description and attempts to explain the reasons for the phenomenon (Cooper & Schindler, 2003). This study used historical data from two main sources (ATNS and Philips) to make comparisons between the two sets of data in terms of the frequency and impact of flight delays, and to find certain associations as set out in the hypotheses in Chapter 1. Thus the study can be described as a descriptive study. The descriptive design allows for the description of certain phenomena and the estimation of certain proportions, and provides indications of relationships among the different variables (Cooper & Schindler, 2003). Descriptive research is fact-finding in nature, as it describes, analyses and interprets prevailing situations. From the findings, a descriptive study could also suggest remedial measures or alternative courses of action for the future (Sridhar, 2004).

Research involves both quantitative and qualitative research. Quantitative research seeks to find how variables are related, whereas qualitative research seeks in-depth information. Quantitative research is largely empirical or experimental and, as its name suggests, is based on the measurement of quantity or amount. The simplest descriptive study concerns a univariate question or hypothesis in which we ask, or state something about, the size, form, distribution or existence of a variable. This is a descriptive study, and as such, it has used quantitative research methods. Only the corporate travellers of Philips South Africa were included in this study, so while a quantitative methodology is used to analyse the data, Philips can be viewed as a corporate case study in determining the effect of flight delays on their travellers. Thus the results of this study cannot be generalised to all business and corporate travellers, other organisations, regions or periods of time. However, the study provides a basis for replication in other environments and periods.

5.4 POPULATION AND DATA

The population for this study was drawn from a list of corporate travellers provided by Philips South Africa (Pty) Ltd. Philips in South Africa is represented by the main operating sectors Consumer Lifestyle, Lighting and Healthcare (Philips, 2008). Currently, Philips South Africa employs approximately 250 people, with regional offices in Durban, Bloemfontein and Cape Town and its head office in Martindale, Johannesburg West. Philips has a broad local and international client base and consequently undertakes a substantial amount of business travel, which makes the corporation and its corporate travellers an appropriate sample for this study. For the purpose of the study Philips supplied company travel data for the period January 2008 to June 2008, as captured by their contracted travel management company Carlson Wagonlit Travel. The Philips travel data contained a total of 749 travel entries. Once all the entries were split into their individual flight legs, a total of 1 313 arrival flights were identified, each with its individual departure and arrival points. The Philips data provided a number of data fields that could be used for analysis, which are shown in Table 5.1.

Table 5.1: Data Labels provided by Philips

REF	TITLE	DESCRIPTION
A	Account Name	Company
B	LocInt	Local / International flight
C	Passenger	Name of Passenger
D	Travel Date	Date of departure
E	Routing	Airport/City legs flown in trip
F	Airline	Airline flown
G	Carriers	Flight code
H	Flight Dates	Date of flights
I	Flight Times	Times of flight legs

Source: Philips Air Data Jan – June 2008. 2008. Philips Medical (Pty) Ltd.

For comparative purposes (to match scheduled and actual flight times) and to analyse the extent of flight delays experienced by Philips travellers over the six-month period, South African flight data for the same period (January to June 2008) were provided by the Air Traffic and Navigation Services Company of South Africa (ATNS). As explained in Section 2.4.2, ATNS is the sole provider of air traffic, navigation, training and associated services within South Africa. ATNS provides vitally important aeronautical information used for all flight planning purposes, and currently manages about 650 000 aircraft arrivals and departures a year (ATNS, 2008a; ATNS, 2008c). From the ATNS data, the fields identified in Table 5.2 were used for statistical purposes.

Table 5.2: Data Labels provided by ATNS

REF	TITLE	DESCRIPTION
A	Tower	ICAO Airline Description
B	Tower_Log_Date	Flight Date (Arr / Dept – see Column C)
C	Tower_Log_Type	Arrival or Departure Flight Leg
D	Agency	Airline Code
E	Flight_Number	Flight number
F	Departure_Airport	Airport of Departure
G	Arrival_Airport	Airport of Arrival
H	ATA	Actual Time of Arrival

Source: Ratcliff, S. 2008. ATNS Air Data Jan – June 2008. 2008. ATNS.

From the data provided, the study aimed to identify any trends or patterns in flight delays in terms of seasonality, departure days (weekends vs weekdays), departure and arrival times

(workdays vs night flights) or even whether some airlines indicated a higher frequency of flight delays.

5.4.1 Editing the Data

Before statistical analysis could begin, editing of the data was done to detect any errors or omissions, which were then corrected wherever possible or removed, to ensure that minimum data quality standards had been achieved. To accurately identify the flight delays, the sets of data from both Philips and ATNS needed to be matched to each other. From the original 749 travel entries provided by Philips, 1 313 arrival flight legs were successfully identified. Of these, 518 flights were discarded for various reasons, including duplication, refunded flights and spelling mistakes. In the end, 752 Philips flights were successfully matched to ATNS flight records. The size of the sample was deemed sufficient for purposes of statistical analysis, since it related only to travel patterns of corporate travellers of a specific company and was of sufficient size to enable certain relationships to be tested.

However, prior to matching the flight data, apart from some minor data errors such as misspelling of some travellers' names, two main issues were identified that made it difficult to accurately match the two sets of data:

- Firstly, the two sets of data were captured according to two different coding systems, namely those of IATA and ICAO.
- Secondly, the two sets of data were captured using two different time zones.

As regards the first problem, the two sets of data were scripted according to two different coding systems: the Philips travel data used IATA codes, while ATNS followed the ICAO coding system. As the general public was more familiar with IATA codes, the decision was made to first replace all relevant ATNS ICAO codes with the corresponding IATA codes before statistical analysis could begin. This would not only allow a broader base of understanding, but also enable accurate comparisons between the two sets of data.

Secondly, it was identified that the two sets of data had been captured according to different time zones. All IATA data were captured according to the Zulu time zone, while the Philips

data were captured according to standard South African time. This meant that all ATNS data were captured as being two hours earlier than the published scheduled times. An IT programme was scripted in conjunction with an IT Software specialist, Mr R. A. du Preez. In this programme two hours were added to all ATNS data times, thereby placing both data sets in the same time zone and allowing for accurate matching of the Philips flights. Additionally, as statistical analysis would include the identification of any trends in flight delays according to the time of day, this would allow for a more representative description of the true travel conditions (based on time) in South Africa.

The programme allowed the Philips and ATNS data to be converted into similar formats in terms of flight dates, carriers, flight numbers and flight times, so as to accurately match all Philips flights with the necessary ATNS flight data. As the main purpose of the study was to identify the occurrence and extent of flight delays impacting on corporate travellers, only the arrival leg of each flight trip was captured. For example, if a traveller flew from JNB (Johannesburg)/CPT (Cape Town / JNB, the trip consisted of two separate flights: 1) JNB – CPT and 2) CPT – JNB. However, each flight leg included both a departure and an arrival slot, for example: 1A) JNB – CPT (Dep), and 1B) JNB – CPT (Arr). Only the arrival leg was captured in the identification of the extent of a flight delay.

Furthermore, the extent of a flight delay needed to be defined for this study. According to the US Department of Transportation a flight is defined as being on time if it has arrived at, or departed from, the “gate or passenger loading area” less than 15 minutes after its scheduled arrival or departure time (Bauer, 2000). In terms of this definition, an aircraft could feasibly land at an airport within 15 minutes of its scheduled arrival and be reported as late if it did not reach the gate in time. An aircraft could also wait an hour or more on the runway for clearance from the tower to take off; and in this situation could be reported as departing on time if it had left the gate within 15 minutes of its scheduled departure. If a flight does depart later than its scheduled departure time, but still arrives at the designated airport within 15 minutes of its scheduled arrival time, it would not be regarded as a delayed flight. Janic (2005) noted that currently congestion causing delays of up to 15 minutes is not deemed relevant. In a survey conducted by Suzuki (2004) respondents were asked to identify previous service failure experiences. However, Suzuki did not specify a specific delay timeframe, but relied on a survey of passengers’ past experiences.

Even though departure times are relevant to the discussion in that they could possibly provide valuable input to indicate why a flight arrived late, ultimately the focus of this study is to identify the occurrence and extent of flight delays based upon arrival times, not departure times. Therefore, for the purposes of this study, if a flight was identified as having arrived 15 minutes or more after its scheduled arrival time, this was recorded as a substantial delay. If a flight arrived less than 15 minutes later than its scheduled arrival time, it was recorded as a minor delay. Conversely, if a flight arrived before its scheduled arrival time, it was recorded as having arrived early. The arrival times will also be used to identify any patterns in flight delays as related to the airline flown, the month, the day of the week or the time of day flown.

ATNS captures all flights as a separate arrival and a departure flight/leg, using a number of different arrival and departure codes. In the ATNS data, the *scheduled arrival time* is recorded as ATA (actual time of arrival). Following discussions with ATNS, it was recommended for this study to focus on matching the scheduled arrival time provided by Philips with the ATA supplied by ATNS.

The ATA was thus used to identify whether flights arrived later than scheduled, on time or even early. If the ATNS data showed an ATA different from the Philips scheduled arrival time, a delayed (or early) flight would be logged. Early arrival of a flight would not necessarily mean that a traveller had “made up” or “gained/won” time, as business travellers often schedule travels according to prior arrangements, so that an early arrival would most likely only result in the traveller waiting longer at the airport for the next leg of transport. Flights that arrived on time would also be logged, but this would indicate no time influence as they arrived as scheduled and originally planned.

5.4.2 Data Analysis

The final number of 752 arrival flights was analysed in conjunction with the Department of Statistics at the University of Pretoria, after which the results were interpreted to indicate any differences between the scheduled times captured by Philips and the actual times of arrival captured by ATNS.

The calculation of certain estimates was required to address the two main objectives of the study, as identified in the problem statement, namely:

- To determine the effect of flight delays experienced by business travellers from a time and cost perspective;
- To quantitatively measure the effect of flight delays on business travellers.

Table 5.3 shows the estimates required for assessing the number of flights affected by delays and cancellations and the subsequent time lost.

Table 5.3: Estimates Required to Assess the Number of Flights Affected by Delays and the Subsequent Time Lost

TOTAL FLIGHTS
% delays to total flights
Number of delayed flights to total flights
Total time lost (in hours)
PER AIRLINE
% delays to total flights per airline
Number of delays to total flights per airline
Time lost per airline
PER ROUTE
% delays to total flights per airline per route
Number of delays to total flights per airline per route
Time lost per airline per route
PER MONTH
% delays to total flights per month
Number of delayed flights to total flights per month
Time lost per month
PER DAY OF WEEK
% delays to total flights per day of the week
Number of delays to total flights per day of the week
Time lost per day of the week
PER TIME OF DAY
% delays to total flights per time of the day
Number of delays to total flights per time of the day
Time lost per time of the day
FREQUENT TRAVELLERS
Identify nr of individual travellers from total flights/travellers (e.g. out of 1000 flights, 200 indiv frequent travellers were identified)
% frequent travellers from total travellers (6 or more flights) : e.g. 20 % of travellers accounted for 80% of total flights
% delays affecting frequent travellers
SUBSTANTIAL DELAYS
% Substantial delays to total flights (flights late 15 min or more)
Total number of substantial delays (flights late 15 min or more)
Total time lost due to substantial delays (flights late 15 min or more)

Once the frequencies and percentages were obtained as per Table 5.3, the hypotheses (except H1 for which a simple frequency and percentage was required) were tested using chi-square significance tests. The chi-square test is probably the most widely used nonparametric test of significance (Cooper & Schindler, 2003). The chi-square goodness-of-fit test was designed to describe a single population of data and employed to test hypotheses (Keller & Warrack, 2000; Cooper & Schindler, 2003). Using this technique, we test for differences between the observed distribution of the data among categories and the expected distribution based on the null hypothesis. The results of the hypothesis tests will be fully discussed in Chapter 6.

- H1(alternate): Flight delays adversely affect more than 30% of frequent corporate travellers in terms of cost and time.
- H2(alternate): There is a relationship between the occurrence of flight delays and specific airlines.
- H3(alternate): There is a relationship between the occurrence of flight delays and specific routes.
- H4(alternate): There is a relationship between the occurrence of flight delays and the month of the year.
- H5(alternate): There is a relationship between the occurrence of flight delays and the day of the week.
- H6(alternate): There is a relationship between the occurrence of flight delays and the time of flight arrival.

Should the study identify certain patterns, the possible reasons for these trends will be discussed. To further assess the value of the time lost to business travellers, business travellers were grouped according to industry standard valuation and levels of seniority. The aim was to match the extent of flight delays to generally accepted hourly rate valuations relative to the salary grades of the Philips travellers, which could then be used to further quantify the value of the time lost to the company. Philips supplied an estimated value of time for each level of business traveller: senior, middle or lower level employee. This allowed the researcher to identify an estimated cost associated with each delay recorded, and ultimately to suggest the potential cost of the flight delays incurred by Philips.

5.5 LIMITATIONS OF THE STUDY

The most important limitation in this study is that it only looks at the estimated monetary value of time lost by travellers. The study does not take into account other costs such as additional accommodation, alternative transport or lost business opportunities. Nevertheless it represents a start in collecting credible evidence of what flight delays may cost companies employing business travellers. If all other effects were taken into account the actual cost (both direct and indirect) would most likely be higher.

It is also important at this point to note that the results from the statistical analysis will be limited to the travel patterns of corporate travellers for a specific company in South Africa, Philips SA (Pty) Ltd, over a period of six months from January to June 2008. Additionally, as ATNS was the partner in supplying flight data for those six months to enable the accurate matching of flights, only flights with a South African departure or arrival leg could be assessed. Flights with purely international legs (no South African departure or arrival point) are not captured by ATNS, and as such, could not be used for statistical analysis as no matching was possible. The study is therefore limited to assessing the extent of delays affecting flights departing from or arriving in South Africa.

The value of time attributed to travellers was a general estimate allocated to each level of employee (senior, middle or lower) by the Philips Financial Manager, Selvan Pillay. The method of assigning a general estimate of the value of time has been used in previous studies (Bauer, 2000). The ATA noted an average \$20 per hour cost as the value of a passenger's time, while the FAA estimated such time as being worth, on average, \$44 an hour (Bauer, 2000). More recently, the FAA recommended an estimated \$35.70 per hour as the average value of a passenger's time (ATA, 2008). However, Philips SA (Pty) Ltd provided estimates according to their own travellers' levels of seniority:

- Senior Level management – R1 111 per hour (R10 000 per day)
- Middle Level Management – R833 per hour (R7 500 per day)
- Lower Level Employees – R555 per hour (R5 000 per day)

Even though the time value attributed to the travellers is in accordance with previous studies (ATA, 2008; Bauer, 2000) the costs that are taken into account resulting from flight delays are limited to the costs to the company, Philips SA (Pty) Ltd. Despite these limitations, the study does provide a valuable foundation for future studies.

The results of this analysis cannot be generalised to flight delays in other geographic regions, other periods of time or different groups of corporate travellers. This study provides a starting point for determining the impact of flight delays specifically in regard to corporate travellers in a specific company. Thus replication of the study and an extension of the study to include other direct and indirect costs could be done, thereby providing motivation for future research that could involve multiple companies or longer periods of time. Despite its limitations, the study clearly does provide a valuable foundation for future studies.

5.6 ETHICAL CONSIDERATIONS

Prior to undertaking the study, ethical clearance was obtained from the University of Pretoria Ethical Committee to ensure that permission had been obtained from all parties involved, i.e. ATNS and Philips, to study and report on the records provided. Permission had been obtained to supply the findings to Philips, ATNS and the University of Pretoria, as well as to publish an article available to the general public. Further use of the data would require informed consent from all parties involved. Following review by the Ethical Committee, no issues were identified and ethical clearance was subsequently granted by the University of Pretoria.

5.7 CONCLUSION

This chapter provided a description of the research design and methodology followed in this study. A comprehensive description of how the sample data were obtained, prepared and finally analysed was presented. The various data fields used to analyse data from both Philips and ATNS in assessing the occurrence of flight delays were provided. Any patterns or trends in the occurrence of flight delays as related to airlines, routes, months, days of the week or times of the day that required analysis were identified. As shown in Table 5.3, in the

identification of any trends a number of estimates were used, including the total percentage of delayed flights out of total flights over the six-month period, as well as the percentage of delayed flights out of total flights per airline, per month, per day, and per time of the day. The chapter also discussed the fact that significance tests were required to accurately address the hypotheses. Finally, the ethical considerations addressed in undertaking this study were briefly explained.

CHAPTER 6

RESULTS

6.1 INTRODUCTION

In this chapter, the findings resulting from the statistical analysis of the final flight data are reported and discussed. The objective is to explain the data and to identify any trends or patterns in the occurrence of flight delays. The discussion will identify the extent of flight delays experienced by corporate travellers from Philips South Africa (Pty) Ltd, with particular focus on the frequent flyer group, and will ultimately assess the monetary cost of these flight delays as related to the traveller's value of time.

6.2 FREQUENCY ANALYSIS OF FLIGHT DELAYS AND TIME LOST

6.2.1 Early, On-time and Late Arrivals

In reporting the results, use is made of charts, graphics and tables to allow for an easier interpretation of the findings. In order to meet the objectives of the study, this section provides the frequencies and descriptive statistics as identified in Table 5.3, to show the estimates required for assessing the number of flights affected by delays and the subsequent time lost.

The flight data and statistical analysis included both early and on-time flights. For the purpose of providing a complete picture of flight arrivals over the period under review, these are briefly presented at the beginning of this discussion, but will not be discussed thereafter as they are not pertinent to the objectives of the study. On-time flights were recorded as having a zero time influence as they arrived as scheduled. It is also important to note that early flights do not indicate a so-called "win", or "gain" in time, as business and corporate travellers often make travel arrangements according to prior schedules. For example, a meeting scheduled to start at a specific time would in most circumstances not start earlier due to the early arrival of some attendees. Additionally, many travellers would simply spend the extra time waiting at the airport for the next leg of their transport, thereby receiving no benefit or gain from the early flight arrivals.

As in previous studies, minor flight delays of less than 15 minutes are not considered to have any significant influence on business travellers (BTS, 2008; Janic, 2005; Bauer, 2000; Bhat, 1995). The discussions surrounding the findings will therefore focus primarily on the occurrence of substantial flight delays (delays of 15 minutes or more) and the influence thereof on the Philips business travellers.

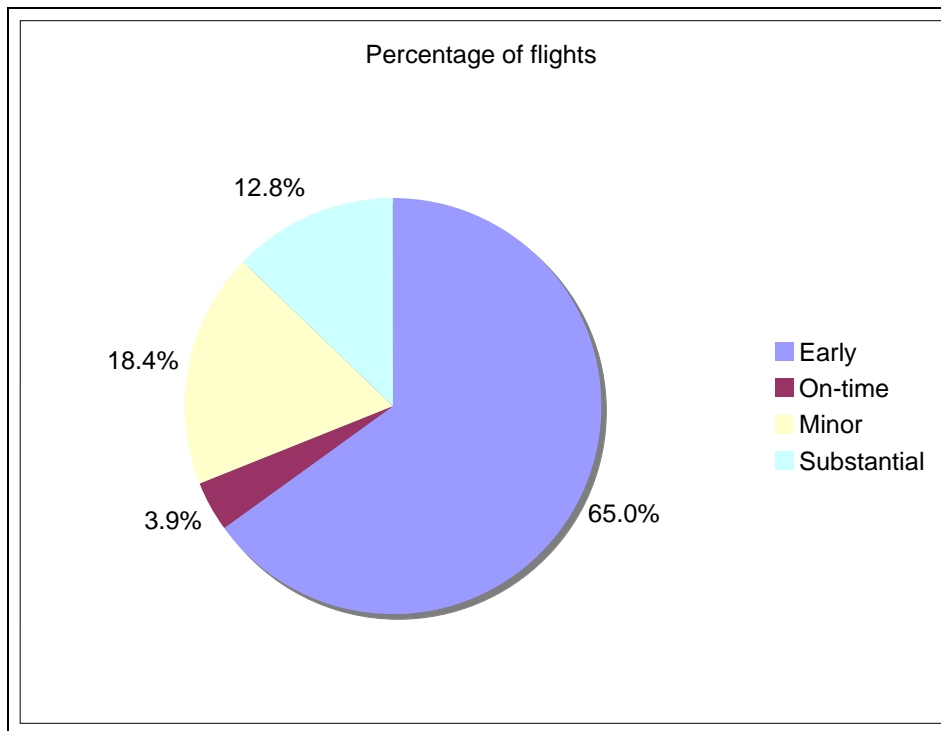
6.2.2 The Total Number of Flight Delays and Time Lost

From the edited and matched flight data, the study identified the total percentage of on-time, early and delayed flights. Delay statistics were analysed from the total 752 flights to demonstrate early, on-time and delayed flights in terms of the total time lost, the number of delayed flights and the percentage of delayed flights.

To better understand the range of substantial delays which could be considered to have an influence on corporate travellers, the various mean scores concerning the occurrence of substantial delays were calculated. The shortest substantial delay experienced was 15 minutes; any smaller than this would constitute a minor delay and have no real influence on business travellers. Conversely, the longest substantial delay experienced by the Philips travellers was 4.5 hours. Finally, from the total of 752 flights analysed, the average substantial delay experienced by Philips corporate travellers was 42.2 minutes in length.

Figure 6.1 shows the total percentages for each category of flights, including on-time flights, early flights, minor flight delays (delays of less than 15 minutes) and substantial delays (delays of 15 minutes or more).

Figure 6.1: Philips SA (Pty) Ltd Flight Delay Percentages Per Delay Category



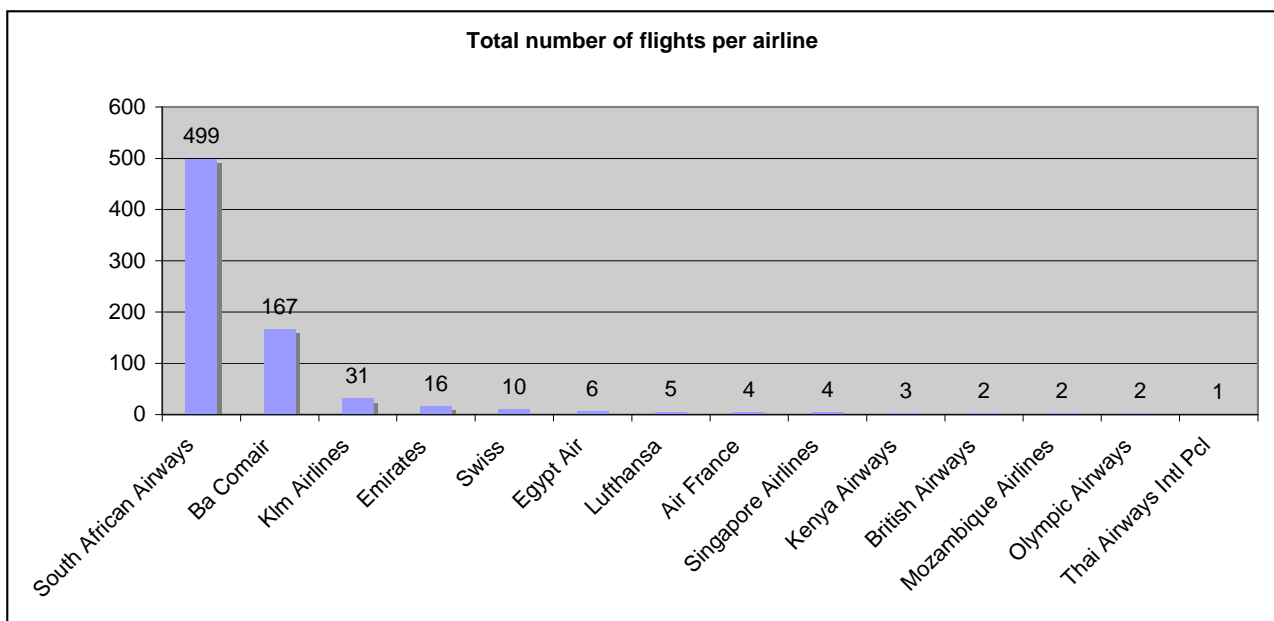
Of the 752 flights analysed, the majority of flights (65%) were identified as having arrived earlier than originally scheduled. Of the total delayed flights (31.2%), Figure 6.1 shows that 18.4% were identified as minor delays (delayed by less than 15 minutes), while 12.8% were identified as substantial delays (delayed by 15 minutes or more). Only 29 flights (3.9%) were identified as having arrived on time – most flights were either early or delayed.

When the actual length of time of the delays was calculated, minor delays totalled 819 minutes (13.7 hrs) from 138 flights, while substantial delays totalled 4 055 minutes (67.6 hrs) from 96 flights. Although the occurrence of minor delays was more common, the actual time lost resulting from substantial delays amounted to more than four times the total time lost due to minor delays. The total time of early arrivals was 97.15 hours, while the total time lost due to delayed flights equalled 81.3 hours. However, as noted, early flights do not indicate a “gain” in time to business travellers as no benefit can be derived from arriving earlier than scheduled. The ensuing discussion will focus on substantial delays, as these are the delays that affect business travellers.

6.2.3 Flight Delay Statistics per Airline

The results show that 12.8% of the 752 Philips flights analysed were substantially delayed. Of these delayed flights, some airlines were seen to contribute more to the total number of delayed flights than others. Figure 6.2 shows the total number of flights per airline flown by the Philips travellers, with SAA being flown 499 times, BA Comair 167 times and KLM Airlines a total of 31 flights.

Figure 6.2: Total Number of Flights per Airline



Following KLM Airlines, the frequency of travel reduced significantly with some airlines used only twice and Thai Airways only once. Figure 6.3 shows the number of substantial flight delays experienced by each airline and Figure 6.4 the percentages.

Figure 6.3: Number of Substantial Flight Delays per Airline

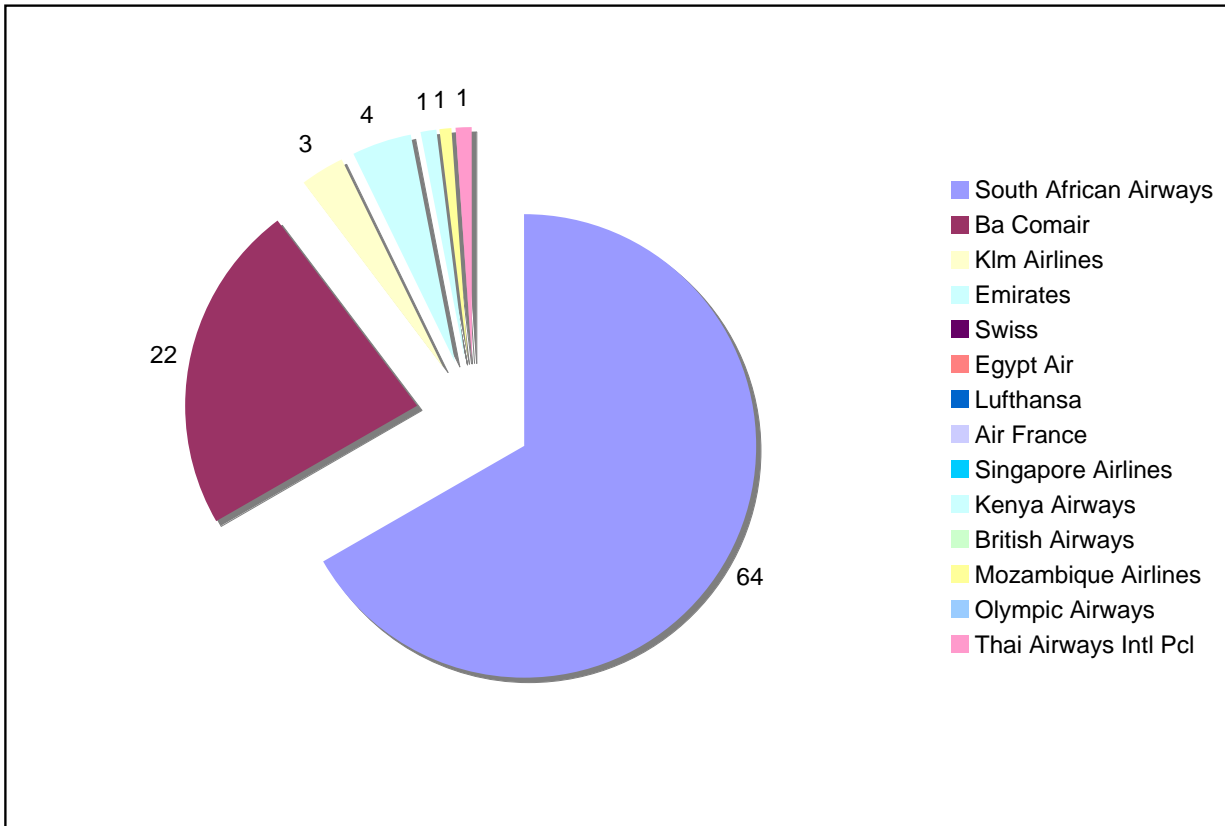
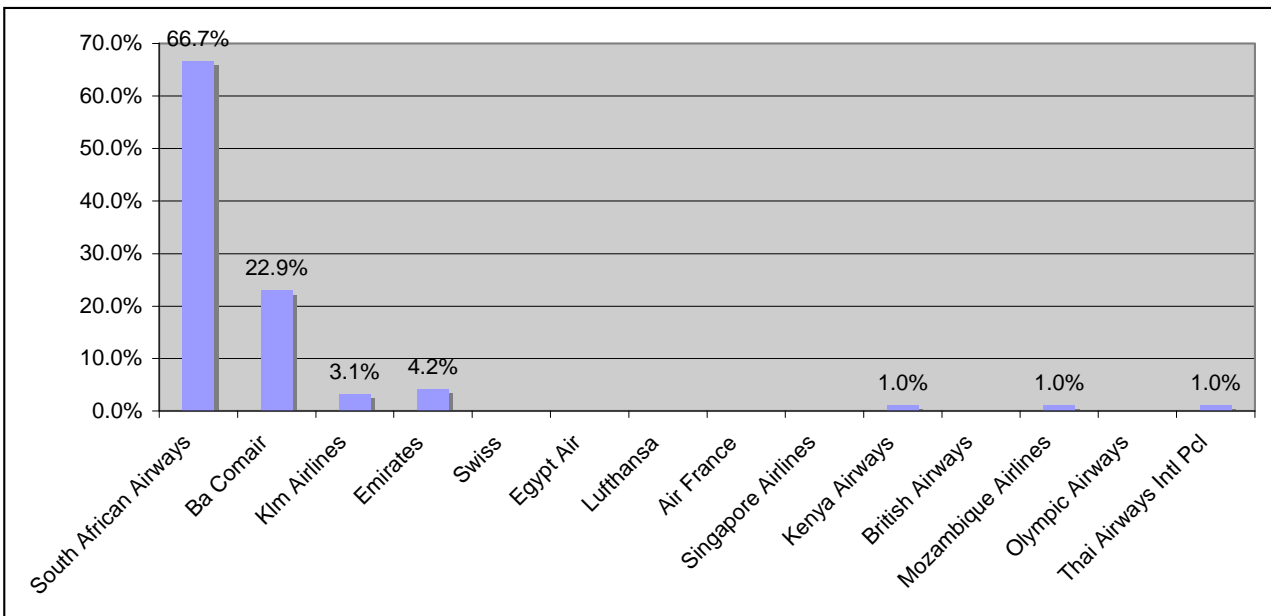


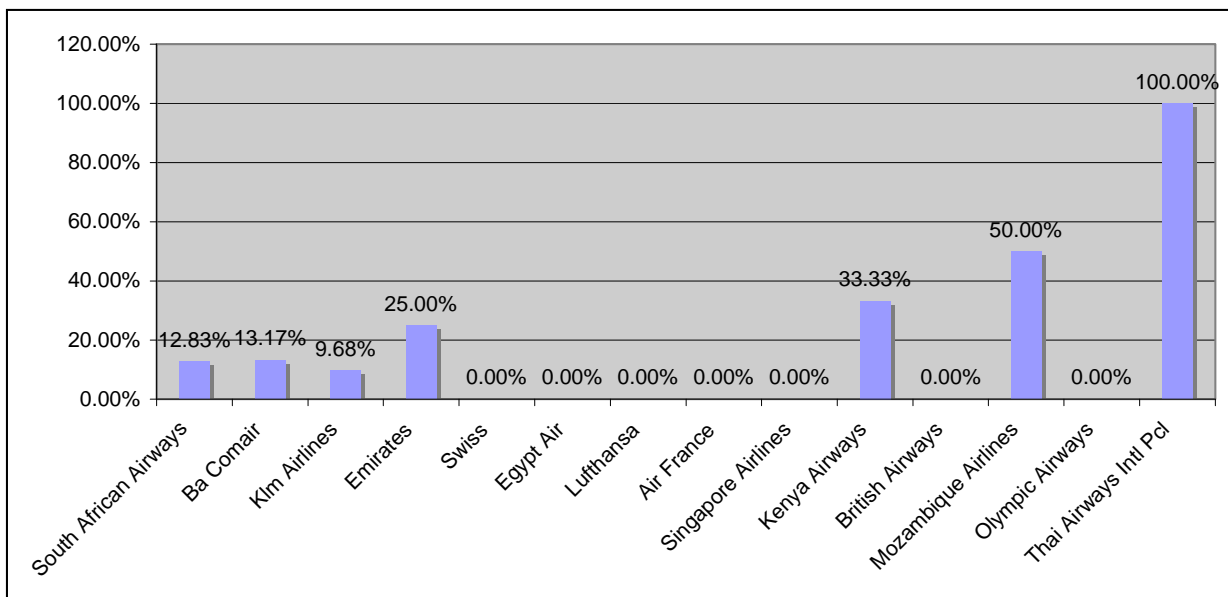
Figure 6.4: Percentage of Substantial Flight Delays per Airline



SAA and BA Comair showed both the greatest numbers and percentages of flight delays. SAA accounted for the largest percentage of substantially delayed flights (66.7%), while BA Comair experienced an average of 22.9% of all flight delays. Thereafter, the percentages of delays fell drastically, with KLM Airways at 3.1% and Emirates at 4.2% and some airlines experiencing no substantial flight delays at all, including Swissair, Egypt Air, Lufthansa, Air France, Singapore Airlines and Olympic Airlines.

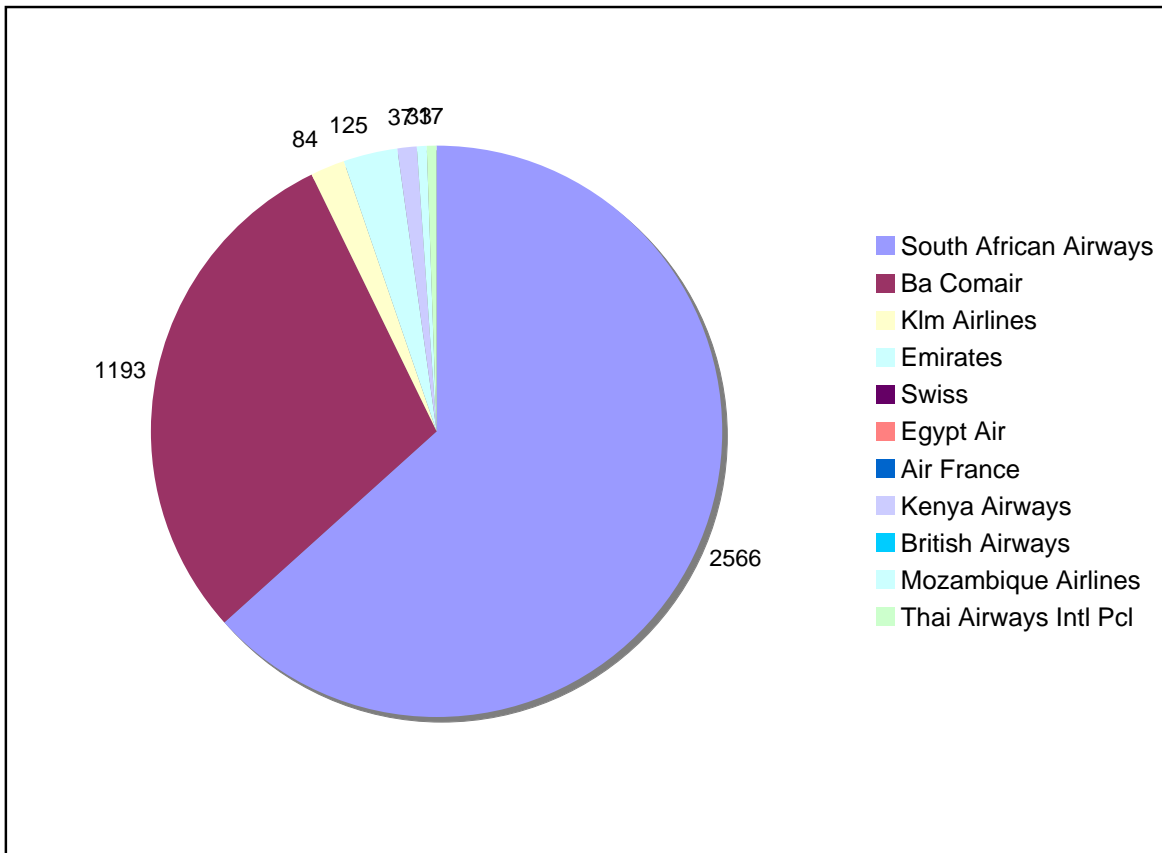
Figure 6.5 shows the percentage of substantial flight delays affecting each airline in relation to the total number of flights flown by that airline. These results merely reflect frequencies and do not necessarily show that one airline is significantly more prone to flight delays than another. This is tested in Section 6.5.2 to address Hypothesis 2 regarding whether or not some airlines show a greater tendency towards the occurrence of flight delays.

Figure 6.5: Percentage of Substantial Flight Delays in Relation to Total Flights Flown by Airline



Apart from assessing the number and percentage of flight delays experienced by each individual airline, the time lost from substantial delays was analysed. Figure 6.6 shows the time (in minutes) lost through substantial flight delays affecting each airline flown over the time period assessed.

Figure 6.6: Time Lost due to Substantial Flight Delays per Airline (Minutes)

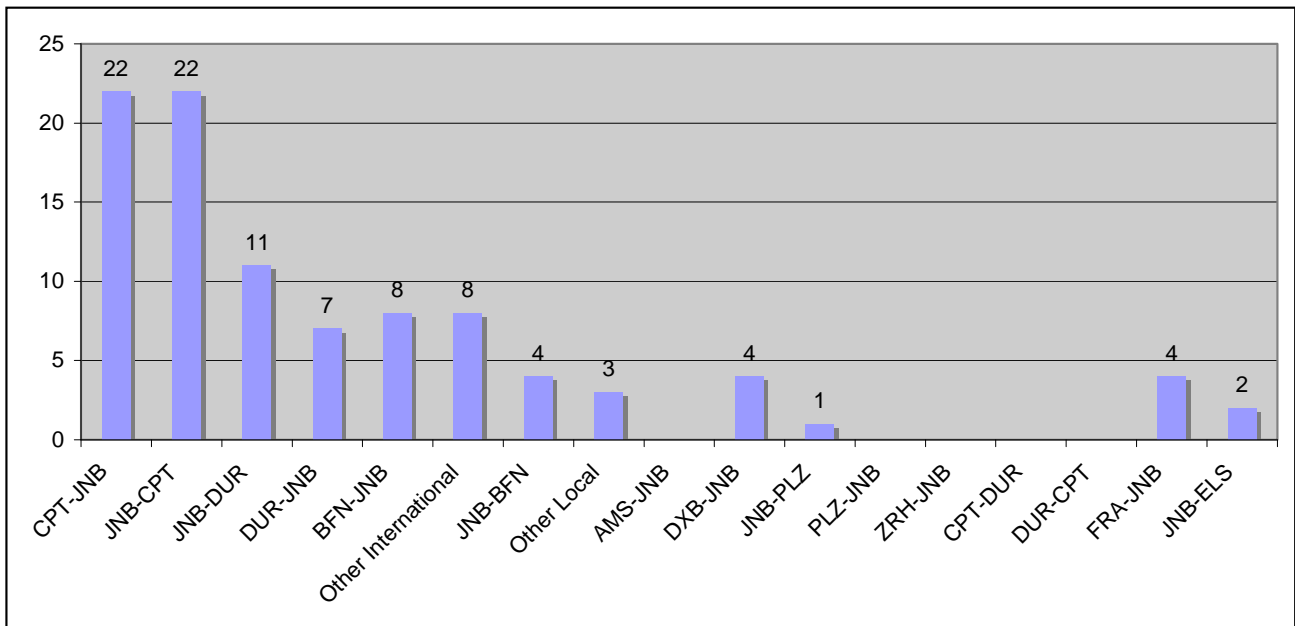


SAA experienced the greatest amount of time lost due to substantial flight delays, altogether 42.8 hours (2 566 minutes). In total, Philips business travellers experienced 67.58 hrs of lost time due to substantial delays. This study does not take into account any delays following the arrival of a flight, such as late baggage arrival, additional transport delays, et cetera. Such information could only be gained through surveying the Philips travellers. One reason why this was not undertaken relates to the time lapse since the travel was undertaken. The study analysed flights from January to June 2008, and accurate traveller recollections of post-flight experiences could not be guaranteed or tested.

6.2.4 Flight Delays per Route Flown

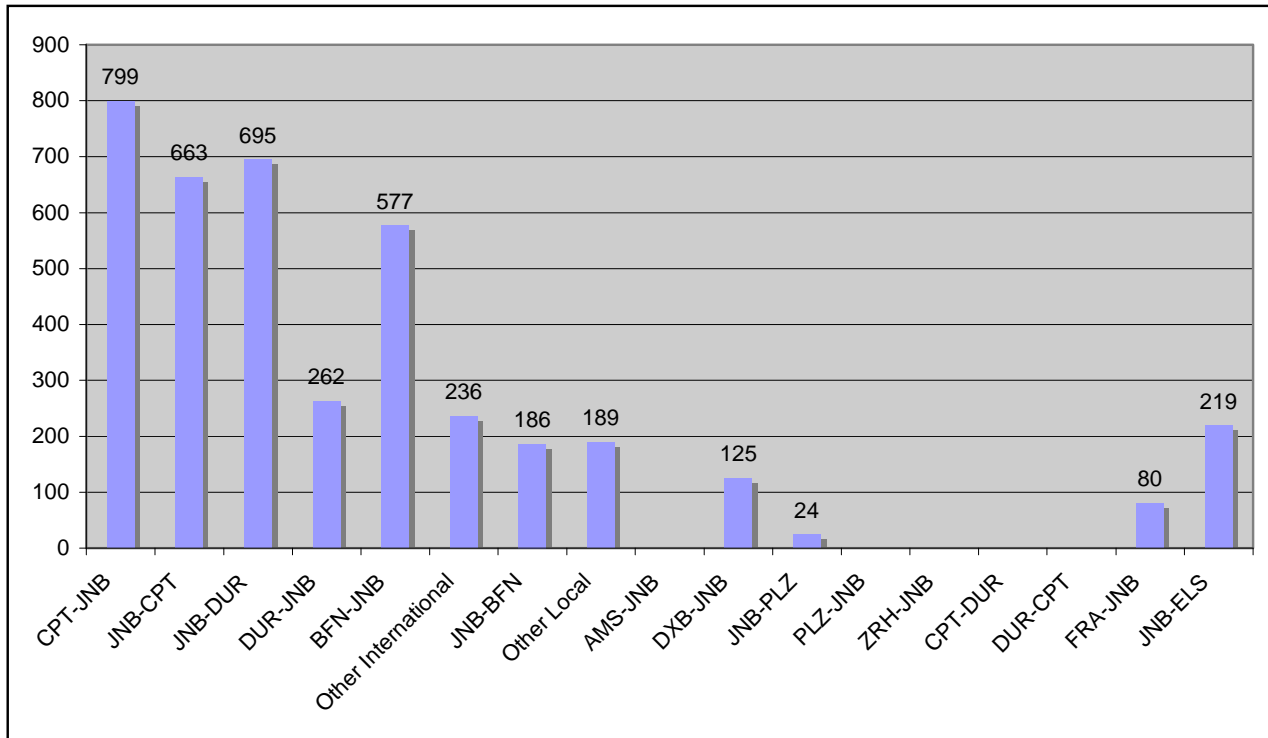
Apart from the airline flown, the research aimed to identify any possible patterns regarding flight delays and the route flown by the travellers. The numbers of substantial flight delays experienced across the routes flown by the Philips travellers are shown in Figure 6.7.

Figure 6.7: Number of Substantial Flight Delays per Route Flown



As expected, the most frequently flown routes had the highest occurrence of substantial delays, as shown in Figure 6.7. Regarding the local South African routes, the CPT–JNB and JNB–CPT routes experienced the majority of flight delays (with an average of 22% of all flight delays), followed by the JNB-DUR (11%) route. However, to accurately assess the influence of substantial flight delays on business travellers, the time lost per route was analysed and is shown in Figure 6.8.

Figure 6.8: Time Lost from Substantial Flight Delays per Route Flown



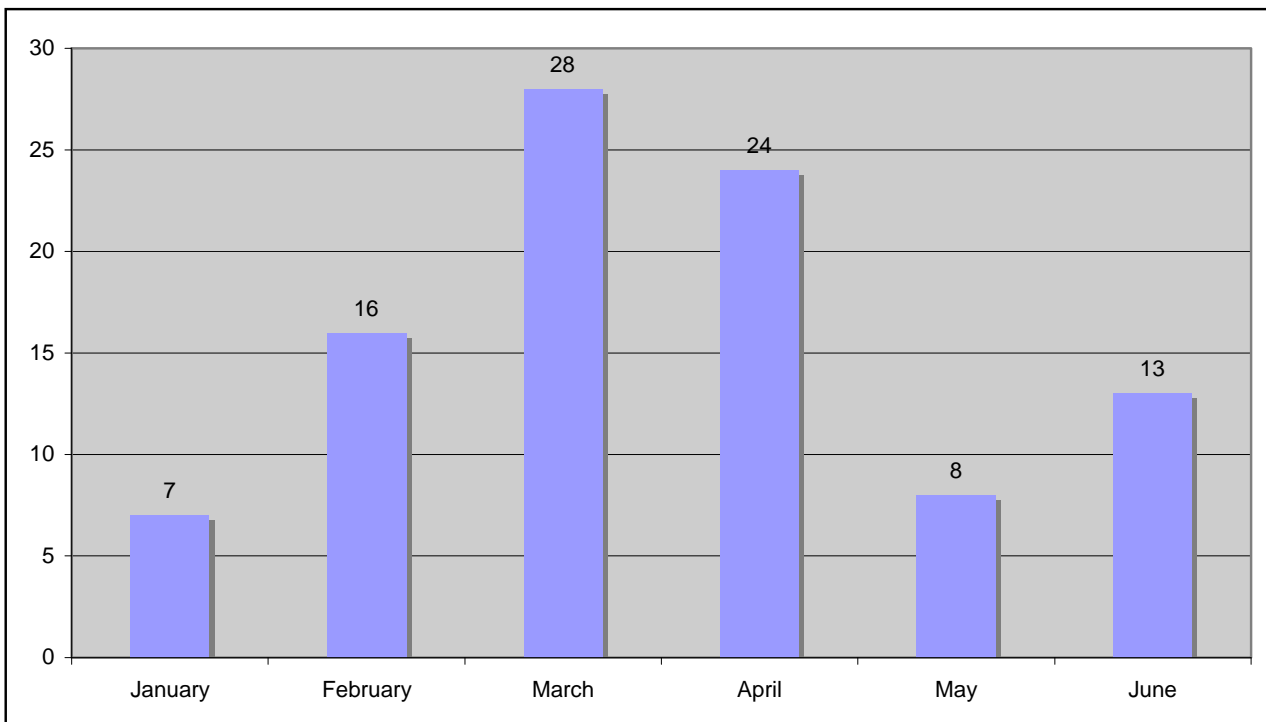
The three major local routes (CPT-JNB, JNB-CPT, JNT-DUR) experienced the greatest loss in time due to substantial delays over the six months period. Internationally, FRA-JNB (Frankfurt to Johannesburg) had the greatest number of substantial delays, as well as a greater time loss due to substantial delays. When the time loss of the three major local routes (CPT-JNB, JNB-CPT and JNB-DUR) was analysed, a loss of 35.95 hours due to substantial delays was indicated.

To gain a more representative perspective of flight delays across all the routes, the relative percentages of flight delays per route in terms of the total flights flown was analysed. This was done to assess whether any route showed a significant relationship concerning the occurrence of flight delays and the route flown – the results of which are further discussed under Section 6.5.3.

6.2.5 Flight Delays per Month of the Year

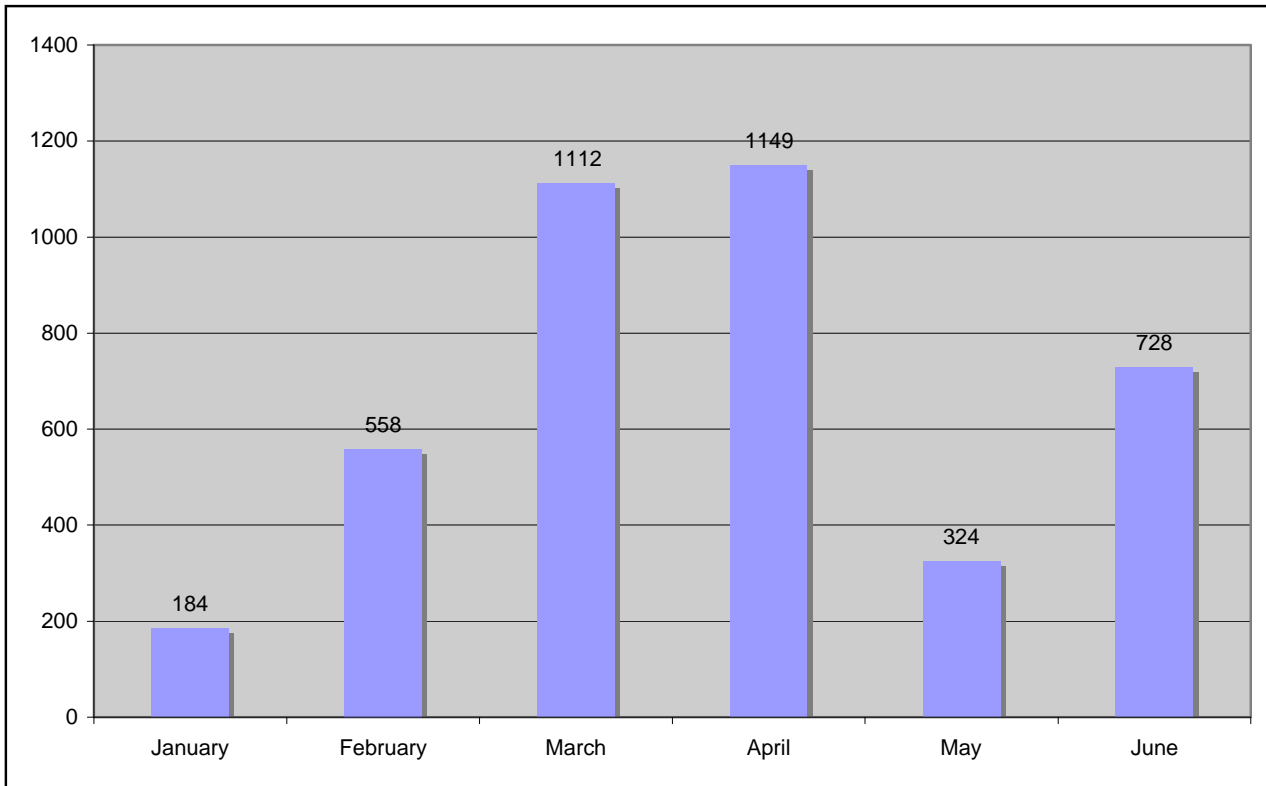
The research further aimed to identify any trends concerning the occurrence of flight delays and the month of the year flown. Figure 6.9 indicates the percentage of flight delays experienced during each month flown over the six-month period from January to June 2008.

Figure 6.9: Number of Substantial Flight Delays per Month



Over the six-month period, March and April experienced the greatest number of substantial flight delays as shown in Figure 6.9. Figure 6.10 shows the time lost per month due to the occurrence of substantial flight delays.

Figure 6.10: Time Lost from Substantial Flight Delays per Month (minutes)



From the time loss analysis, March (18.53 hrs / 1112 minutes) and April (19.15 hrs / 1149 minutes) indicated the greatest time lost. Additionally, significance tests were done to identify any potential relationship between the occurrence of flight delays and the month flown. The results are discussed in Section 6.5.4.

6.2.6 Flight Delays per Day of the Week

This section addresses the occurrence of flight delays per day of the week flown by the Philips travellers. The number and percentage of substantial flight delays per day of the week flown were analysed, and the results are shown in Figure 6.11 and Figure 6.12.

Figure 6.11: Number of Substantial Flight Delays per Day of the Week

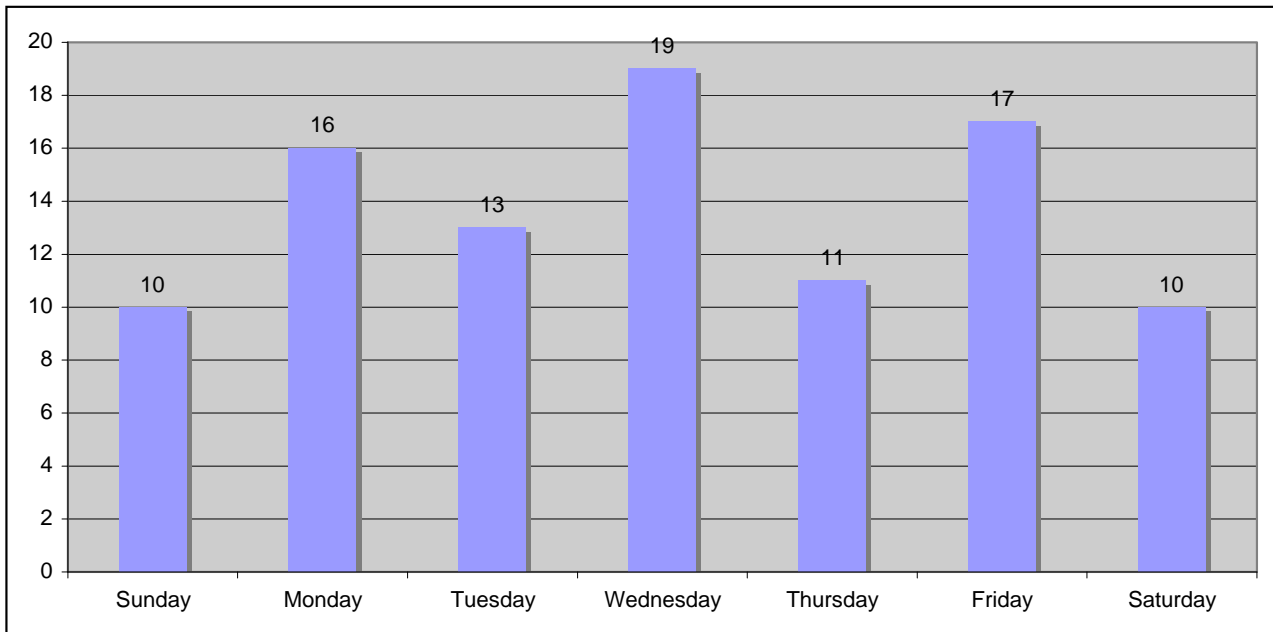
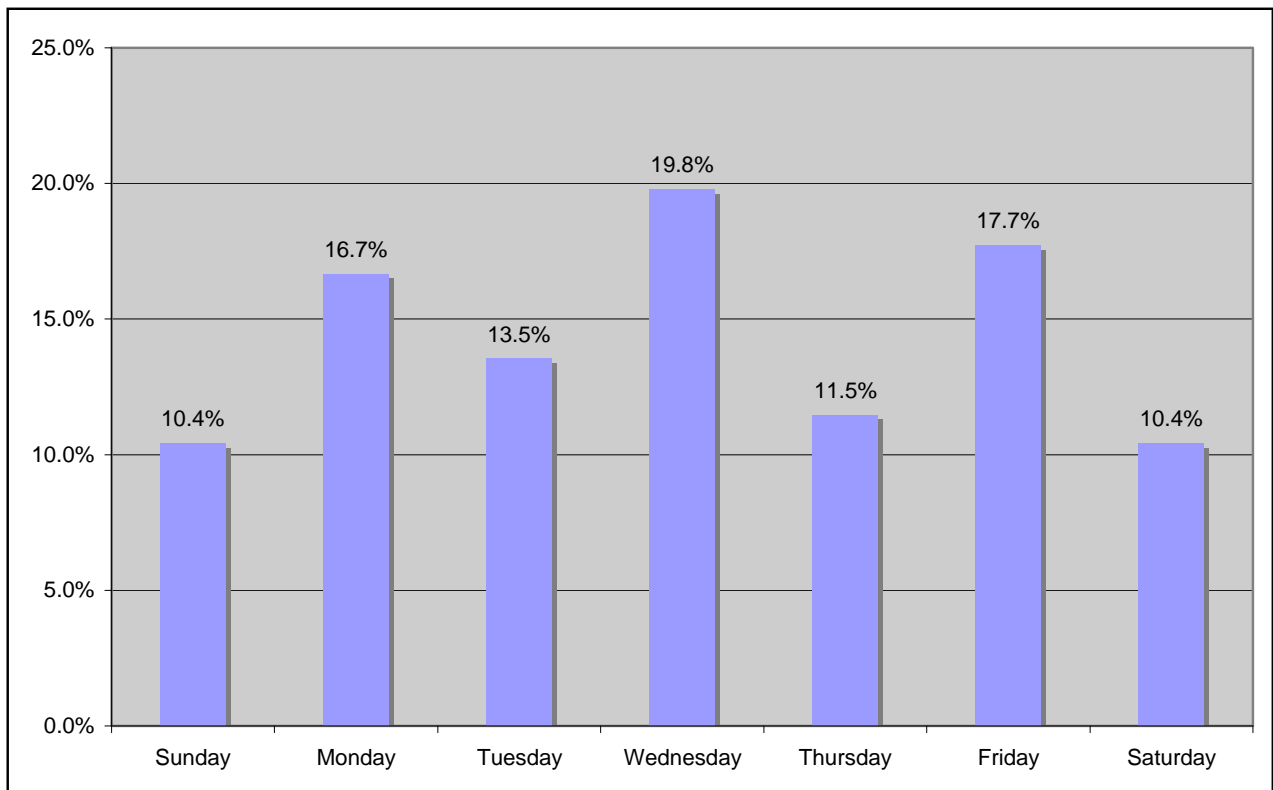


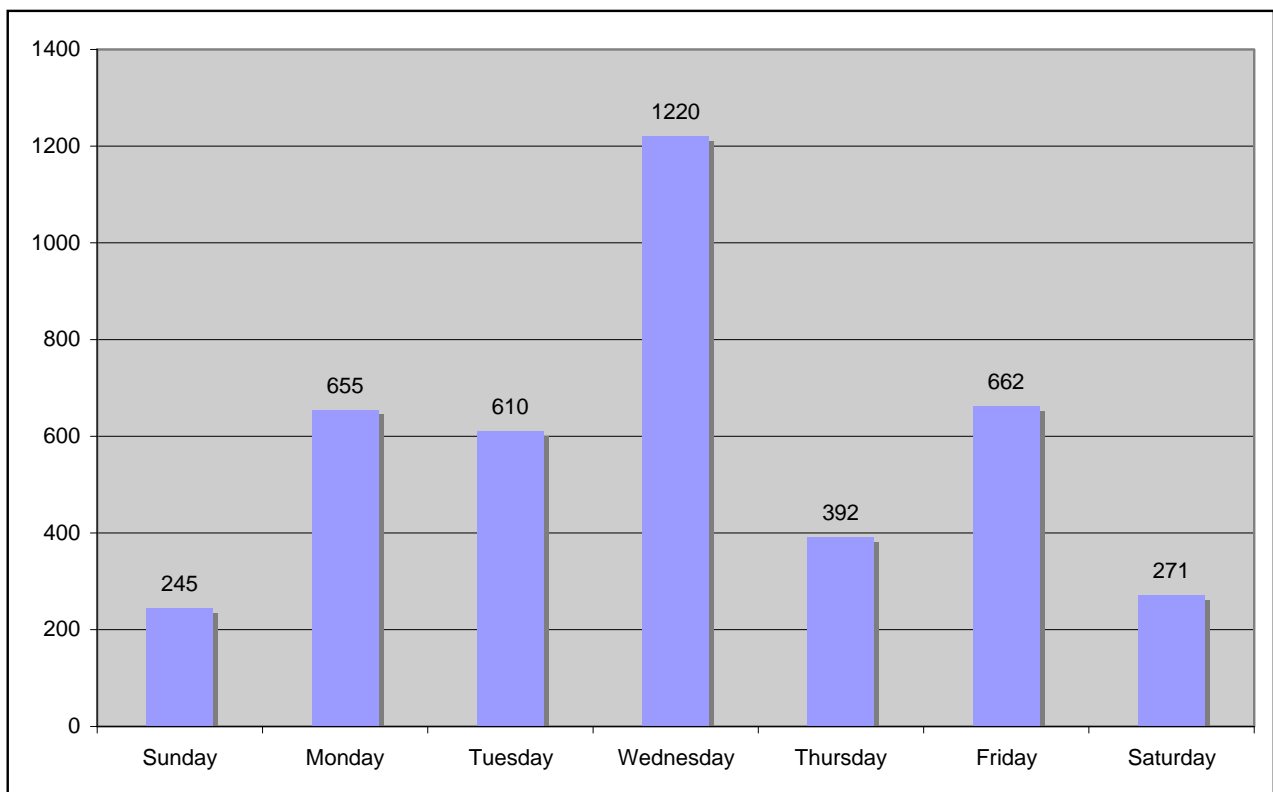
Figure 6.12: Percentage of Substantial Flight Delays per Day of the Week



Mondays, Wednesdays and Fridays experienced the greatest numbers and percentages of substantial flight delays. Wednesdays experienced the greatest percentage of substantial delays (19.8%) and Saturday (10.4%) and Sunday (10.4%) the least.

Figure 6.13 shows the time lost due to the occurrence of substantial flight delays per day of the week flown by the Philips travellers.

Figure 6.13: Time Lost due to Substantial Flight Delays per Day of the Week (in Minutes)



However, to accurately assess the existence of any trends or patterns regarding the occurrence of flight delays per day of the week travelled, significance tests and relative percentages of the substantial flight delays experienced per day of the week in relation to the total flights per day of the week were analysed. These results are discussed in Section 6.5.5.

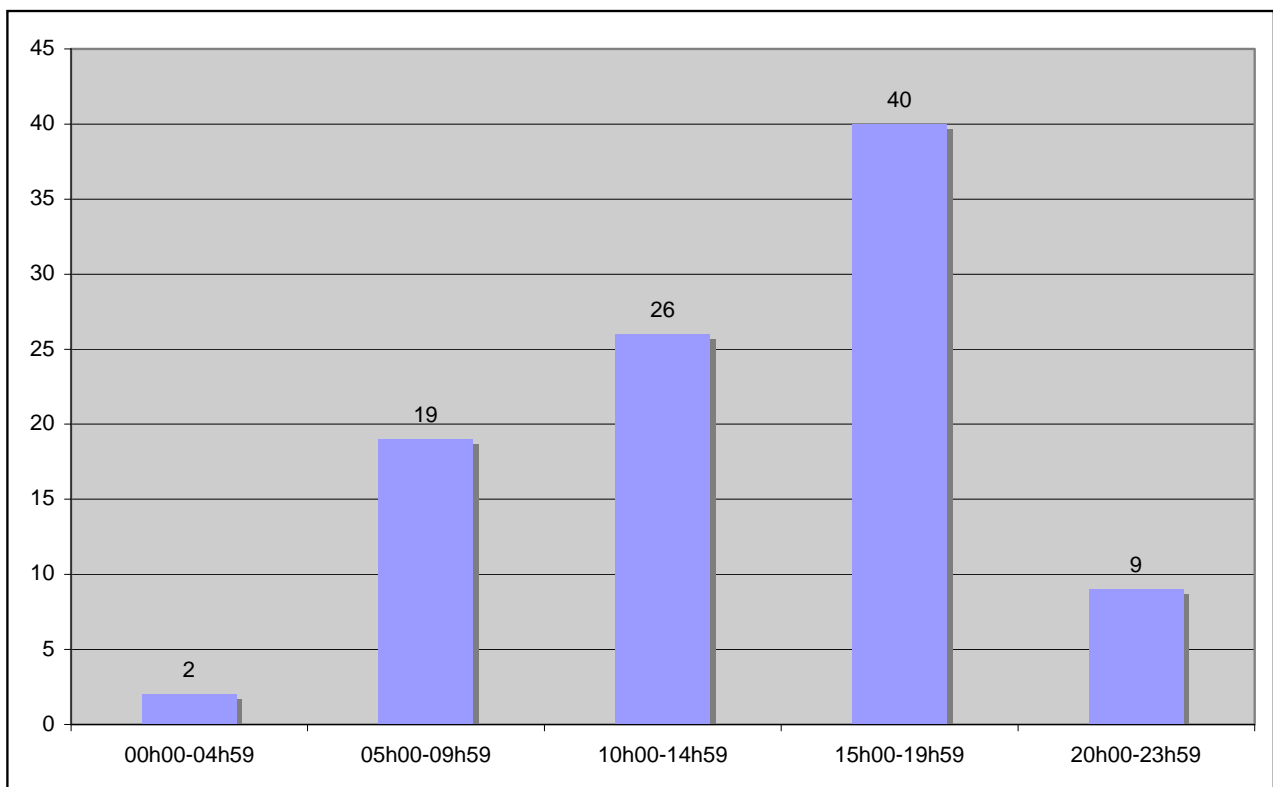
6.2.7 Flight Delays per Time of Day

To accurately identify any patterns related to the occurrence of flight delays according to the time of the day travelled, the 24-hour day was divided into five time zones to allow for the grouping of flights as follows:

- 00h00 – 04h59 (Zone 1)
- 05h00 – 09h59 (Zone 2)
- 10h00 – 14h59 (Zone 3)
- 15h00 – 19h59 (Zone 4)
- 20h00 – 23h59 (Zone 5)

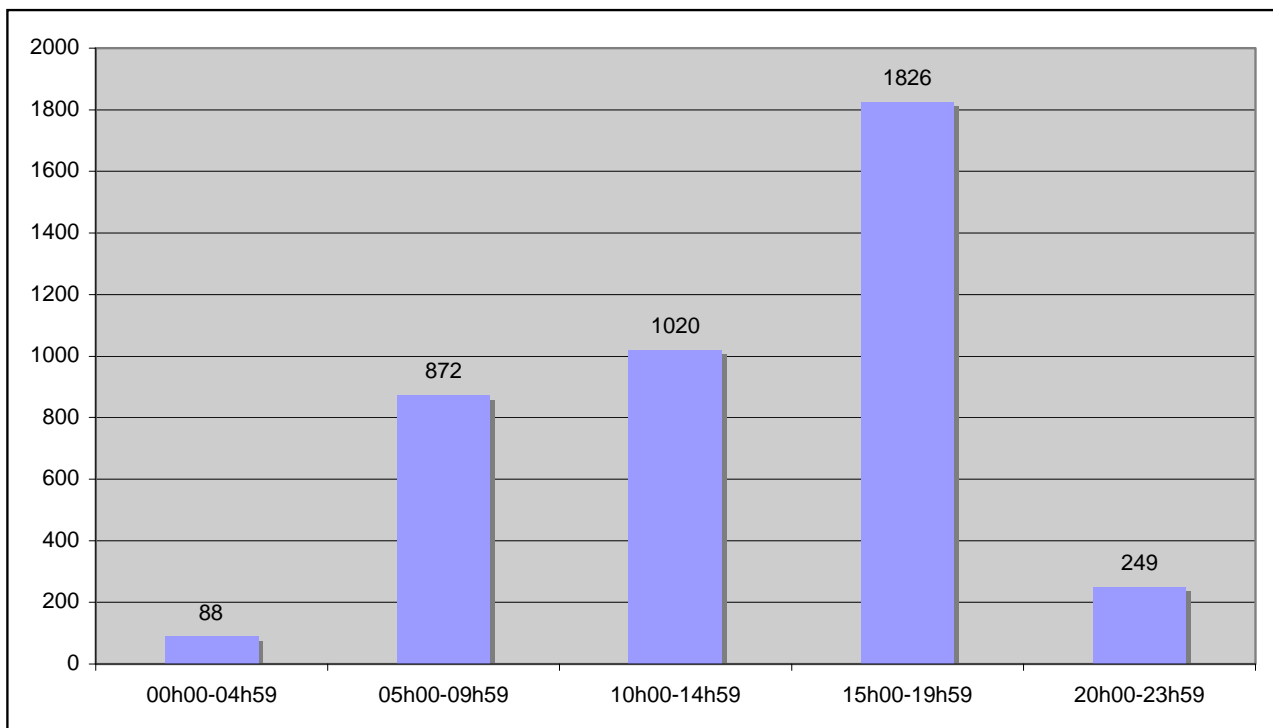
The flight delays per time of day (as per the time zones chosen above) are graphically shown in Figure 6.14.

Figure 6.14: Number of Substantial Flight Delays per Time of Day



From Figure 6.14 it is evident that Zones 2, 3 and 4 experienced the greatest number of substantial flight delays. These zones do fall within the generally accepted working hours, which could account for a greater amount of passenger traffic and thus for greater numbers of flight delays. From the data, it was found that Zones 2 and 3 experienced greater numbers of minor delays, as opposed to Zone 4, which experienced a greater number of substantial delays. It seemed that substantial flight delays were more prevalent later in the day as demonstrated by Zone 4. One possible explanation for the greater number of substantial delays occurring later could be the propagation of minor delays earlier in the day. This is similar to previous research findings, which suggested that earlier flight delays tended to propagate through the system and affect subsequent flights. To more accurately understand the influence of flight delays, the actual time lost due the occurrence of flight delays per time of the day flown was analysed, and the results are given in Figure 6.15.

Figure 6.15: Time Lost (Minutes) from Substantial Flight Delays per Time of Day Flown



While Zone 2 (05h00 – 09h59) and Zone 3 (10h00 – 14h59) experienced a larger number of minor delays, the substantial delays accounted for a much greater loss in time. Zone 4

(15h00 – 19h59) showed the greatest time lost due to substantial delays, a total of 30.43 hours (1 826 minutes). Zones 1 and 5 experienced the lowest numbers of substantial flight delay occurrences as well as the least amount of time lost. Interestingly, from the 15 delayed flights recorded in Zone 5, 9 were substantially delayed and a total delay time of 5 hours was recorded. To accurately identify any relationships in the occurrence of substantial flight delays per the time of day flown, relative percentages of the flight delays per time of day in relation to the total flights flown were analysed. The results are discussed in Section 6.5.6.

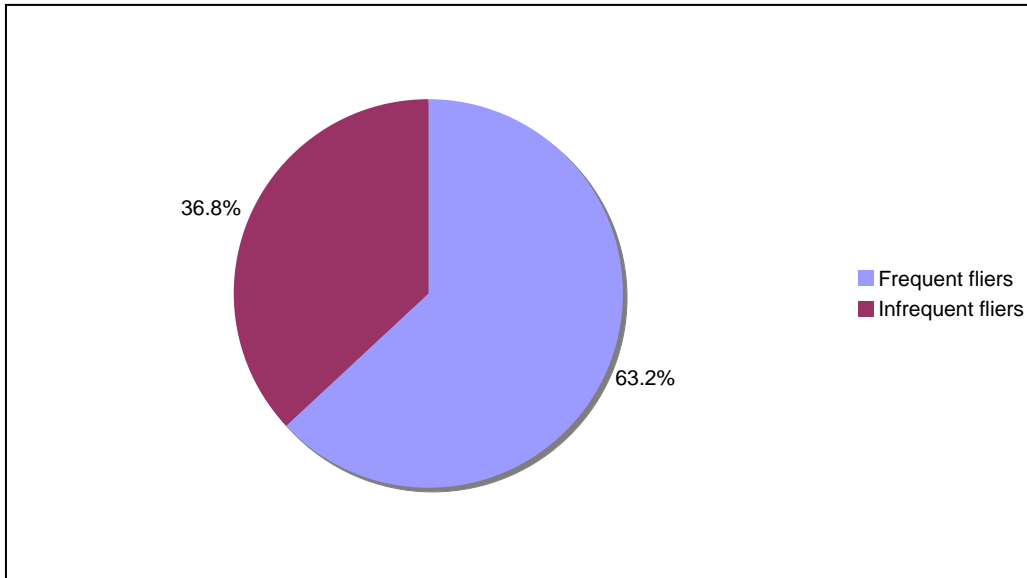
6.3 FREQUENT FLYERS

Frequent flyers are a major source of income for airlines. As noted in the study conducted by Suzuki (2000), it is well known in the airline industry that the top 20% of all air travellers (frequent flyers) account for 80% of airline revenue (approximately every 4-5 weeks) on average. Frequent flyers were classified as generally travelling more than 10 times a year (Suzuki, 2000). From the Philips data, a total of 144 individual travellers were identified. For the purposes of this study, frequent travellers were classified as having flown a minimum of once a month, thus having flown six or more times during the six-month period. This frequency was deemed appropriate due to the size of the sample population and the period studied, January to June 2008. It is hypothesised that frequent flyers are more prone to flight delays simply because of the frequency of their travel. Hypothesis 1 states:

H1: Flight delays adversely affect more than 30% of frequent corporate travellers in terms of cost and time.

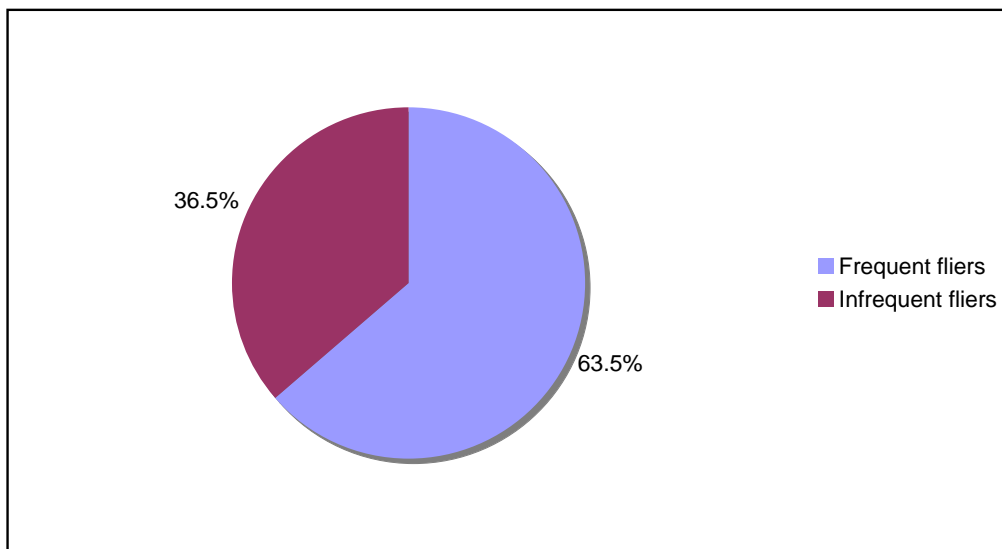
The research found that of the 144 individual Philips travellers on the database, 35 were identified as frequent travellers, i.e. 24.3%. To assess the number of flights undertaken by these frequent travellers, all the flights flown by them were grouped and analysed. It was found that the 24.3% frequent travellers accounted for 63.2% of the total flight travel undertaken by Philips travellers, as shown in Figure 6.16. This percentage is somewhat lower than the 80% suggested by Suzuki, but is still a significant amount.

Figure 6.16: Percentage of Flights Flown by Philips' Frequent Flyers



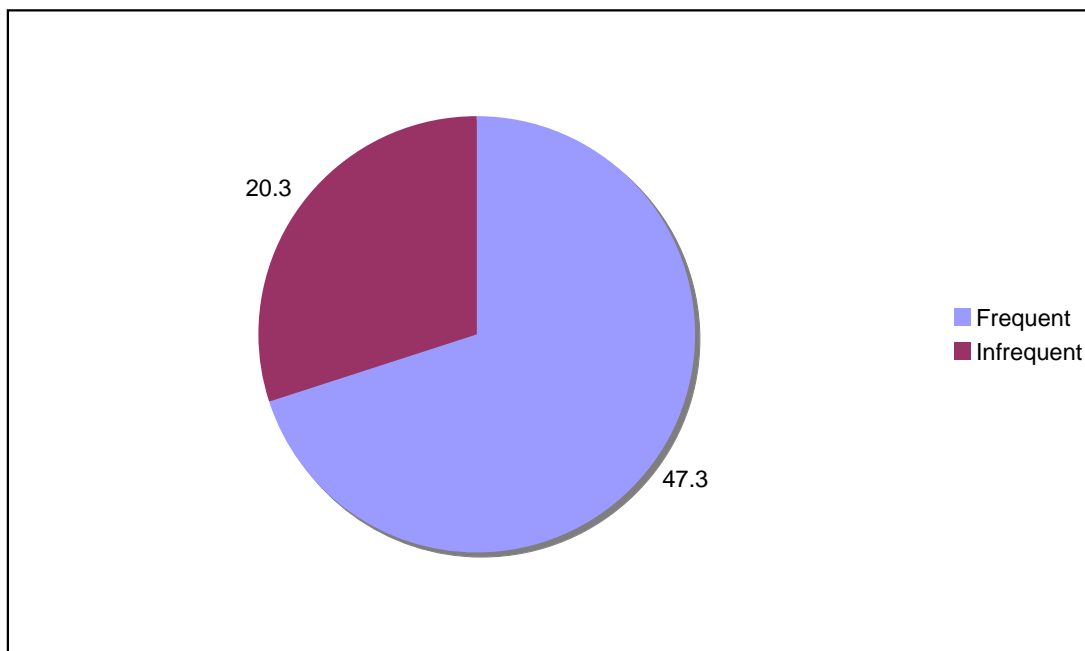
To further assess the influence of flight delays, the percentage of flight delays experienced by the frequent travellers was analysed. The results in Figure 6.17 showed that the Philips frequent flyers experienced 63.5% of the total number of substantially delayed flights, i.e. the majority of the flight delays, and infrequent travellers 36.5%.

Figure 6.17: Percentage of Substantial Flight Delays Experienced by Frequent Travellers



The time lost by the frequent travellers due to the occurrence of substantial flight delays was analysed. As noted in Section 6.2.2, the average substantial delay experienced by Philips corporate travellers totalled 42.2 minutes. The average substantial delay experienced by frequent travellers was 46.5 minutes, as opposed to non-frequent travellers who were delayed by 34.7 minutes on average. Figure 6.18 shows the total time loss experienced by frequent (47.3 hours) and infrequent travellers (20.3 hours) due to the occurrence of substantial delays.

Figure 6.18: Frequent Flyer Time Lost due to Substantial Flight Delays



6.4 AN ANALYSIS OF THE COST OF FLIGHT DELAYS

Over the six-month period, the 144 Philips travellers experienced a total of 67.7 hours of time lost due to the occurrence of substantial flight delays. In calculating the value of the time lost by Philips travellers due to flight delays, it was decided to divide the travellers into levels of seniority, as it is generally accepted that the higher the level of seniority of an employee, the

greater the value of his or her time. From the information provided by Philips (Appendix A) the travellers were divided into seniority levels as follows:

- 35% of travellers were senior level management
- 55% of travellers were middle level management
- 10% of travellers were lower level employees

The total flight delay time was proportionally allocated to provide a delay time for each level of seniority (calculating the percentage of each level against the total time lost) as follows:

- Travellers at senior level experienced a total of 23.7 hours of substantial flight delays,
- Travellers at middle level experienced a total of 37.2 hours of substantial flight delays, and
- Lower level travellers experienced 6.8 hours of substantial flight delays.

Following this, the actual cost resulting from the flight delays for each level of traveller was determined. As mentioned in Section 5.4.2, Philips provided an estimated value of time for each level of traveller (Appendix A), according to their level of seniority (rounded to the nearest Rand):

- Senior level management – R10 000 per day (R1 111 per hour)
- Middle level management – R7 500 per day (R833 per hour)
- Lower level employees – R5 000 per day (R555 per hour)

From the estimates provided, the relevant cost of time lost due to flight delays for each level of traveller was calculated as follows (value of time per minute rounded up to the next Rand):

- The substantial flight delays experienced by senior level travellers, whose time was valued at R1 111/hour or R19.00/min, resulted in a cost to the company of R26 330.70.
- The substantial flight delays experienced by middle level managers, whose time was valued at R833/hour or R14.00/min, resulted in a cost to the company of R30 987.60.
- Finally, the cost of substantial flight delays experienced by lower level employees, whose time was valued at R555/hour or R10.00/min, resulted in a total loss of R3 774.

As demonstrated in Section 6.2.2, from the Philips travel data, 12.8% of the delays experienced were substantial. From the estimates calculated above, the total cost of the 12.8% of substantial flight delays experienced by the Philips corporate travellers over the six-month period from January to June 2008 amounted to R61 092.30.

6.5 HYPOTHESIS TESTING

This section concentrates on discussing and explaining the results of the hypotheses tested in this research study. The hypotheses aimed to identify any significant association between the on-time performance of a flight and a number of variables including the airline, month of the year, day of the week and time of the day flown, the purpose of which was to assess if certain periods could feasibly be avoided if they were more prone to flight delays.

Probably the most widely used nonparametric test of significance is the chi-squared goodness-of-fit test (Cooper & Schindler, 2003). The test is a statistical procedure employed to test hypotheses about a population proportion (Keller & Warrack, 2000). It is particularly useful in tests involving nominal data. Using this technique one tests for significant differences between the observed distribution of data among categories and the expected distribution based on the null hypothesis.

However, for the discrete distribution of the test statistic to be adequately approximated by the (continuous) chi-squared distribution, the conventional (and conservative) rule – known as the rule of five – is to require that the expected frequency for each cell be at least five (Keller & Warrack, 2000). Where necessary, certain categories were combined in order to satisfy this condition. Where categories/cells have been combined, the choice of combination will also be discussed to indicate why they were deemed to represent meaningful categories for statistical analysis.

Additionally, as the focus of the study is to assess the influence of flight delays, all early and on-time flights were grouped together in a category indicating that no delay had occurred. This was also done to satisfy certain statistical conditions, such as the rule of five, during the testing of some hypotheses.



6.5.1 Hypothesis 1

The first hypothesis (H1) focused on the extent to which flight delays affected corporate travellers, and specifically frequent travellers, from a specific company, as follows:

- H1(alternate): Flight delays adversely affect more than 30% of frequent corporate travellers in terms of cost and time.

It was found that 28 (80%) of the total of 35 frequent travellers experienced at least one substantial delay. Thus substantial flight delays adversely influenced more than 30% of the Philips frequent corporate travellers in terms of cost and time.

6.5.2 Hypothesis 2

The travel undertaken by the Philips travellers was undertaken using a number of different airlines, some more frequently than others. Hypothesis 2 aimed to identify if there could possibly exist a relationship between the frequency of flight delays and the specific airline chosen by the Philips travellers, as follows:

- H2(alternate): There is a relationship between the occurrence of flight delays and specific airlines.
- H2(null):: There is no relationship between the occurrence of flight delays and specific airlines.

Certain airline categories/cells were grouped together. SAA and BA Comair had a large enough frequency count to stand on their own, but other, Europe-based, airlines were grouped together under “European Airlines”: KLM, Air France, British Airways, Lufthansa and Swissair. Similarly, due to low frequency counts, Olympic Air, Egypt Air, Kenya Airways, Mozambique Air, Thai and Singapore Airlines were grouped under the “Other” category. Furthermore, the grouping of early and on-time flights was necessary to enable accurate frequency counts during statistical analysis. Table 6.1 shows the results of the frequency tests per airline.

Table 6.1: Delays per Airline

Table of Airline by Substantial			
Airline(Airline)	Substantial		
	No	Yes	Total
BA Comair	145	22	167
	19.28	2.93	22.21
	86.83	13.17	
European	49	3	52
	6.52	0.4	6.91
	94.23	5.77	
Other	27	7	34
	3.59	0.93	4.52
	79.41	20.59	
South African Airways	435	64	499
	57.85	8.51	66.36
	87.17	12.83	
Total	656	96	752
	87.23	12.77	100

From Table 6.1, the average percentage of substantial flight delay occurrences was 12.77%. The group of airlines under “Other” showed a percentage count higher than the average of 20.59%, followed by BA Comair and SAA, whereas European airlines recorded an average percentage (5.77%) far below the average. The chi-square test for flight delays per airline was conducted at a 5% level of significance to infer whether there was a relationship between the occurrence of substantial flight delays and the airline flown. Table 6.2 shows the results of the chi-square test.

Table 6.2: Chi-square Test for Significance per Airline

Statistic	DF	Value	Prob
Chi-Square	3	4.1805	0.2426
Likelihood Ratio Chi-Square	3	4.4397	0.2177
Mantel-Haenszel Chi-Square	1	0.0494	0.824
Phi Coefficient		0.0746	
Contingency Coefficient		0.0744	
Cramer's V		0.0746	

Table 6.2 shows the chi-square test result as 0.2426. For there to be a relationship at a 5% significance level, the result would have to be less than 0.05, therefore the results indicate no statistically significant relationship between the occurrence of flight delays and the airline flown.

6.5.3 Hypothesis 3

Hypothesis 3 aimed to analyse whether a relationship existed between the route flown and the occurrence of flight delays. Hypothesis 3 was stated as follows:

- H3(alternate): There is a relationship between the occurrence of flight delays and specific routes.
- H3(null): There is no relationship between the occurrence of flight delays and specific routes.

Due to smaller numbers of international flights, all international routes were grouped together under the category “Other International”. The major local routes remained on their own, including Johannesburg (JNB), Cape Town (CPT), Durban (DUR) and Bloemfontein (BFN). All other local routes that experienced a smaller frequency of flights, including destinations such as Port Elizabeth and East London, were grouped together under the category “Other Local”. Table 6.3 shows the results of the frequency tests per route.

Table 6.3: Delays per Route

Table of RouteType2 by Substantial			
RouteType2	Substantial		
	No	Yes	Total
BFN-JNB	42	8	50
	5.59	1.06	6.65
	84	16	
CPT-JNB	113	22	135
	15.03	2.93	17.95
	83.7	16.3	
DUR-JNB	85	7	92
	11.3	0.93	12.23
	92.39	7.61	
JNB-BFN	42	4	46
	5.59	0.53	6.12
	91.3	8.7	
JNB-CPT	109	22	131
	14.49	2.93	17.42
	83.21	16.79	
JNB-DUR	90	11	101
	11.97	1.46	13.43
	89.11	10.89	
Other International	92	16	108
	12.23	2.13	14.36
	85.19	14.81	
Other Local	83	6	89
	11.04	0.8	11.84
	93.26	6.74	
Total	656	96	752
	87.23	12.77	100

From Table 6.3, it can be seen that both the JNB-CPT and CPT-JNB routes experienced a greater than average frequency of substantial delays. Additionally, the “Other International” category also seemed to show a greater frequency of substantial delays. The “Other Local” routes experienced a below-average frequency of substantial flight delays. The results of the chi-square test are shown in Table 6.4.

Table 6.4: Chi-square Test for Significance per Route

Statistic	DF	Value	Prob
Chi-Square	7	10.397	0.1672
Likelihood Ratio Chi-Square	7	11.032	0.1372
Mantel-Haenszel Chi-Square	1	1.2846	0.257
Phi Coefficient		0.1176	
Contingency Coefficient		0.1168	
Cramer's V		0.1176	

The result shows that at a 5% significance level, a significant relationship does not exist between the occurrence of flight delays and the route flown.

6.5.4 Hypothesis 4

The fourth hypothesis aimed to identify whether any relationship or travel patterns existed between the occurrence of flight delays and the month travelled.

- H4(alternate): There is a relationship between the occurrence of flight delays and the month of the year.
- H4(null): There is no relationship between the occurrence of flight delays and the month of the year.

As the flight data was captured over the six-month period from January to June 2008, only those months were tested, meaning that the results could differ across other months. Table 6.5 shows the results from the frequency tests performed as per the month flown. The months were coded from 1 (January) to 6 (June).

Table 6.5: Delays per Month of the Year

Table of Month by Substantial			
Month	Substantial		
	No	Yes	Total
1	79	7	86
	10.51	0.93	11.44
	91.86	8.14	
2	85	16	101
	11.3	2.13	13.43
	84.16	15.84	
3	107	28	135
	14.23	3.72	17.95
	79.26	20.74	
4	148	24	172
	19.68	3.19	22.87
	86.05	13.95	
5	133	8	141
	17.69	1.06	18.75
	94.33	5.67	
6	104	13	117
	13.83	1.73	15.56
	88.89	11.11	
Total	656	96	752
	87.23	12.77	100

From Table 6.5 it was identified that the months of February (2), March (3) and April (4) showed greater than average frequencies of substantial flight delays. March experienced the greatest frequency of substantial delays (20.74%), while May (5.67%) experienced the least. Table 6.6 shows the results of the chi-square test.

Table 6.6: Chi-square Test for Significance per Month of the Year

Statistic	DF	Value	Prob
Chi-Square	5	17.0945	0.0043
Likelihood Ratio Chi-Square	5	17.6595	0.0034
Mantel-Haenszel Chi-Square	1	1.7271	0.1888
Phi Coefficient		0.1508	
Contingency Coefficient		0.1491	
Cramer's V		0.1508	

From Table 6.6 the chi-square result is 0.0043, thus at a 5% significance level, a significant relationship does exist between the occurrence of substantial flight delays and the month flown. However, for this sample, Cramer's V has to be taken into consideration. The size of the chi-square coefficient depends on the strength of the relationship and sample size. Cramer's V is based on adjusting chi-square significance to factor out sample size.

From Table 6.4 it is evident that Cramer's V is 0.1508, suggesting that even though the results may be statistically significant, they have a relatively small level of practical significance. Practical significance refers to an arbitrary limit whereby an observed difference is of some practical use in the real world. In other words, practical significance looks at whether the difference is large enough to be of value in a practical sense. For example, should Philips SA (Pty) Ltd deem the avoidance of certain routes, on account of the potential occurrence of substantial delays, to have a very limited beneficial effect, then it would be of little practical significance.

6.5.5 Hypothesis 5

Hypothesis 5 addressed the question of whether any relationship existed between the occurrence of flight delays and the day of the week flown. Hypothesis 5 was scripted as follows:

- H5(alternate): There is a relationship between the occurrence of flight delays and the day of the week.
- H5(null): There is no relationship between the occurrence of flight delays and the day of the week.

Table 6.7 shows the results of the frequency tests conducted to address the occurrence of flight delays per the day of the week flown by the Philips travellers.

Table 6.7: Delays per Day of the Week

Table of DayOfWeek by Substantial			
DayOfWeek	Substantial		
	No	Yes	Total
1 Sunday	58 7.71 85.29	10 1.33 14.71	68 9.04
2 Monday	63 8.38 79.75	16 2.13 20.25	79 10.51
3 Tuesday	118 15.69 90.08	13 1.73 9.92	131 17.42
4 Wednesday	108 14.36 85.04	19 2.53 14.96	127 16.89
5 Thursday	141 18.75 92.76	11 1.46 7.24	152 20.21
6 Friday	131 17.42 88.51	17 2.26 11.49	148 19.68
7 Saturday	37 4.92 78.72	10 1.33 21.28	47 6.25
Total	656 87.23	96 12.77	752 100

From Table 6.7, while Sundays and Wednesdays experienced greater than average substantial delays, Mondays and Saturdays experienced the greatest frequency of substantial flight delays. Tuesdays and Thursdays showed a lower than average frequency of occurrence of substantial flight delays. To accurately identify whether a relationship exists between the occurrence of flight delays and the day of the week travelled, the goodness-of-fit chi-square test was conducted. Table 6.8 shows the results of the chi-square test.

Table 6.8: Chi-Square Test for Significance per Day of the Week

Statistic	DF	Value	Prob
Chi-Square	6	13.1533	0.0407
Likelihood Ratio Chi-Square	6	12.913	0.0444
Mantel-Haenszel Chi-Square	1	0.6084	0.4354
Phi Coefficient		0.1323	
Contingency Coefficient		0.1311	
Cramer's V		0.1323	

The chi-square result is 0.0407. Thus it could be inferred that at the 5% level of significance, a relationship does exist between the occurrence of flight delays and the day of the week flown. However, Cramer's V is 0.1323, meaning that the relationship could be considered as being of small practical significance.

6.5.6 Hypothesis 6

Hypothesis 6 identified whether any relationship existed between the occurrence of flight delays and the time of the day flown. Hypothesis 6 read as follows:

- H6(alternate): There is a relationship between the occurrence of flight delays and the time of flight arrival.
- H6(null): There is no relationship between the occurrence of flight delays and the time of flight arrival.

To better allow for the identification of any trends/patterns, the standard 24-hour day was divided into five time zones as discussed in Section 6.2.7 and shown in Table 6.9. The frequency results regarding the occurrence of flight delays per time zone are shown in Table 6.9.

Table 6.9: Delays per Time Zone

Table of TimeZone by Substantial			
TimeZone	Substantial		
	No	Yes	Total
00h00-04h59	13 1.73 86.67	2 0.27 13.33	15 1.99
05h00-09h59	207 27.53 91.59	19 2.53 8.41	226 30.05
10h00-14h59	198 26.33 88.39	26 3.46 11.61	224 29.79
15h00-19h59	205 27.26 83.67	40 5.32 16.33	245 32.58
20h00-23h59	33 4.39 78.57	9 1.2 21.43	42 5.59
Total	656 87.23	96 12.77	752 100

The frequency tests noted some relationships between the occurrence of flight delays and the time zones. Zone 4 (15h00 – 19h59) and Zone 5 (20h00 – 23h59) experienced the greatest frequency of substantial delays, while Zone 2 (05h00 – 09h59) showed a lower than average frequency of substantial delay occurrences. The chi-square test was conducted at a 5% level of significance, and the results are shown in Table 6.10.

Table 6.10: Chi-Square Test for Significance per Time Zone

Statistic	DF	Value	Prob
Chi-Square	4	9.7495	0.0449
Likelihood Ratio Chi-Square	4	9.6104	0.0475
Mantel-Haenszel Chi-Square	1	8.5477	0.0035
Phi Coefficient		0.1139	
Contingency Coefficient		0.1131	
Cramer's V		0.1139	

The chi-square result was 0.0449. Thus it could be inferred that at the 5% level of significance, a relationship does exist between the occurrence of flight delays and the time of day flown, but with Cramer's V result of 0.1139 the relationship could be considered of small practical significance.

6.6 CONCLUSION

This chapter presented the results of the statistical tests performed to analyse the occurrence of substantial flight delays experienced by the Philips corporate travellers from January to June 2008. The results aimed to identify whether any relationships existed between the occurrence of substantial flights and a number of parameters including the airline flown, the month flown, the day of the week and the time of day flown. While some statistically significant relationships were identified in regard to the occurrence of substantial delays and the month, day of the week, and time of day flown, the practical significance was small. Nevertheless the possible reasons for the occurrence of any statistically significant relationships will be discussed in Chapter 7.

Chapter 6 also aimed to identify the cost influence of the substantial delays on the Philips travellers over the six-month period. To calculate the cost of the substantial delays, Philips provided an estimated value of time for each level of traveller, ranging from senior manager to middle manager and lower level employee. From the calculations, the substantial flight delays experienced by Philips corporate travellers resulted in a total cost of R61 092.30 to Philips SA (Pty) Ltd. The impact of the actual time lost will be discussed in Chapter 7.

Finally, Chapter 6 discussed the influence of the substantial delays experienced by the Philips frequent travellers. Even though the frequent travellers accounted for no more than 24.3% of the total Philips population analysed, the study found that these travellers nevertheless experienced 63.5% of the total substantial delays. This statistic is similar to the findings of previous research studies, which noted that frequent travellers accounted for the majority of flight delay experiences (Suzuki, 2000).

Chapter 7 discusses how the primary objectives identified in this study were addressed and also provides a conclusion to the research by discussing the results and the implications thereof for Philips corporate travellers, as well as making recommendations for future travel. The limitations of the research are highlighted and possible areas for further research identified.

CHAPTER 7

CONCLUSIONS AND RECOMMENDATIONS

7.1 INTRODUCTION

The aim of the study was to assess the direct time and cost influence of substantial flight delays on corporate travellers of an organisation. As noted, business travel is a large segment of the air travel market and a substantial contributor to the economy (UNWTO, 2008). The World Travel and Tourism Council (WTTC) estimated that global business travel was an \$843 billion industry in 2008, and expected this figure to increase to \$1 443 billion by 2018 (WTTC, 2008). A study of this nature could provide business travellers with the information to better manage their travel arrangements and allow for the optimising of travel times and costs. Furthermore, through identifying the existence of any trends or patterns that could influence the likelihood of the occurrence of flight delays, such as the route or the time of day flown, business travellers could attempt to reduce or even avoid the costs and loss of time associated with the occurrence of flight delays.

Moreover, certain perceptions exist regarding the benefits of negotiating travel agreements with airline companies. Some may even suggest that the extent of flight delays experienced might negate the potential benefits derived from such agreements. Through quantifying the effects of flight delays experienced by business travellers over a period of time, the study could provide valuable insight into the true value of these agreements. The study could thus aid in the contracting of agreements that are truly mutually beneficial to both business travellers of a specific organisation and the individual airline companies.

A further aim of the study was to identify to airlines the benefits of utilising mobile technology to more efficiently manage and communicate to travellers regarding the occurrence of flight delays. In the 2007 SITA Passenger Self-Service Survey, “staying informed” came third on a wish-list of travel elements passengers most wanted to change about their travel experience, with 79% of passengers wanting to receive an SMS notification service (SITA, 2008a). According to the survey, one of the most likely manners in which mobile devices would impact on the air travel experience was through keeping passengers informed. The manner

in which flight delays are communicated to business travellers could aid in managing traveller expectations better and alleviating the frustrations that could potentially arise from such service disruptions. This discussion was purely theoretical and no empirical testing was done on this topic. The conclusions drawn in the discussion relate to the fact that business travellers desire to be kept informed about flight delays by receiving accurate information quickly. Rapid dissemination of information and regular updates via mobile devices could not only reduce frustrations, but also give passengers a greater degree of mobility and personal control over their time (SITA, 2008a; SITA, 2008b; Gould *et al.*, 2006). Passengers can decide for themselves whether they prefer to wait or perhaps make alternative transport or accommodation arrangements in the event of substantial flight delays. Additionally, mobile devices could help airlines to manage passenger flow better (SITA, 2008a). Should a plane need to depart earlier than scheduled, timely communication through personal mobile devices could inform passengers and reduce delays caused by waiting for late boarding passengers.

Finally, mobile technologies provide a channel for one-to-one marketing between airlines and passengers (SITA, 2008a; Gould *et al.*, 2006; MobileInfo.com, 2006). Marketers could send targeted content, with offers to make new arrangements, to passengers' mobile devices (SITA, 2008a). Additionally, this could aid the recovery process if vouchers for repayments need to be issued to passengers. However, to bridge the gap between now and then, the delivery of mobile-based services for passengers will require a strategy rethink for airlines and airport information and communications technology (ICT) infrastructure (SITA, 2008a). There are a number of challenges in the use of mobile technology: SMS text messages can be unreliable, network limitations can affect reliability, and the heterogeneous nature of the mobile world, with a diverse set of devices running on a variety of software, makes the task harder (Gould *et al.*, 2006; Okazaki, 2006). The challenge will be to create a platform that can integrate data located in dispersed systems, some local, others remote, and then deliver the data in a reliable, secure and efficient manner to provide "real-time" information and context-aware services (SITA, 2008a; Gould *et al.*, 2006).

Studies on flight delays have been done from a number of different perspectives, as they affect airlines, airports and travellers. Milan Janic (2005) modelled congestion charges at an airport, that is, the cost of marginal delays that a flight could impose in regard to other flights

due to congestion. Muller and Santana (2008) analysed flight operating costs and delays, focusing on aircraft in-flight delays and their costs, noting that the effective management of congestion was vital to managing delays and accordingly costs. Forbes (2006) discussed the effect of flight delays on airline fares for certain routes.

Research has also been done on the potential effects of service failures (including flight delays) on passengers. Suzuki (2000) analysed the relationship between on-time performance and airline market share, finding that once flight delays had been experienced, passengers were more likely to switch airlines for subsequent flights. Suzuki furthered this research in 2004 by looking at a number of service failures, including seat denials (bumping), baggage mishandling and flight delays, and how airline choices were affected. AhmadBeygi *et al.* (2008) studied the potential for delays in passenger airline scheduling, finding that when airlines schedule their aircraft, they often focus primarily on achieving high levels of utilisation, thus limiting the schedule's ability to absorb any disruptions such as flight delays. Initial flight delays may then propagate to delay subsequent flights.

Some studies have focused on the reasons for the occurrence of flight delays, as well as potential methods available to reduce their impact or even prevent flight delays (Suzuki, 2004; Wu & Caves, 2003; Bauer, 2000; Bhat, 1995). Bard *et al.* (2001) discussed optimising aircraft routings in response to groundings and flight delays, and found that, following flight delays, the immediate objective of airlines was to minimise the cost of reassigning aircraft to flights, taking into account available resources and other system constraints. Wu & Caves (2003) investigated the influence of flight schedule punctuality control and management. They found that ground operations of airlines were the second major cause of flight delays at airports. This study did discuss the various potential causes of flight delays in general, but did not provide any reasons for the flight delays experienced by the Philips corporate travellers whose cases were analysed.

However, none of the studies mentioned focused on business travel and the actual costs to business travellers resulting from flight delays. Studies on business travellers in relation to air travel have mainly focused on airline selection criteria and airline service attributes. Many of these studies did acknowledge "on-time performance" as an important service attribute and selection criterion (Forbes, 2006; Janic, 2005; Mason, 2000; Suzuki, 2004; Suzuki, 2000;

Evangelho *et al.*, 2005). However, none took into account the influence or cost of flight delays, leaving a gap in the research which this study addresses. Moreover, even though a number of studies have been done on the causes, costs and potential solutions for flight delays (Forbes, 2006; Suzuki, 2004; Bauer, 2000) few have focused on the better management of business travel by taking potential flight delays into account.

In the next section, before the results presented in Chapter 6 are interpreted, a brief discussion on the limitations of the study will be given. In spite of its limitations, the study does provide a valuable basis for future research based on broader parameters, which could provide more comprehensive results, especially in areas with a greater density of flights such as the United States of America or Europe. After the implications of the results have been discussed, conclusions will be drawn and some recommendations will be made. The chapter concludes with some suggestions on future research in this area.

7.2 LIMITATIONS OF THE RESEARCH

As discussed in Chapter 5, in this study there are a number of limitations in addressing the influence of flight delays on business travellers. The most important limitation inherent in this study is that it looks only at the estimated monetary value of the time lost by the travellers. The study does not take into account other costs such as additional accommodation, alternative transport or lost business opportunities through missed meetings. Future extensions of the study could include both direct and indirect costs.

To calculate the cost of the flight delays experienced, a general estimate of the value of time was attributed to the travellers of Philips SA (Pty) Ltd according to their respective levels of seniority (senior, middle and lower). The method of attributing a general estimate of value of time has been used in previous research through the use of publicised estimates from the ATA and the FAA (ATA, 2008; Bauer, 2000). However, Philips provided estimates according to their travellers' seniority, as described in Chapter 5. Therefore, even though the value attributed to the travellers is in accordance with previous studies, the costs resulting from the assessed flight delays are limited to those of Philips SA (Pty) Ltd. The study nevertheless represents a start in collecting credible evidence of what flight delays may cost a company.

Moreover, the results of the statistical analysis are applicable only to the travel patterns of corporate travellers for a specific company in South Africa, Philips SA (Pty) Ltd., over a period of six months from January to June 2008. As such, the results may differ from those for corporate travellers of other companies or over different periods of time.

Finally, as ATNS was the partner in supplying flight data for those six months, only flights with a South African departure or arrival leg could be analysed. Flights with purely international legs (no South African departure or arrival points) could not be analysed as no match could be found on the ATNS database for statistical analysis. The study is therefore limited to assessing the extent and effect of flight delays affecting flights departing from or arriving in South Africa.

In essence, the results of the study cannot be generalised to flight delays in other geographical regions, over other periods of time or to other groups of corporate travellers. However, the study does provide a valuable starting point for assessing the influence of flight delays on corporate travellers of a specific company. As noted in the previous section, future research based on broader parameters (e.g. over longer periods of time, or through using larger or numerous companies) could provide more comprehensive results, especially in areas with a greater density of flights such as the United States of America or Europe.

7.3 INTERPRETATION OF THE RESULTS

The substantial flight delays experienced by corporate travellers from Philips SA (Pty) Ltd over a six-month period from January to June 2008 were identified and assessed. Any travel patterns or relationships in regard to the occurrence of the substantial flight delays were also assessed. The identification of patterns was done to potentially give corporate travellers the opportunity to manage their travel arrangements better, so as to possibly reduce the likelihood of experiencing substantial flight delays.

The study found that 12.8% of the total of business travellers analysed were influenced by the occurrence of substantial flight delays in terms of time and cost. Following the simple

value of time calculation, the 12.8% of substantial flight delays experienced by the Philips corporate travellers resulted in a total cost of R61 092.30 to Philips SA (Pty) Ltd.

It is evident from the simple calculation of the value of time lost according to the frequency of delays, that the value of the time lost does not constitute a substantial amount for the corporation, and that it could easily be discounted as being unimportant. Two perspectives could be taken here:

1. The actual impact of flight delays is much greater than depicted in these results.
 - The monetary value of time lost, the objective set for this study, is only one component when looking at the impact of flight delays. Other components, such as additional delays due to delayed baggage arrival, may well be involved. Also other direct costs such as transport and accommodation, as well as indirect costs such as missed appointments or business opportunities, may also be factors that could increase the amounts involved.
 - The reader is reminded of the limitation of the research in terms of the geographic location of the arriving and originating flights, the period over which the flights were calculated and the small number of corporate travellers used in contrast to the total number of flights flown.
 - The sample is small in terms of the total number of travellers and represents one company only; a different result would be probable with a larger sample and different companies.
2. The total time lost in actual fact represents only a small number of delays, and even if the sample is relatively small, this, together with the number of times that flights arrived early, has implications in terms of traveller perceptions. This means that the perception of travellers that flight delays are an increasing source of concern may be exaggerated. Airlines should therefore pursue research in this area in order to utilise whatever positive results could be obtained from such research, so as to differentiate themselves in terms of the broader picture and promote positive traveller perceptions.

The study also aimed to analyse the influence of substantial flight delays experienced by frequent travellers. While only 24.3% of the total Philips population can be regarded as frequent travellers, they accounted for 63.5% of the total substantial flight delays experienced. Frequent travellers not only undertook the majority of travel, but also

experienced the majority of substantial flight delays. This statistic is similar to previous research which noted that frequent travellers tend to account for the majority of flight delay experiences (Suzuki, 2000).

The first hypothesis (H1) focused on the extent to which flight delays influenced corporate travellers, and specifically frequent travellers, from a specific company. H1 proposed that flight delays adversely affected more than 30% of frequent corporate travellers in terms of cost and time. As expected, the majority of frequent travellers experienced substantial flight delays. The results showed that 80% of the frequent travellers were influenced by the occurrence of at least one substantial flight delay. Furthermore, the smaller percentage of frequent travellers accounted for the greatest monetary loss. Following the value of time calculation, the frequent travellers (24.3%) accounted for a total monetary loss of R42 708.50, compared with the infrequent travellers (75.5%), who accounted for R18 383.80. The results suggest that frequent travellers' arrangements need to be carefully managed, as they experience not only the greatest amount of substantial flight delays but also the greater monetary losses. By arranging their travel according to certain parameters such as selected flight times or days, the percentage of flight delays experienced by frequent travellers could potentially be reduced. If frequent travellers then experienced a lesser number of flight delays, the consequent monetary losses resulting from frequent flyer delays would be reduced.

The existence of any travel patterns or relationships in regard to the occurrence of the substantial flight delays and a number of parameters was assessed. The identification of patterns or relationships was done to potentially provide corporate travellers with the opportunity to plan their travel arrangements better and possibly reduce their potential to experience substantial flight delays. The avoidance of substantial delays could promote more efficient use of travellers' time through less time wastage, as well as lower traveller frustration levels during travels, particularly in the case of frequent travellers. Within the limits of this study significant relationships were found between substantial delays and the month of the year, the day of the week, and the time of day flown.

As noted in Chapter 6, the results did identify a statistically significant relationship between the occurrence of flight delays and the month flown, suggesting that flight delays were more

prevalent in some months than in others. February, March and April had greater than average frequencies of substantial flight delays, with March experiencing the greatest frequency of substantial delays, while May had the least. Although some months did show a greater frequency of occurrence of flight delays and consequently a greater total cost to the company, the data did not provide any possible reason for these occurrences. An explanation could be that in South Africa, March and April are characterised by numerous public holidays as well as a number of sporting events throughout the country, including the ABSA Cape Epic and the Argus Cycle Tour. These events could lead to increased passenger traffic moving through the airline industry: thereby putting greater pressure on the system's capacity and increasing the potential for the occurrence of substantial flight delays. On the other hand, May had the lowest frequency of substantial flight delays. One possible explanation could be that May falls within the winter months in South Africa, and that therefore the amount of leisure travel is a lot less and the passenger load on airline and airport capacities is potentially much lower.

The results suggest that business travellers could possibly reduce the potential for, or even avoid the occurrence of, substantial flight delays through careful selection of the month of travel. Perhaps the use of online media such as video-conferencing, which reduces the need and amount of travel required, could be increased during certain months of the year that indicate a higher likelihood of occurrence of flight delays, such as March. However, it should be noted that the results did show a small level of practical significance. It is further relevant to note that, as the flight data were only captured over the six months from January to June 2008, the results could differ for other months of the year.

Additionally, a statistical relationship was identified between the occurrence of substantial flight delays and the day of the week flown. Mondays and Saturdays showed the greatest frequency of substantial flight delays, while Tuesdays and Thursdays experienced lower than average frequencies. It could therefore be suggested that scheduling business travellers' arrangements for certain days of the week when substantial delays are less likely to occur (such as Tuesdays and Thursdays) could potentially reduce their experience of substantial flight delays as well as any resulting losses to the company.

Furthermore, the study identified a relationship between substantial flight delays and the time of day flown. Zone 4 (15h00 – 19h59) and Zone 5 (20h00 – 23h59) experienced the greatest frequency of substantial delays, while Zone 2 (05h00 – 09h59) experienced the lowest. This trend is similar to that of previous research which suggests that arrival delays, especially those that occur early in the day, tend to propagate in the network (AhmadBeygi *et al*, 2008; MIT, 2003). This also means that flight delays that occur early in the day could accumulate to such an extent that flights later in the day become substantially delayed. As evident in the results, the occurrence of substantial delays seemed to be more prevalent later in the day, in Zones 4 and 5. Thus it could be advisable for corporate travel managers to schedule business travellers' flights earlier in the day. Additionally, instead of having travellers return to their point of origin later on the same day, it could prove viable to have them stay over and return early the next morning. However, the travel manager would have to weigh up the cost of spending the night against the cost of potential delays on the return trip, to find the preferable solution.

It should be noted that, while a statistically significant relationship was found, the practical significance of all three these relationships was rather small. Therefore, should the company consider the avoidance of travel in certain periods of time, days or months to be impractical or of little benefit, they may prefer to not alter their travel patterns accordingly. For example, even though a relationship does exist between substantial delays and the day of the week flown, companies may deem this relationship to provide little benefit in the “real world” and therefore be of little practical significance.

Other relationships, while not found to be statistically significant, need to be discussed, as the frequency with which delays occurred is also important. There is a possibility that further research may show that in other geographic regions or time periods a relationship may exist. In this study no statistically significant relationship was found between the occurrence of substantial delays and the airline or route flown.

From the results, it is evident that business travellers could not avoid or reduce the likelihood of experiencing substantial flight delays by avoiding a specific airline. Thus the perception of travellers that flight delays are very common amongst certain airlines is an element that needs to be addressed by airlines. Airlines could potentially use such information, not only to

aid in marketing initiatives to alter negative public perceptions, but also during contract negotiations with companies.

Major local South African routes recorded a greater frequency of flight delays than non-major routes. This could most likely be due to the fact that major routes transport a larger number of passengers, thereby putting greater strain on airport capacities and increasing the potential for substantial flight delay occurrences. This is similar to previous research which noted that major hubs were more prone to flight delays (Givoni & Rietveld, 2006; Kazda & Caves, 2000). Additionally, the results suggested that international routes were more prone to the occurrence of substantial flight delays. This could be due to numerous reasons including stringent entry and safety regulations, and air traffic control procedures. In some countries legislators have imposed certain take-off and landing constraints at airports which effectively imposed entry restrictions at many heavily congested airports (Duval, 2008; Forbes, 2006). Air traffic control ensures the safety of all users and intervenes by maintaining adequate distances between aircraft in line with international safety standards (Skyguide, 2005). However, these interventions could at times result in flight delays due to aircraft being delayed both on the ground and in the sky while awaiting arrival and departure slots.

The results of this study indicated that no statistically significant relationship exists between the occurrence of substantial flight delays and the route flown. Thus business travellers would not be able to potentially reduce or avoid the occurrence of substantial flight delays in terms of the route they flew. Once again, this could suggest that passenger perceptions that flight delays are more common on certain routes, and specifically major routes, are an element that needs to be addressed. Airlines could use this information not only to address negative public perceptions and promote certain routes, but also to conclude truly mutually beneficial contracts with companies.

It would appear that while substantial flight delays do occur, it is the traveller perceptions regarding the frequency and extent of these flight delays that need to be addressed by airlines. Better communication regarding the occurrence of flight delays to business travellers could therefore aid in better managing the influence of flight delays and consequently passenger perceptions. It is important to note that these findings could differ

when measured over different months or geographical areas, or when compared to those for other companies. However, the findings do provide a valuable basis for future research.

7.4 AREAS FOR FURTHER RESEARCH

Even though a number of limitations exist, the study does provide valuable groundwork for future research on the influence of flight delays on business travellers. Future research could aim to use multiple companies to gather a larger sample population, and/or to capture flights over extended periods of time. Furthermore, future research could aim to gather flight data from geographical areas with a greater density of flights such as the United States of America and Europe. Moreover, a number of different geographical areas could be used to gather an even wider sample. Such future research strategies based on broader parameters could provide even more comprehensive results.

As noted, the perception of travellers that flight delays are an increasing source of concern is perhaps exaggerated and airlines should pursue research in this area in order to harness whatever positive results are obtained from such research to distinguish themselves and promote positive traveller perceptions. Airlines could work in conjunction with companies to research the extent of flight delays experienced over a period of time specifically by each company. By working together in this way, the airlines would have access to suitable samples, while each company would receive feedback specific to its own corporate travel behaviour. The information obtained from such research could provide valuable insight into the true extent of flight delays experienced and provide both companies and airlines with the opportunity to negotiate truly mutually beneficial agreements. In addition, such joint research would also give airlines an opportunity to address any negative perceptions that may exist.

Another element companies could address relates to the extent of flight delays experienced by frequent corporate travellers. The study noted that frequent travellers accounted for the largest percentage of substantial flight delays, and consequently the largest cost to the company. It could prove valuable for companies to implement corporate travel policies that specifically address the travel patterns and arrangements of frequent travellers. Companies could aim to better manage frequent travellers' arrangements in accordance with to the

relationships identified in this study. Policies could be put in place to promote travel on certain days of the week, or at certain times of the day, which have been identified as less likely to experience substantial flight delays. Conversely, policies could be drafted to promote the avoidance of travel during certain periods of time unless prior approval is obtained, with the aim of reducing travel costs and improving travel expenditure control.

Finally, the timely dissemination of information to travellers during flight delays is an element that needs to be addressed by airlines. Keeping passengers informed during service disruptions is a vital element in managing passenger frustrations. Regular status updates of flight delays via mobile devices also provide travellers with a degree of mobility and personal control. Corporate travellers could decide for themselves whether to wait at the airport until the delay is resolved or instead to make alternative transport or accommodation arrangements. Airlines may need to address current communication and recovery strategies to incorporate the benefits of mobile technology to more efficiently manage and communicate with travellers regarding the occurrence of flight delays. Moreover, as a number of challenges exist in the use of mobile-based services, such initiatives would require a strategy rethink for airlines as well as for airport information and communications technology infrastructure (SITA, 2008a; Gould *et al.*, 2006; Okazaki, 2006). The challenge will be for airlines and airports to create a platform to deliver “real-time” information and context-aware services to traveller devices in dispersed locations.

Contract negotiations between companies and airlines could therefore include discussions on the communication of service disruptions to corporate travellers. Company-specific programmes could be put in place to make rapid communication more efficient. For example, as an additional communication strategy, airlines could contact a designated representative in a company’s corporate travel department, who could then communicate the delay status to the affected traveller. Companies have all the necessary contact details of their employees and may be able to communicate with travellers faster. This could be done in addition to airlines’ mobile communication strategies as a preventative measure to ensure the rapid and effective dissemination of flight information, should any network limitations possibly delay message delivery.

7.5 CONCLUSION

In this final chapter, two important areas were drawn together. The first was the theoretical framework for the occurrence of flight delays and the travel patterns of business travel in the air transport industry. The first four chapters discussed the concepts, theories and previous research perspectives relating to the occurrence of flight delays. This chapter also provided a theoretical discussion on the manner in which flight delays are communicated to passengers, with specific reference to the use of mobile technologies.

The second area was the empirical research, of which the results and conclusions provided the basis for the recommendations on how both companies and airlines could address and potentially better manage the occurrence of flight delays.

The study expands the current theory on business travel with specific reference to the cost and time influence of flight delays on business travellers. Moreover, the study provides evidence to suggest not only that certain relationships do exist in the occurrence of flight delays, but also that certain perceptions may exist that need to be addressed. The study provides the groundwork for further research from an academic perspective. It also provides valuable information to assist companies in assessing and implementing policies to better manage corporate travel, and consequently to improve travel expenditure control.

CHAPTER 8

REFERENCES

- Abbot, L. 2007. MobileInfo's M-Commerce report. [Online] Available from: <http://www.mobileinfo.com/Mcommerce/index.htm> [Accessed: 2007-08-14]
- Abdelghany, K.F. & Shah, S.S. & Raina, S. & Abdelghany A.F. 2004. A model for projecting flight delays during irregular operation conditions. *Journal of Air Transport Management*, 10: 385 – 394.
- ACI. 2001. Slot allocation: the airport perspective. [Online] Available from: <http://www.aci-europe.org> [Accessed: 2008-10-12]
- ACI. 2002. ACI Europe's position on the legislative proposals for the creation of the Single European Sky. [Online] Available from: <http://www.aci-europe.org/upload/Establishment%20of%20a%20Single%20European%20Sky.pdf> [Accessed: 2008-10-12]
- ACI. 2003. Growing Concern over Slots Review. [Online] Available from: <http://www.aci-europe.org> [Accessed: 2008-10-12]
- ACI. 2006a. An action plan for airport capacity, efficiency and safety in Europe. [Online] Available from: http://www.aci-europe.org/upload/2006_communication_action_plan_en.pdf [Accessed: 2008-10-12]
- ACI. 2006b. Understanding Airport Business. [Online] Available from: <http://www.aci-europe.org> [Accessed: 2008-10-12]
- ACI. 2007a. Top 30 ACI Airports – International Passengers 2007. [Online] Available from: http://www.aci-europe.org/upload/TOP30_International%20Passengers_2007.pdf [Accessed: 2008-10-12]

ACI. 2007b. ACI Europe Position on Airport Charges. [Online] Available from: <http://www.aci-europe.org> [Accessed: 2008-10-12]

ACI. 2008a. Airports welcome record 4.8 billion passengers in 2007. [Online] Available from: http://www.airports.org/cda/aci_common/display/main/aci_content07_c.jsp?zn=aci&cp=1-5-54_666_2 [Accessed: 2008-10-03]

ACI. 2008b. Airports: Strong Growth in 2007, advise cautious outlook. Media Release. [Online] Available from: http://www.aci.aero/aci/aci/file/Press%20Releases/2008/PR_WATR2007_290708.pdf [Accessed: 2008-10-03]

ACI. 2008c. ACI Europe's Position of Airport Charges. [Online] Available from: <http://www.aci-europe.org/upload/ACI%20EUROPE%20Position%20on%20Airport%20Charges.pdf> [Accessed: 2008-10-12]

ACI. 2008d. Challenges of Growth 2008 Summary Report. [Online] Available from: <http://www.eurocontrol.int/statfor> [Accessed: 2009-01-12]

ACSA. 2008a. About ACSA - Company Profile. [Online] Available from: <http://www.acsa.co.za/home.asp?pid=53> [Accessed: 2008-07-12]

ACSA. 2008b. About ACSA – Group Structure. [Online] Available from: <http://www.acsa.co.za/home.asp?pid=57> [Accessed: 2008-07-12]

ACSA. 2008c. OR Tambo Developments. [Online] Available from: <http://www.acsa.co.za/home.asp?pid=65> [Accessed: 2008-07-12]

ACTE. 2009. ACTE Business travel survey shows stronger negative economic impact on global travel industry than expected. [Online]

<http://www.travelindustrywire.com/modules.php?op=modload&name=HNR&file=detail&sid=37025> [Accessed: 2009-02-10]

AhmadBeygi, S. & Cohn, A. & Guan, Y. & Belobaba, P. 2008. Analysis of the potential for delay propagation in passenger airline networks. *Journal of Air Transport Management*, 14: 221 – 236.

Alcatel. 2003. Alcatel's Solution for M-Commerce. [Online] Available from: http://www1.alcatel-lucent.com/doctypes/articlepaperlibrary/html/ATR2003Q4/ATR2003Q4A04_EN.html;jsessionid=FRFHTE1SAO5HDLAWFRSHJHFMCYWGQTN?_DARGS=/common/atr/DATR_table_of_contents.html_A&_DAV=/com/en/appxml/articlepaperlibrary/alcatelssolutionformcommercetcm17217791635.html [Accessed: 2008-11-12]

Applogix, 2006. Mobile Case Studies: Mobile Markets. [Online] Available from: <http://www.applogix.co.za/> [Accessed: 2007-08-15]

Armstrong, D. 2007. Virgin seeks to reduce its carbon emissions: airline orders lighter jets from Boeing, plans to test a form of biofuel next year. [Online] Available from: <http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2007/04/25/VIRGIN.TMP> [Accessed: 2007-06-02]

Ashford, N. & Stanton, H.P.M. & Moore, C.A. 1997. Airport Operations. Second Edition. United States: McGraw-Hill.

ATA. 2008. Cost of Delays. [Online] Available from: <http://www.airlines.org/economics/specialtopics/ATC+Delay+Cost.htm> [Accessed: 2009-02-21]

ATNS. 2008a. About Us: What we do. [Online] Available from: <http://www.atns.co.za/> [Accessed: 2008-07-12]

ATNS. 2008b. Product and Services: Air Traffic Management. [Online] Available from: <http://www.atns.co.za/> [Accessed: 2008-07-12]

ATNS. 2008c. Air Traffic and Navigation Services Annual Report 2007. [Online] Available from: <http://www.atns.co.za/> [Accessed: 2008-09-30]

ATNS. 2008d. AE Report August 2008. South Africa. ATNS

ATNS. 2008e. Average delay per delayed flight. South Africa. ATNS.

ATNS. 2009a. Air Traffic and Navigation Services Annual Report 2009. [Online] Available from: <http://www.atns.co.za/PDF/Performance/Annual%20Reports/ATNS%202009%20Annual%20Report.pdf> [Accessed: 2010-01-03]

ATNS. 2009b. Who we are. [Online] Available from: <http://www.atns.co.za/PDF/SlideShow/whoweare.pdf> [Accessed: 2010-01-03]

Aviation Consumer Protection Division. 2008. Coping With Flight Delays. [Online] Available from: <http://airconsumer.dot.gov/publications/delays.htm> [Accessed: 2009-06-07]

Aviation Weather. 2008. Another perfect African day for flying, volume 2: issue 1. [Online] Available from: http://aviation.weathersa.co.za/aviationold/Newsletter/AviationNewsVol2_I1.pdf [Accessed: 2007-08-15]

Bard, J.F. & Yu, G. ^ Argello, M. 2001. Optimizing aircraft routings in response to groundings and delays. IIE Transactions, 33: 931-947.

Bauer, S.D. 2000. Flight Delays: Causes and Costs to Passengers. Embry-Riddle Aeronautical University/Masters of Business Administration in Aviation.

BBC. 2007. EU plans airline CO2 reductions. The European Commission has recommended that airlines should be included in its carbon dioxide trading scheme. [Online] Available from: <http://news.bbc.co.uk/2/hi/europe/4287048.stm> [Accessed: 2007-06-01]

Bettini, H.F.A.J. & Oliveira, A.V.M. 2008. Airline capacity setting after re-regulation: The Brazilian case in the early 2000s. *Journal of Air Transport Management*, 14: 289 – 292.

Bhat, V.N. 1995. A multivariate analysis of airline flight delays. *International Journal of Quality and Reliability Management*, 12: 54-59.

BLS. 2008. Air Traffic Controllers. [Online] Available from: <http://www.bls.gov/oco/ocos108.htm> [Accessed: 2008-10-20]

Bogdan, R. & Taylor, S.J. 1975. *Introduction to Qualitative Research Methods*. New York: John Wiley & Sons.

Braun, A. 2004. Battle of the beds. *Business Travel Now*, January:10.

Brueckner, J. K. & E. Pels. 2003. Institutions, regulations and the revolution of European air transport. VU University Amsterdam, Faculty of Economics, Business Administration and Econometrics. [Online] Available from: <http://dare.ubvu.vu.nl/bitstream/1871/8908/1/20030010.pdf> [Accessed: 2009-01-20]

BTS. 2009. On-time performance: flight delays at a glance. [Online] Available from: <http://www.transtats.bts.gov/HomeDrillChart.asp> [Accessed: 2009-12-12].

Business Day. 2006. Cellphone theft becomes a case of blame the victim. *Business Day*, January. [Online] Available from: <http://mybroadband.co.za/nephp/?m=show&id=1782> [Accessed: 2009-01-20]

Button, K. & McDougall, G. 2006. Institutional and structure changes in air navigation service-providing organisations. *Journal of Air Transport Management*, 12: 236 – 252.

Cao, J.M. & Kanafani, A. 2000. The value of runway time slots for airlines. *European Journal of Operational Research*, 126:491 – 500.

Carlson Wagonlit Travel. 2003. What benefits do low-cost carriers really bring to business travel in Europe? [Online] Available from: http://www.carlsonwagonlit.com/white_papers/lowcosts.pdf [Accessed: 2004-06-10]

Carlson Wagonlit Travel. 2008. Our Company: What we do? [Online] Available from: http://www.carlsonwagonlit.com/en/global/our_company/ [Accessed: 2008-07-28]

Cellular. 2004. M-commerce. [Online] Available from: http://www.cellular.co.za/news_2004/dec/121204-qpass_study_finds_limited_first.htm [Accessed: 2009-01-03]

Chen, C-F. & Wu, T-F. 2009. Exploring passenger preferences in airline service attributes: A note. *Journal of Air Transport Management*, 15 (1): 52 – 53.

CIC Research, Inc. 2003. SIAT US to Overseas Tables. [Online] Available from: <http://www.cicresearch.com/newhome2/AviationAndAirlines/UsRes/Res-Tables.asp-25k> [Accessed: 2004-06-10]

City of Tshwane. 2006. City of Tshwane: Integrated Transport Plan 2006 – 2011. Chapter 9: Airport Development Proposals. [Online] Available from: <http://www.tshwane.gov.za/documents/ITP/Chapter3LandTransportStatusQuoPart4.pdf> [Accessed: 2008-11-03]

Civil Aviation Authority (CAA). 2006. Civil Aviation Authority Strategic Plan for 2006 to 2009. [Online] Available from: http://www.caa.co.za/CAA%20Info/CAA%20STRATEGIC%20PLAN_2006_2009.pdf [Accessed: 2009-01-03]

Civil Aviation Authority (CAA). 2009a. Chairman's Report. [Online] Available from: http://www.caa.co.za/publications_files/Corporate%20Publications/AR2005/index.html [Accessed: 2009-01-03]

Clarke, M.D.D. 1996. Development of Heuristic Procedures for Flight Rescheduling in the Aftermath of Irregular Airline Operations. *International Centre for Air Transportation*.

CNNMoney.com. 2007. Report: 42 years of flight delays in 2006. [Online] Available from: <http://money.cnn.com/2007/01/24/news/companies/airline?hearings/index.htm?postversion=2007012413> [Accessed: 2004-06-10]

Cochrane, K. & Mackenzie, J. 2004. A Budget Gamble. *Business Travel Now*, February:4-7.

Cooper, D.R. & Schindler, P.S. 2003. Business research methods. Singapore: McGraw-Hill/Irwin

Creotec, 2007. E-business terms. [Online] Available from: http://www.creotec.com/index.php?page=e-business_terms [Accessed: 2007-08-14]

Defence Web. 2009. Civil aviation authority eroding: DA. [Online] Available from: http://www.defenceweb.co.za/index.php?option=com_content&task=view&id=1197&Itemid=350 [Accessed: 2007-08-14]

Delta. 2007. Airline to off-set Carbon Emissions. [Online] Available from: <http://www.lifegoggles.com/?p=50> [Accessed: 2007-06-01]

Diaz, A.B.C. & Ruiz, F. J.M. 2004. The consumer's reaction to delays in service. *International Journal of Service Industry Management*, 13:118-140.

Doganis, R. 1991. Flying off course: The Economics of International Airlines. USA / Canada: Routledge.

Doganis, R. 2001. The airline business in the 21st century. USA / Canada: Routledge.

Doganis, R. 2006. *The airline business*. Second edition. USA / Canada: Routledge.

Douglas, A. 2005. *The development of a conceptual model for the effective management of corporate travel*. Department of Tourism Management / University of Pretoria.

Douglas, A. 2009. *A survey of corporate travellers in South Africa: towards a model for travel policy compliance*. Department of Tourism Management / University of Pretoria. [Online] Available from: <http://upetd.up.ac.za/thesis/available/etd-04012009-235957/> [Accessed: 2009-07-30]

DPE. 2009. *State Owned Enterprises – South African Airways (SAA)*. [Online] Available from: <http://www.dpe.gov.za/home.asp?id=406> [Accessed: 2009-01-03]

Duval, D.T. 2007. *Tourism and Transport: Modes, Networks and Flows*. Great Britain: Channel View Publications.

Duval, D.T. 2008. Regulation, competition and the politics of air access across the Pacific. *Journal of Air Transport Management*, 14: 237 – 242.

Emarketer. 2007. *The Occasional Internet*. [Online] Available from: http://www.emarketer.com/Articles/Print.aspx?1004885&src=print_article [Accessed: 2007-05-08]

Evangelho, F., Huse, C. & Linhares, A. 2005. Market entry of a low cost airline and impacts on the Brazilian business travellers. *Journal of Air Transport Management*, 11: 99 – 105,

FAA Air Traffic Organisation. 2007. *2007 Annual Performance Report. Focused on Excellence*. [Online] Available from: http://www.faa.gov/airports_airtraffic/air_traffic/publications/media/2007_ATO_AR_9.pdf [Accessed: 2009-01-18]

Fone Deals, 2007. Mobile Phone Jargon Buster. [Online] Available from: <http://www.fone-deals.co.uk/mobile-phone-jargon-buster.asp?X=l&Y=S> [Accessed: 2007-05-08]

Forbes, S.J. 2006. The effect of air traffic delays on airline prices. [Online] Available from: <http://weber.ucsd.edu/~sjanusze/www/airtrafficdelays.pdf> [Accessed: 2007-03-22]

Fourie, C. 2004. The propensity of business travellers to use low-cost airlines within South Africa. Department of Tourism Management / University of Pretoria.

Fourie, C & Lubbe, B. 2006. Determinants of selection of full-service airlines and low-cost carriers – a note on business travellers in South Africa. *Journal of Air Transport Management*, 12 (2): 98 - 102.

Foss, B. & Stone, M. 2001. Successful customer relationship marketing. [Online] Available from: <http://books.google.co.za/books?hl=en&lr=&id=D4KIS8KL3ioC&oi=fnd&pg=PR10&dq=Foss+%26+Stone,+2001+mobile+technology&ots=YBVKZmfGmu&sig=FhiYdXjdTnXHN79MzK1izoI8EuM#PPP1,M1> [Accessed: 2008-10-22]

Frost & Sullivan (Business Research & Consultancy Firm). 2006. Worlds Airports – Financial Evolution and Market Dynamics. [Online] Available from: <http://www.researchandmarkets.com/reports/c45811> [Accessed: 2008-08-15]

Givoni, M. & Rietveld, P. 2006. Choice of Aircraft Size – Explanations and Implications. *Department of Spatial Economics / Tinbergen Institute Discussion Paper*. [Online] Available from: <http://www.tinbergen.nl> [Accessed: 2008-08-15]

Graham, A. 2003. *Managing Airports*. Great Britain: Butterworth-Heinemann.

Gomes-Costa, I. & Birns, H. 2003. Zero commission not set in stone says SAA. *Travel Industry Review*, 95:1.

Gould, C. & Jackson, M. & Schnydel, R. & O'Donnell, J. 2006. Mapping the Mobile Landscape of Australia. Peer reviewed Journal on the Internet. *First Monday*, 11 (11). [Online] Available from: <http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/viewArticle/1414/1332> [Accessed: 2008-11-15]

Gronau, R. 1970. The value of time in passenger transportation: the demand for air travel. Occasional Paper 109. New York: Columbia University Press.

Hanlon, P. 1999. Global Airlines: Competition in a transnational industry. Second Edition. Great Britain: Butterworth-Heinemann.

Hill, M. 2007. OR Tambo passenger volumes may rise 28 % by 2010. ? [Online] Available from: http://www.engineeringnews.co.za/article.php?a_id=105600 [Accessed: 2007-11-02]

Horonjeff, R. & McKelvey, F.X. 1994. Planning and Design of Airports. Fourth Edition. United States: McGraw-Hill.

Hotelmarketing.com. 2007. What causes the most trouble when you travel? [Online] Available from: http://www.hotelmarketing.com/index.php/content/print/070410_what_causes_the_most_trouble_when_you_travel/ [Accessed: 2007-04-10]

House of the Oireachtas. Consumer Protection Act 2007. [Online] <http://www.oireachtas.ie/documents/bills28/acts/2007/a1907.pdf> Available from: [Accessed: 2008-12-10]

iafrica. 2007. Airlines 'not worst' polluters. [Online] Available from: <http://travel.iafrica.com/flights/838275.htm> [Accessed: 2007-06-02]

IATA (International Air Transport Association). 2008. 2007 Total Passenger Traffic Results. [Online] Available from: <http://www.iata.org/ps/publications/2007-results.htm> [Accessed: 2008-10-03]

IATA (International Air Transport Association). 2007. IATA Economic Briefing: Passenger and Freight Forecasts 2007 to 2011. [Online] Available from: http://www.iata.org/NR/rdonlyres/E0EEDB73-EA00-494E-9408-2B83AFF33A7D/0/traffic_forecast_2007_2011.pdf [Accessed: 2008-09-21]

ICAO (International Civil Aviation Organisation). 2007. Aviation Safety. [Online] Available <http://www.icao.int/anb/FLS/icaosafety.html> [Accessed: 2008-09-27]

ICAO (International Civil Aviation Organisation). 2008a. History of international civil aviation. [Online] Available from: http://www.icao.int/icao/en/m_about.html [Accessed: 2008-09-27]

ICAO (International Civil Aviation Organisation). 2008b. List of Government-owned and privatized airlines (unofficial preliminary compilation. [Online] Available from: <http://www.icao.int/icao/en/atb/epm/ecp/PrivatizedAirlines.pdf> [Accessed: 2008-09-27]

Isadore, C. 2007. Senators fly idea of airline re-registration. [Online] Available from: <http://money.cnn.com/2007/01/24/news/companies/airline?hearings/index.htm?postversion=2007012413> [Accessed: 2007-08-19]

Janic, M. 2005. Modelling Airport Congestion Charges. *Transportation Planning and Technology*, 28 (1): 1 – 26.

Jankovec, O. 2007. How to Address the Capacity Challenge? [Online] Available from: [http://www.aci-europe.org/upload/Aviation%20club%20Draft%204%20\[Lecture%20seule\].pdf](http://www.aci-europe.org/upload/Aviation%20club%20Draft%204%20[Lecture%20seule].pdf) [Accessed: 2008-11-10]

Johnson, T. & Savage, I. 2006. Departure delays, the pricing of congestion, and expansion proposals at Chicago O'Hare Airport. *Journal of Air Transport Management* 12:182 – 190.

Jonas, D. 2004. Special report: Annual airline survey. [Online] Available from: http://www.btnmag.com/businesstravelnews/images/pdf/btn_annualairlinesurvey_04.pdf [Accessed: 2008-11-10]

Kane, R.M. 1996. Air Transportation. Twelfth Edition. United States: Kendall/Hunt Publishing Company.

Kazda, A. & Caves, R.E. 2000. Airport design and operation. Netherlands: Pergamon.

Keller, G & Warrack, B. 2000. Statistics for management and economics. Fifth Edition. United States of America: Brooks/Cole.

Kjelgaard, C. 2007. Next gen air technology to tackle flight delays. [Online] Available from: http://www.msnbc.msn.com/id/19227152/ns/business-future_of_business/ [Accessed: 2008-05-05]

Knowler, W. 2008. Air Travel Woes. [Online] Available from: http://www.iol.co.za/index.php?set_id=1&click_id=13&art_id=vn20080505053512669C111567 [Accessed: 2008-05-05]

Koetting, M. & Gillespie, S. 2004. Dispelling the Myths for Effective Airline Negotiations. *Business Travel Now*, 21(1): 11-12.

kulula.com. 2008. Routes flown. [Online] Available from: www.kulula.com [Accessed: 2008-07-19]

Lan, S. & Clarke, J.P. & Barnhart, C. 2006. Planning for Robust Airline Operations: Optimizing Aircraft Routings and Flight Departure Times to Minimize Passenger Disruptions. *Transportation Science*, 40:15-28.

Louviere, J.J. 2004. Random Utility Theory-Based Stated Preference Elicitation Methods: Applications in Health Economics with Special Preference to Combining Sources of Preference Data. Centre for the Study of Choice (CenSoC) Working Paper No. 04-001.

[Online] Available from: <http://www.business.uts.edu.au/censoc/papers/wp04001.pdf>

[Accessed: 2009-01-02]

Lubbe, B.A. 2000. *Tourism Distribution: Managing the Travel Intermediary*. Cape Town: Juta

Lubbe, B.A. 2003a. An investigation into the Current Status of Corporate Travel Management in South African and the Use of Online and Wireless Technologies by Corporate Travellers. South Africa: Department of Tourism Management/University of Pretoria.

Lubbe, B.A. 2003b. A study of corporate travel management in selected South African organisations and a Conceptual model for effective corporate travel management. *Research Report*. South Africa. Department of Tourism Management / University of Pretoria.

Lubbe, B.A. 2008. TBE 320 – The role of airports 2008. *Course material*. South Africa. Department of Tourism Management / University of Pretoria.

Makgale, S. 2008. Ground-handling change-over to BidAir and Menzies a success. [Online] Available from: <http://www.acsa.co.za/home.asp?pid=94&toolid=2&ItemID=4722> [Accessed: 2008-07-12]

Martin-Cejas, R.R. 2006. Tourism service quality begins at the airport. *Tourism Management*, 27(5): 874 – 877.

Marx, M. 2003. E-ticket...eish! *Business Travel Now*, November:4-6.

Marx, M. 2004. Through the telescope. *Business Travel Now*, December/January:8-9.

Mason, K.J. 2000. The propensity of business travellers to use low cost airlines. *Journal of Transport Geography*, 8:107-113.

Mason, K.J. 2001. Marketing low-cost airline services to business travellers. *Journal of Air Transport Management*, 7: 103 – 109.

May, J.C. 2007. Airline Service Improvements: Statement of James, C. May, President and CEO of Air Transport Association of America, Inc. before the Senate Committee on Commerce, Science and Transportation – 11 April 2007. [Online] Available from: <http://www.airlines.org/government/testimony/2007/ATA+Testimony+-+President+and+CEO+Jim+May+on+Customer+Service+Improvements.htm> [Accessed: 2009-02-01]

May, P. 2002. Mobile Commerce. Opportunities, applications and technologies of wireless business. First Edition. Cambridge University Press.

Mayer, C. & Sinai, T. 2003. Network effects, congestion externalities, and air traffic delays: or why all delays are not evil. *American Economic Review*, 93 (4): 1194 – 1215.

Mazzeo, M.J. 2003. Competition and Service Quality in the U.S. Airline Industry. *Review of Industrial Organisation*, 22(4), 275-296.

Merchant Seek. 2007. Glossary. [Online] Available from: <http://www.merchantseek.com/glossary.htm> [Accessed: 2007-08-14]

Microsoft Visual Studio.net. 2003. Leading Airline Enhances the Customer Experience with Mobile Access. [Online] Available from: <http://www.microsoft.com/netframework/> [Accessed: 2007-05-23]

MIT. 2003. Massachusetts Institute of Technology. Airline Operations: Lecture 1 and 2. [Online] Available from: http://ocw.mit.edu/NR/rdonlyres/Civil-and-Environmental-Engineering/1-206JAirline-Schedule-PlanningSpring2003/582393E6-2CA6-4CC1-AE66-1DAF34A723EA/0/lec11_aop1.pdf [Accessed: 2009-03-10]

MobileInfo.com. 2006. M-Commerce. [Online] Available from: <http://www.mobileinfo.com/mcommerce/differences.htm> [Accessed: 2009-01-14]

MTrvl. 2008. Mobile Travel Aid. [Online] Available from:
<http://www.mtrvl.com/?gclid=CKOH9bStlpICFRkR1Aodul5WMg> [Accessed: 2008-03-18]

Muller, C. & Santana, E.S.M. 2008. Analysis of flight operating costs and delays: The Sao Paulo terminal maneuvering area. *Journal of Air Transport Management*, 14: 294 - 296.

National Consumer Agency. 2007. Consumer Protection Act 2007. Putting Consumers First. [Online] Available from:
http://www.consumerconnect.ie/eng/Get_Your_Rights/Consumer_Protection_Act_guide.pdf
[Accessed: 2008-12-04]

Nolan, M.S. 1994. Fundamentals of Air Traffic Control. Second Edition. United States: International Thomson Publishing.

Okazaki, S. 2006. New perspectives on m-commerce research. College of Economics and Business Administration. Autonomous University of Madrid, Spain. [Online] Available from:
<http://www.csulb.edu/journals/jecr/issues/20053/paper0.pdf> [Accessed: 2009-01-03]

OFT. 2006. Office of Fair Trading. The EU Regulation on Consumer Protection Cooperation (the CPC) – on site inspection powers.

Pazgal, A. & Seetharaman, P.B. & Batsell. 2005. Incorporating Probabilistic Choice Rules within the Random Utility Models of Brand Choice: Theory and Empirical Illustration. [Online] Available from: <http://www.ruf.rice.edu/~seethu/incorporatingprobablistic1105.pdf> [Accessed: 2009-01-02]

Philips. 2009. Company Profile. [Online] Available from:
<http://www.philips.co.za/about/company/local/index.page> [Accessed: 2009-07-03]

Prussaloglou, K. & Koppelman, F. 1995. Air carrier demand: an analysis of market share determinants. *Transportation*, 22: 371 – 388.

Ratcliff, S. 2008. Verbal communication with Stuart Ratcliff. Johannesburg / Holiday Inn.

Radebe, J. 2006. Airlines and Air Transport Africa 2006. [Online] Available from: http://www.polity.org.za/article.php?a_id=92456 [Accessed: 2008-09-30]

Riley, G. 2003. The European airline Market. [Online] Available from: http://www.tutor2u.net/Case_Study_European_Airlines.pdf [Accessed: 2008-09-01]

RITA (Research and Innovative Technology Administration). Bureau of Transportation Statistics. [Online] Available from: http://www.transtats.bts.gov/OT_Delay/ot_delaycause1.asp?type=21&pn=1 [Accessed: 2009-02-01]

Rosenberger, J.M. & Schaefer, A.J. & Goldsman, D. & Johnson, E.L. & Kleywegt, A.J. & Nemhauser, G.L. 2000. Simair; A Stochastic Model of Airline Operations. Georgia Institute of Technology. [Online] Available from: <http://www2.isye.gatech.edu/~anton/SimAir.pdf> [Accessed: 2008-11-02]

Rupp, N.G., Owens, D. & Plumly, L.W. 2001. Does Competition Influence Airline On-time Performance. [Online] Available from: <http://www.ecu.edu/cs-educ/econ/upload/ecu0115.pdf> [Accessed: 2009-12-01]

Sa2010. 2006. Africa's time has come! South Africa is ready. [Online] Available from: http://www.sa2010.gov.za/news/presentation/2010_booklet.pdf [Accessed: 2007-11-02]

SA Department of Transport. 2006. Airlift Strategy 2006. [Online] Available from: <http://www.transport.gov.za/library/docs/airstr/part1.pdf> [Accessed: 2008-09-30]

SA Info. 2008a. SA hits 9 million mark. [Online] Available from: <http://www.southafrica.info/travel/tourism-2007.htm> [Accessed: 2008-11-01]

SA Info. 2008b. South Africa's transport network. [Online] Available from: <http://www.southafrica.info/business/economy/infrastructure/transport.htm> [Accessed: 2008-11-01]

SA Online. 2008. About SA – Transport. [Online] Available from: http://www.southafrica.co.za/transport_91.html [Accessed: 2008-09-01]

Sarmadi, S. 2004. Minimizing Airline Passenger Delay through Integrated Flight Scheduling and Aircraft Routing. Massachusetts Institute of Technology Library. [Online] Available from: <http://dspace.mit.edu/bitstream/handle/1721.1/29401/56132667.pdf?sequence=1> [Accessed: 2009-05-10]

SA Tourism. 2008a. Annual Report 2007. [Online] Available from: <http://www2.southafrica.net:80/satourism/research/viewResearchDocument.cfm?ResearchDocumentID=477> [Accessed: 2009-01-17]

SA Tourism. 2008b. 10 Quick Facts about Business Tourism in SA. [Online] Available from: <http://www1.southafrica.net/Cultures/en-US/bt.southafrica.net/About+Business+Tourism/10+Quick+Facts+about+Business+Tourism+in+SA.htm> [Accessed: 2009-01-17]

Savage, I. & Scott, B. 2004. Deploying regional jets to add new spokes to a hub. *Journal of Air Transport Management*, 10:147 – 150.

SAWS. 2009. Aeronautical Meteorological Services. [Online] Available from: <http://aviation.weathersa.co.za/webcams/> [Accessed: 2007-11-02]

Search Mobile Computing. 2003. SearchMobileComputing.com Definitions: M-Commerce. [Online] Available from: http://searchmobilecomputing.techtarget.com/sDefinition/0,,sid40_gci214590,00.html [Accessed: 2004-08-14]

SITA. 2009. What we do. [Online] Available from: <http://www.sita.aero/about-sita/what-we-do>
[Accessed: 2009-07-02]

SITA. 2008a. How mobile technology will enhance passenger travel. White paper. [Online] Available from: http://www.appearnetworks.com/IMG/pdf/SITA_White_Paper_Digital_Traveller.pdf
[Accessed: 2009-07-02]

SITA. 2008b. Airline IT Trends Survey 2008. [Online] Available from: <http://www.sita.aero/content/airline-it-trends-survey-2008> [Accessed: 2009-07-02]

Skyguide. 2005. Delays: Limited responsibility of air traffic control. [Online] Available from: http://www.skyguide.ch/en/Dossiers/Dossier_Delays/Factsheet_Delays_2005_06_08_e.pdf
[Accessed: 2008-07-20]

smh.com. 2007. Delays, lost luggage, complaints soar for US airlines. [Online] Available from: <http://www.smh.com.au/news/news/delays-lost-luggage-complaints-soar-in-us/2007/08/08/1186530410838.html> [Accessed: 2008-10-22]

Smith, P. 2008. Airport congestion and flight delays are making travellers insane: A look at what will and won't solve the problem. [Online] Available from: <http://www.salon.com/tech/col/smith/2007/10/05/askthepilot248/index1.html> [Accessed: 2008-07-20]

Smuts, C.A. & Brits, A. 1999. Air Transport: Study guide for TRL303-6. Department of Transport Economics and Logistics/UNISA.

South African Consulate General. 2008. Transportation. [Online] Available from: <http://www.southafrica-newyork.net/consulate/transport.htm> [Accessed: 2008-11-02]

Spadavecchia, O. 2007. OR Tambo development programme progressing to Schedule. [Online] Available from: http://www.engineeringnews.co.za/article.php?a_id=105959
[Accessed: 2007-11-02]

Sridhar, M.S. 2004. Research Methodology Part 3: Research Design and Plan. [Online] Available from: <http://www.scribd.com/doc/1016595/Research-Methodology-Part-3-Research-Design-Plan> [Accessed: 2009-11-20]

Stander, W. 2008. Verbal Communication with the author on 25 March 2008. Johannesburg/ATNS Head Office. (Notes in possession of the author)

Steinbock, D. 2005. The Mobile Revolution: The making of mobile services worldwide. [Online] Available from: http://books.google.co.za/books?id=cUQ1y4iNrGcC&pg=PA259&lpg=PA259&dq=The+value+chain+of+flight+delays&source=web&ots=B6X7gj_c1S&sig=o5IUJLNGmUVv2C5DZkzX8Whgmxg&hl=en#PPA263,M1 [Accessed: 2008-09-02]

Sulzmaier, S. 2001. Consumer-Oriented Business Design: The Case of Airport Management. Physica-Verlag. [Online] Available from: http://books.google.co.za/books?id=fiJxAbd2VjMC&pg=PA1&lpg=PA1&dq=Hierarchical+system+of+airport+relationships%3B+Ashford+diagram&source=web&ots=GOdgqfNrg&sig=6zihuLPHFgJOz8R5xbyfv0Yig20&hl=en&sa=X&oi=book_result&resnum=4&ct=result#PPP1,M1 [Accessed: 2008-09-25]

Suzuki, Y. 2000. The relationship between on-time performance and airline market share: a new approach. *Transportation Research Part E: Logistics and Transportation Review*, 36 (2): 139 – 154.

Suzuki, Y. 2004. The impact of Airline Service Failures on Travelers' Carrier Choice: A Case Study of Central Iowa. *Transportation Journal*, 26-37. [Accessed: 2007-02-06]

Swarbrooke, J. & Horner, S. 2001. Business Travel and Tourism. Oxford: Butterworth-Heinemann.

The Boyd Group, Inc. 2008. The Real Cause of Airline Flight Delays. [Online] Available

from: <http://www.aviationplanning.com/ATCFaliures.htm> [Accessed: 2004-04-30]

The Travel Insider. 2008. The Weakest Link. [Online] Available from: <http://www.thetravelinsider.info/23nov01.htm> [Accessed: 2008-07-20]

Travel Industry Association. 2003. Archive. [Online] Available from: <http://tinet.ita.doc.gov> [Accessed: 2004-04-30].

Travelmole. 2007. Flights hit record high. [Online] Available from: http://www.travelmole.com/printable.php?news_id=1118052 [Accessed: 2007-05-13]

Travelport. 2003. What business travellers want. [Online] Available from: http://www.travelmole.com/printable.php?news_id=98854 [Accessed: 2004-05-20]

Tyler, C. 2000. Ticketing and distribution in the airline industry. *Travel and Tourism Analyst*, 2: 83 – 105.

UK Department of Transport. 2003. Transport Analysis Guide. [Online] Available from: <http://www.dft.gov.uk/webtag/documents/expert/unit3.5.6.php> [Accessed: 2009-09-15]

UNESCAP. 2003. Review of Developments in Transport in the ESCAP Region. [Online] Available from: <http://www.unescap.org/publications/detail.asp?id=972> [Accessed: 2008-09-15]

Uniglobe Travel. 2004. The T&E Policy issues. *Business Travel Now*, October: 3.

UN World Trade Organisation (UNWTO). 2008. Tourism Highlights: 2008 edition. [Online] Available from: <http://www.unwto.org> [Accessed: 2009-08-11]

Van der Merwe, C. 2008. ACSA's new ground-handling operators commit to improved service delivery. [Online] Available from: http://www.engineeringnews.co.za/article.php?a_id=127760 [Accessed: 2008-07-12]

Wells, A.T. & Young, S.B. 2004. Airport Planning and Management. McGraw-Hill.

Wie, J. & Ozok, A. 2005. Development of a web-based mobile airline ticketing model with usability features. *Industrial Management & Data Systems*, 105: 1261 – 1277.

Wikipedia. 2009a. South African Weather Service. [Online] Available from: http://en.wikipedia.org/wiki/South_African_Weather_Service [Accessed: 2009-02-17]

Wikipedia. 2009b. Weather Radar. [Online] Available from: http://en.wikipedia.org/wiki/Weather_radar [Accessed: 2009-02-17]

Wikipedia. 2008. Mobile Ticketing. [Online] Available from: http://en.wikipedia.org/wiki/Mobile_ticketing [Accessed: 2009-08-03]

Wikipedia. 2007a. Mobile Commerce. [Online] Available from: <http://en.wikipedia.org/wiki/M-commerce> [Accessed: 2008-08-14]

Wikipedia. 2007b. Mobile Ticketing. [Online] Available from: http://en.wikipedia.org/wiki/Mobile_ticketing [Accessed: 2008-08-14]

Wilber, DQ. 2006. Like Clockwork: Hour of delay, Hour of flight. [Online] Available from: http://www.washingtonpost.com/wp-dyn/content/article/2006/11/12/AR2006111200972_2html [Accessed: 2008-07-18]

Wittmer, A. & Laesser, C. 2008. Customer issues related to limited air connectivity. *Journal of Air Transport Management* :1 – 3.

WTTC. 2008. The 2008 Travel & Tourism Economic Research Executive Summary. [Online] Available from: http://www.wttc.org/bin/pdf/original_pdf_file/exec_summary_final.pdf [Accessed: 2009-09-11]

Wu, C-L & Caves, R.E. 2003. Flight schedule punctuality control and management: A stochastic approach. *Transportation Planning and Technology*, 26 (4): 313-330.

Yoon, M.G. & Yoon, D.Y. & Yang, T.W. 2006. Impact of e-business on air travel markets: Distribution of airline tickets in Korea. *Journal of Air Transport Management* 12: 253 – 260.



APPENDIX A
- Philips Survey -

PHILIPS SURVEY

VALUE OF TIME ANALYSIS

QUESTIONS:

- 1) What is the level of seniority of most of your travellers?
(Tick most appropriate option. For online survey, highlight in red)
- Senior Level Management / **Middle Level Management** / Lower level Employee
- 2) What percentage would you attribute to each level of travellers?
- Senior Level Management : ___ 35 ___ %
- Middle Level Management : ___ 55 ___ %
- Lower Level Employees : ___ 10 ___ %
- 3) Please indicate, in your opinion, the estimated industry value of time (per hour in rand) for each level?
- Senior Level Management : ___ 10000 ___ Rand per **day**
- Middle Level Management : ___ 7500 ___ Rand per **day**
- Lower Level Employees : ___ 5000 ___ Rand per **day**

This information will only be used in the fulfilment of my MCom study in Tourism Management at the University of Pretoria under the supervision of Prof. Berendien Lubbe.

Purpose of information: to calculate the monetary cost resulting from flight delays to corporate travellers of a specific company, in South Africa.

For any enquiries related to the above questions or the Masters study in general, please contact either myself, Colette Victor, on colettef@lantic.net or Prof. Lubbe on berendien.lubbe@up.ac.za

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