AIRPORT INFRASTRUCTURE AND REGIONAL DEVELOPMENT: A CASE FOR RESURRECTING THE GROWTH POLE CONCEPT

by

Michael A. Crockatt

A Thesis submitted to the Faculty of Graduate Studies in
Partial Fulfillment of the Requirement for the Degree of

Master of Arts

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THE UNIVERSITY OF MANITOBA

FACULTY OF GRADUATE STUDIES

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ABSTRACT

Industry tends to locate near transportation centres, transforming the latter into magnets of development. Airports are becoming as important as seaports in this role of attracting economic development. National and regional economic development requires transportation infrastructure. Infrastructure may not directly result in development, but the fact remains that it is a prerequisite for any sustained economic development.

Growth poles are a geographic/economic phenomenon, sometimes planned to encourage regional development, but sometimes occurring naturally in a region. A growth pole is a spatial agglomeration of firms that expand, inducing economic development in the surrounding region. Growth poles, too, require transportation infrastructure to be effective. This study argues the case for cargo-based airports as growth poles. With the continued expansion of global air cargo, airports are being planned to encourage airport-related regional development. Three successful cargo-based growth pole airports in the United States are Fort Worth Alliance Airport (Fort Worth, TX), Dallas/Fort Worth International Airport (Dallas-Fort Worth, TX), and Huntsville International Airport (Huntsville, AL): all of which are examined in this thesis.

Winnipeg is frequently touted as being an excellent cargo airport, with the potential to act as a growth pole for its region. This study assesses whether Winnipeg International Airport can have the same impact regionally as the case studies in the United States. In order to address the issue, extensive use is made of qualitative data collection, in the form of interviews, surveys, and personal observations, and statistical analysis. The results expose some fundamental differences between Winnipeg and its counterparts in the United States. However, they also show that Winnipeg has many of the requisite characteristics and competitive advantages to become a successful cargo-based growth pole airport.

A set of policy recommendations is made, targeted at the Winnipeg Airports Authority, the City of Winnipeg, the Province of Manitoba, and the Rural Municipality of Rosser. The status quo of airport business park development is inadequate to effect any real change in the regional economy. If Winnipeg is to compete on a national and global scale, it must adopt a more aggressive developmental strategy for airport business park development.

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LIST OF ABBREVATIONS

ACI.....Airports Council International
AEI.....Area of Economic Influence
AFW.....Fort Worth Alliance Airport
ANOVA.....Analysis of Variance (statistical analysis)
ARC.....Appalachian Regional Commission
ARDA.....Appalachian Regional Development Act
AusCID.....Australian Council for Infrastructure Development
CAB.....Civil Aeronautics Board
CAC.....Canadian Airports Council
CFB.....Canadian Forces Base
CN.....Canadian National Railway
CP.....Canadian Pacific Railway
CPAR.....Cargo-Passenger Activity Ratio
CRP.....Cummings Research Park
DAL.....Dallas Love Field Airport
DART.....Dallas Area Rapid Transit
DEA.....Drug Enforcement Agency
DFW.....Dallas/Fort Worth International Airport
EDA.....Economic Development Agency
EDW.....Economic Development Winnipeg
EI.....Economic Impact
EPZ.....Export Processing Zone
FAA.....Federal Aviation Administration
FBO.....Fixed Base Operator
FTW.....Fort Worth Meacham International Airport
FTZ.....Foreign Trade Zone
GA.....General Aviation
HSV.....Huntsville International Airport
IATA.....International Air Transport Association
ITPC.....International Trade Processing Center
JIT.....Just In Time
KCS.....Kansas City Southern Railroad
LHR.....London Heathrow Airport
MSFC.....Marshall Space Flight Center
MSP.....Minneapolis-St. Paul International Airport
NAFTA.....North American Free Trade Agreement
NAS.....National Airport System
NASA.....National Aeronautics and Space Administration
NCTCOG.....North Central Texas Council of Governments
NH-NP.....Non-Hub, Non-Primary Airport
NTC.....North Texas Commission
PWEDA.....Public Works and Economic Development Act
RG.....Richards-Gebaur Airport
RM.....Rural Municipality

SEZ .....Special Economic Zone
TTI .....Texas Transportation Institute
UPS .....United Parcel Service
USHUD.....United States Department of Housing and Urban Development
VISTAS.....Vancouver International Strategic Services Ltd.
WAA .....Winnipeg Airports Authority
WALCO.....Winnipeg Airport Lands Corporation
YEG .....Edmonton International Airport
YHM .....Hamilton International Airport
YMX .....Montreal Mirabel International Airport
YUL .....Montreal Dorval International Airport
YVR.....Vancouver International Airport
YWG.....Winnipeg International Airport
YYC .....Calgary International Airport

GLOSSARY

Belly Cargo

Air cargo that is carried in the cargo hold of passenger aircraft. Takes advantage of existing international routes for passenger airlines, especially when not enough cargo exists to fill a regularly scheduled freighter aircraft. Belly cargo provides incremental revenue flows for passenger-focused airlines.

Foreign Trade Zone

A specially-designated area enabling firms to save on costs associated with storage, shipping, customs and duty.

Freight Forwarder

Independent business managing cargo shipments in exchange for compensation.

Growth Pole

A geographic location around which investment and/or economic development are centred.

Integrator

A door-to-door package delivery company, incorporating ground and air transportation services, specializing in overnight and time-definite deliveries. Examples include Purolator Courier in Canada and Federal Express and United Parcel Service in the United States.

Intermodal

Movement of goods by more than one mode of transport.

CHAPTER 1 – AIRPORTS AS GROWTH POLES

1.1 – Introduction

Historically, industry has tended to locate near transportation gateways and hubs. From traditional clusters of industry around seaports and along roadways, to more recent developments near intermodal rail terminals and airports, centres of transportation have always been attractive to firms. "This tendency of industry to concentrate in transportation hubs has been the primary cause for the rapid growth of cities" (FAA 1965, p.5). Many cities, regions and countries have taken advantage of this propensity by attempting to use transportation hubs as centres around which economic growth can flourish. Because of the multitude of such development centres, increasing importance has been placed on the presence of more than one mode of transportation. To gain an advantage over the numerous locations with road-sea, road-air or road-rail infrastructure, some hubs develop three or more modes of transportation.

This thesis focuses on airports – and any other transportation infrastructure located at airports – as growth poles. The aim of this study is to understand the locational forces acting on industrial and commercial firms located near these airports. The rationale accounting for movement of firms to a particular airport identifies these forces most clearly.

The primary objective of this study is to answer the question:

How can a location reach the critical mass for a cargo-based growth pole airport?

It is necessary to define the terms in the primary objective as they are used throughout this thesis. The term *critical mass* refers to the minimum agglomeration of industry at an

airport so that firms do not need to be enticed to locate there by any means other than the advantages that will accrue to them by choosing that location.[1]

For this study, *agglomeration* refers to the spatial concentration of firms leading to collective benefits for firms located close together. These benefits – called *agglomeration economies* – are gained by firms due to the operation of other firms (Todd 1995a). Normally, the location of minimum transport cost is found to be the point of minimum total cost for industrial location. However, agglomeration may make the point of lowest total cost differ from the point of lowest transport cost (Weber 1909). Agglomeration economies are further examined in Section 1.5.

Some airports considered in this study are primarily *cargo-based* and some are primarily passenger-based, but air cargo plays an important role for each. Because air cargo is an important factor in terms of airport development, the main airports included in this study are deemed to be cargo-based.

The term *growth pole* is more difficult to define because it has been given many different meanings over the past four decades.[2] A growth pole can be considered to be a region consisting of many countries with strong economies. For instance, Das (1997) referred to the Asia-Pacific region as the third growth pole of the global economy.[3] In geography and economics, a growth pole is better defined "a spatial agglomeration of related industries, located in an urban centre, which, through their expansion, induce growth in its surrounding hinterland" (Boudeville 1966).[4] The growth pole concept is further discussed in Section 1.5 and in Chapter 2.

The secondary objective of this study is to assess the importance of the factors that may lead to a successful growth pole, including:

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[1] Critical mass can be defined as "a size, number, or amount large enough to produce a particular result" (Miriam-Webster, February 1999).
[2] Todd (1974) wrote of "misconceptions arising from variations in terminology" about growth poles. Parr (1973) discussed the ambiguity surrounding the term.
[3] This reference was made prior to the onset of the recent "Asian flu" during which many strong Asian economies entered recessions.

- expansion of airport-related companies;
- the value-added by airport-related manufacturing companies;
- employment generated by airport-related companies;
- cooperation between the airport, industry, and government (including incentives and abatements);
- the critical nature of a third transportation mode (rail or sea); and
- the take-off point for the airport growth pole.

The first five factors above measure the *critical mass* for an airport growth pole. The final factor – the take-off point – connotes that critical mass. It is this point, or this amount of agglomeration, that has policy implications for the planning of a cargo-based airport growth pole.

This thesis determines the hierarchy of factors influencing the locational decisions made by firms. Companies are asked to assess whether or not the airport in question has lived up to expectations.

The scope and goals of this thesis are as follows:

1. Review the relevant literature with respect to transportation infrastructure, growth poles and economic development.
2. Examine three case-study airports that have successfully attracted industry and have had a positive effect on regional economic development.
3. Identify the characteristics and factors that have contributed to the success of these airports.
4. Determine if the success of these airports can be replicated elsewhere.
5. Assess the potential of a specific location to replicate the success of the three case-study airports.
6. Recommend a developmental path to achieve success.

[4] Miyoshi (1997) provides several similar descriptions of growth poles.

Four airports have been chosen as case studies (see Figure 1.1). The first three airports have already been successful at attracting industry. The fourth airport's potential for similar success is assessed. The official three-letter abbreviations follow each airport's name and are used throughout this thesis:

- Alliance Airport in Fort Worth, Texas (AFW);
- Dallas-Fort Worth International Airport in Texas (DFW);
- Huntsville International Airport in Alabama (HSV); and
- Winnipeg International Airport in Manitoba (YWG).

Figure 1.1 – Airport Case Studies

This study determines the set of circumstances that must exist and steps that must be taken in order to achieve success in economic development near airports. This information is valuable to airport authorities wishing to develop or better manage nearby industrial growth and to business executives considering airport location opportunities. Government officials can also gain new knowledge regarding economic development near airports that can be used for regional development planning and zoning, and infrastructure planning.

1.2 – Justification of the Study

By determining the critical mass for establishing a cargo-based airport as a growth pole, the nature of the airport hinterland can be better understood. Knowledge gained from this study can aid land-use planning around airports. This is an extremely important issue for airport authorities and local governments. Such organizations can use this study's findings as the basis for development surrounding airports.

The impetus for the study was the air cargo and land development initiative at Winnipeg International Airport, including Winnport.[5] With part of the airport's future planning including a business park and foreign trade zone adjacent to the airport, industrial location relative to the airport gained importance. Questions arose as to whether industrial and commercial firms would be willing to relocate on the currently underdeveloped west side of the airport and whether the airport – transferred in 1997 from Transport Canada to the private non-profit Winnipeg Airports Authority (WAA) – could attract businesses from other communities to locate in this business park. This study considers cases (DFW, AFW, and HSV) where an airport has been successful in attracting firms to adjacent land areas and attempts to infer from these experiences what might be in store for the likes of Winnipeg.

Besides Winnipeg, however, this study's results should be valuable for other airports. For instance, privatized Canadian airports are in direct competition with each other and with American airports for passenger and cargo service. Learning the key elements necessary to becoming a cargo-based growth pole airport would be valuable for airports such as:

- Vancouver International Airport;
- Calgary International Airport;
- Hamilton International Airport (TradePort Corporation); and
- Montreal's Mirabel Airport (see Figure 1.2).

[5] While Winnport has been an important part of this initiative, it has not been the only component. The Winnipeg Airports Authority has now taken a lead role in growing the air cargo industry at the airport and has established a subsidiary corporation to market and develop land on the west side of the airport – the Winnipeg Airport Lands Corporation.

Figure 1.2 – Potential Cargo-Based Growth Pole Airports, Canada

Knowing what factors give one airport an edge over its competitors may help that airport be more successful as a growth pole. Airport trying to become growth poles need to know if it is possible to replicate the success of other locations. If it *is* possible, then identifying the developmental stages en route to becoming a growth pole – what this study attempts to do – will help such airports.

Impressive growth has been forecast for both airline passenger and air cargo activity. Robart (1995) estimated that the number of air travel enplanements will have increased from 450 million passengers in 1992 to 800 million by 2000, an annual growth rate of around 7.5 percent. The International Air Transport Association (IATA, January 2000) and Boeing (May 1999) forecast passenger traffic to grow by about 5 percent between 1999 and 2003. The aircraft manufacturing company, Boeing, is well respected industry-wide for its passenger and air cargo forecasts. Most recently, Boeing has predicted an average annual growth rate of 6.4 percent in air cargo volume over the next twenty years (Boeing, February 2000). Tretheway and Ouimet (1999) note that air transport is currently growing at twice the rate of the world economy.[6] These numbers express the increasingly important role that airports have in both the global and local economies. The next section provides a closer look at airports.

[6] Specifically, air cargo is growing at three times global economic growth (Tretheway and Ouimet 1999).

1.3 – Classification of Airports

The regional impacts of large airports have revolved around the fact that they:

- are users of large amounts of land;
- have large work-forces with dependent families;
- are vital parts of the transportation network;
- require large investment in public infrastructure;

and that they are attractive to:

- firms with overseas offices for ease of travel;
- transport-related industries, especially those with international markets;
- regional market industries;
- research activities; and
- airport-related firms (hotels, catering and car-rental, etc.) (USHUD 1974; Hoare 1974).

Airports are not all created equal. Those considered in this study were intentionally chosen because each is in a separate category. Having said that, it is important to provide a preliminary classification of airports in general, followed by a classification of the four airports included in this study.

As there are two countries represented in this study, it is reasonable to examine both nations' systems for classifying airports. The Federal Aviation Administration (FAA) classifies airports in the Unites States according to the total number of passengers enplaned (see Table 1.1).[7] The FAA classifies airports as follows:

- *Primary Airports* account for the vast majority of scheduled commercial service and enplane at least 10,000 passengers annually. Primary Airports are broken down into four types of hub, depending on the airport's total number of enplaned passengers in a given year: large, medium, small, and non-hub.

[7] This classification system applies to the National Plan of Integrated Airport Systems (NPIAS). The NPIAS designates 3,331 airports as components in the national system out of a total of 18,292 airports in the United States in 1997 (Horonjeff and McKelvey 1994).

- *Non-Hub, Non-Primary Airports* (NH-NP), typically in smaller communities, offer commercial service but enplane between 2,500 and 10,000 passengers annually.
- *Reliever Airports* are usually located in large metropolitan areas and provide general aviation services for smaller, non-commercial aircraft. Their main purpose is to alleviate the demands placed on the infrastructure at congested commercial airports.
- *General Aviation Airports* (GA) link smaller communities and rural areas (including remote parts of Alaska) with the rest of the US aviation system.

Table 1.1 – United States Federal Aviation Administration Airport Classification

Hub Classification	% of National Enplanements	Classification by Number of Enplanements	Number of Airports in Class
Primary Airports			
Large Hub	≥ 1%	6,415,638 or more	29
Medium Hub	.250% to .999%	1,603,910 to 6,415,637	42
Small Hub	.050% to .249%	320,782 to 1,603,909	67
Non-Hub	> .050%	10,001 to 320,781	273
NH-NP	> .050%	2,500 to 10,000	155
Reliever	-	-	319
GA	-	-	2446
Total	-	-	**3331**

Source: Federal Aviation Administration (February 1999)

The Canadian Airports Council (CAC), whose member airports account for 90 percent of passenger movement in Canada, provides a classification scheme for airports in Canada. Most of the National Airport System (NAS) and regional airports (offering regular scheduled passenger service) that have been transferred by Transport Canada to local airport authorities are members of CAC.[8] The simple classification system employed by CAC divides member airports into two categories (Canadian Airports Council, March 1999).

Level I Airports have annual passenger volumes over 1 million. Level I Airports in Canada include Calgary, Edmonton, Halifax, Montreal Dorval, Montreal Mirabel, Ottawa, Toronto, Vancouver and Winnipeg. Level II Airports experience annual

[8] Some airport authorities that are negotiating privatization with Transport Canada are also members.

passenger volumes between 300,000 and 1 million. Level II Canadian Airports are Charlottetown, Grand Prairie, Kelowna, London, Moncton, Hamilton, Quebec City, Regina, Saskatoon, St. John's, Sudbury, Sydney, Thunder Bay and Victoria.

While the smaller airports still operated by Transport Canada (i.e. non-CAC airports) are important to the nation's air transportation network, their ability to act as growth poles is limited. Thus, for the most part, these small airports are given only cursory attention in this study.

To classify the case study airports in this thesis, Canadian and American systems are combined with some original criteria. The most well-known class of airports is the major international hub, where tens of millions of passengers arrive, depart and make connections to other flights. DFW fits into this category. HSV represents a much smaller hub in terms of passengers with a proportionally greater focus on air cargo.[9] AFW represents a small category of airports with no passenger traffic and a dedicated focus on air cargo and nearby industrial development. The main focus at YWG is on passenger traffic, but its cargo traffic is increasing. It is important to compare YWG with HSV and with AFW because air cargo development and land development – both of which have been hugely successful at HSV and AFW – are major concerns of this study. Table 1.2 summarizes the classification of the airports included in this thesis.

Table 1.2 – Case Study Airport Classification

Airport	Location	Classification
Dallas/Fort Worth International	Irving, Coppell, Euless, Grapevine, Bedford, TX	Major International Hub for American Airlines
Alliance Airport	Fort Worth, TX	Industrial, Cargo-Based
Huntsville International	Huntsville, AL	Cargo-Focus with Passenger
Winnipeg International	Winnipeg, MB	Passenger-Focus with Cargo, Non-Hub for Major Airlines

[9] According to the Airports Council International (ACI), HSV ranks 335th in the world in passenger numbers and 172nd in cargo volumes. By contrast, DFW ranks 5th in passengers and 21st in cargo (ACI, February 1999).

Some classes of airports have not been included in this study. For example, Shannon Airport in Ireland; Prestwick in Scotland; Gander in Newfoundland; and Anchorage in Alaska have traditionally been *refuelling stations* along major world flight routes. Although this class of airport can be crucial to a region's economy, and although airports of this class can be designated as instruments of regional development, none has been included in this study.[10]

There are more *general aviation* airports in North America than any other class of airport.[11] General aviation accounted for 35 times as many aircraft, twice the number of flight hours, and almost twice the mileage of commercial airlines in the United States in 1990 (Horonjeff and McKelvey, 1994). However, airports devoted to general aviation do not have as significant an impact regionally as commercial airports; therefore, they are excluded from this study. The dedicated factory airport can also have a significant regional impact. For instance, Boeing Field in Seattle is owned and operated by the Boeing Company. The airport offers no passenger service and no true cargo operations, but because Boeing is the largest private employer in the State of Washington, its impact in the region is enormous. With an understanding of the airports that are included in this study, and their classification understood, another part of the primary objective is outlined next: air cargo.

1.4 – The Air Cargo Industry

A lack of current research exists in the field of air cargo.[12] There is a need to gain more knowledge of the key attributes of air cargo, such as weights, values, numbers of pieces, origins, transfer points, and destinations in order to broaden the understanding of this topic. This study aims to contribute to this base of knowledge.

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[10] Shannon Airport has been a key element of Irish regional development for decades. For a closer look, please see Shannon Development (2000).

[11] General aviation refers to all flying done other than that by commercial airlines, including business, instructional and personal flying. In this sense, GA has a different meaning from that adopted by the FAA for its classification scheme.

[12] This is a problem in Canada and the United States. For information on some of the challenges faced in researching air cargo at the University of California at Berkeley, see Tsao (1997), or for the US in general, see FAA (1991).

Prior to the 1950s, piston-engined aircraft could only transport on any flight a maximum of four to six tonnes of goods to a geographically limited range of destinations. With costs approximately seven times higher than surface transport costs, air freight was not practical (Basi, 1970). Hence, with no air cargo industry other than mail, there were no advantages to firms located at airports in terms of the movement of goods. The advent of jet aircraft, however, led to lower transport costs, increased cargo capacity, and longer hauls – characteristics that made air cargo transport more attractive and, in turn, helped airports become more attractive to firms.

Goods transported by air tend to be high in value and time-sensitive. Some of air cargo's key commodities are electronic equipment, machinery and parts, scientific instruments, live animals, pharmaceuticals, perishable products, textiles and overnight packages (Basi 1970, O'Connor 1995). O'Connor (1995) divides air cargo into the following groups:

- Mail;
- Small packages (air express); and
- Air freight, which is further divided into:
  - Emergency (e.g. medical emergencies, parts for shut-down assembly line);
  - Routine perishable (e.g. flowers, fruits, vegetables, newspapers); and
  - Routine surface-divertible (e.g. cameras, toys, tools).[13]

The majority of air cargo is still carried in the bellies of passenger aircraft. However, overnight packages and time-definite packages (two-to-three day delivery time) are currently the fastest growing sector of air cargo (Tretheway and Ouimet 1999). Integrated express companies (or *integrators*) transport most of these packages in their own dedicated all-cargo aircraft with Federal Express (FedEx) and United Parcel Service (UPS) dominating the North American and global integrator market.[14] However,

[13] Surface-divertible products are those that could move by surface transport, but move by air to reduce inventory and warehousing costs and to provide customer satisfaction through quick service (O'Connor 1995).

[14] The term *integrated carrier* or *integrator* refers to carriers that provide single-company, door-to-door service (O'Connor 1995). Primarily, this category consists of companies like FedEx, UPS, DHL and Purolator.

Purolator Courier has a significant share of this market in Canada.[15] Boeing predicts that the integrators' share of the international air cargo market will grow from its current 5 percent to 37 percent by 2015, possibly accounting for all the growth in the air cargo industry over that time period (VISTAS 1998).

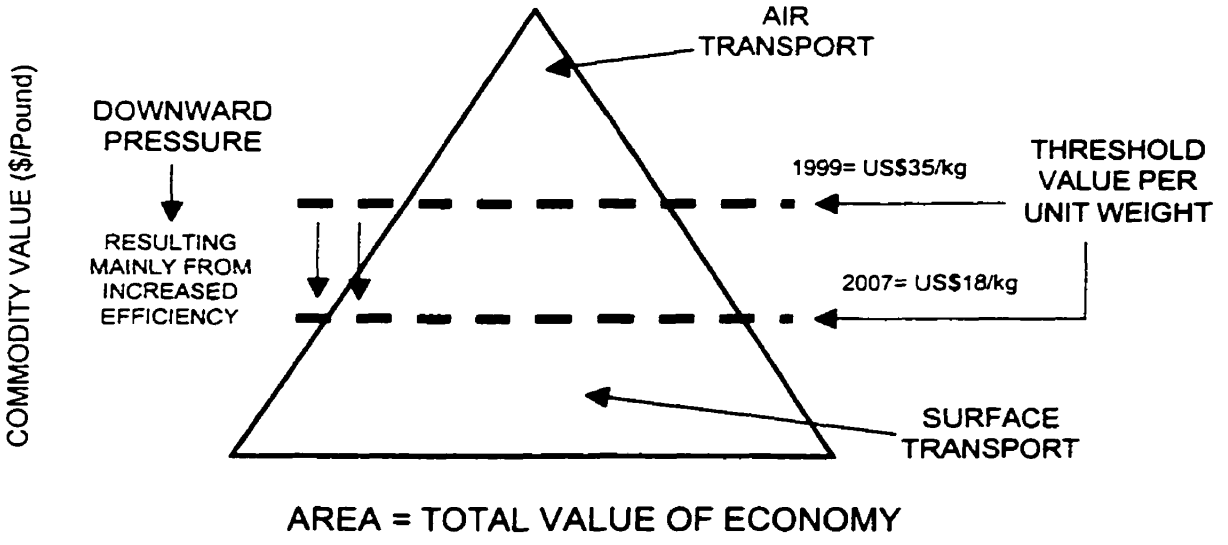
The threshold value-per-unit-weight for goods to move by air has been falling. Goods with values less than the threshold move more frequently by surface transportation while goods exceeding the threshold value are likely to move by air.[16] High value-per-unit-weight goods can bear the higher transport costs associated with air cargo. As the air cargo industry increases its own efficiency, air cargo transport costs are decreasing, putting downward pressure on the air cargo threshold.

As the threshold shrinks and the volume of goods transported by air increases, airports with the most advanced air cargo networks are likely to be the most successful growth poles. Figure 1.3 displays the "value-pyramid" concept put forth by Tretheway and Ouimet (1999). This diagram shows that, in 1999, goods with a value of at least $35 per kilogram were likely to be transported by air freight, while those with lower values would be shipped via surface transport. By 2007, it is predicted that the threshold value will be approximately $18 per kilogram, meaning that there will be a huge increase in the variety of goods that will be shipped by air. Essentially, as it continues to improve in terms of efficiency, air cargo continues to capture a larger share of the total value of the economy, represented by the area of the triangle.

[15] In Canada, Purolator has an advantage over FedEx and UPS. As a Canadian company, Purolator can move packages between Canadian cities without restriction (other than airport-specific restrictions such as Toronto's nighttime curfew). FedEx and UPS can bring packages to Canadian airports, but aircraft that enter Canada can not continue on to other Canadian destinations under current co-terminal restrictions. The American companies contract out these portions of their routes to smaller Canadian carriers.

[16] Other factors also play a role in the division of commodities between air and surface transportation such as time-sensitivity and perishability. For the purposes of this discussion, value per unit weight is deemed to be the most important factor.

Figure 1.3 – Air Cargo Value Pyramid



Source: Tretheway and Ouimet, 1999

The air cargo industry is entering a new development phase as companies moving air cargo increase efficiency. Now international agreements are aiding this trend toward increasing efficiency. Originally drawn up in 1975, the Montreal Protocol did not come into effect until June 1998. The Montreal Protocol

> represents a significant milestone in the history of air cargo. The legal 'green light' to replace the paper air waybill with an electronic record of carriage will facilitate new processes, systems and products and act as a catalyst for fundamental change throughout the air cargo industry. The elimination of paper documents from the shipment cycle will lead to greatly improved customer service and substantial cost savings for the airlines of ... millions of dollars per annum for the industry.
>
> (IATA, February 1999)

As the global trend toward electronic commerce continues, air cargo plays an increasingly important role in airport development and, consequently, an important role in regional development. As predicted by Boeing, air cargo should experience steady growth over the next twenty years. While more aircraft will certainly be required to meet

the demands of air cargo transportation, growth could also occur in the size of aircraft in cargo (and passenger) transportation.

Consequently, airport infrastructure must be able to accommodate the increasing number and size of aircraft. It is likely that airports receiving infrastructure investment will be better suited to the future of air transportation and will probably become choice locations of global air commerce – and, in turn, more successful growth poles. As more air cargo moves through an airport, more businesses are likely to see the advantages of locating near that airport. Comparing airports with different traffic volumes can substantiate this view.[17] For example, more businesses are agglomerated near Dallas/Fort Worth International Airport than at Winnipeg International. Greater amounts of passenger and cargo traffic translate into a higher level of service at DFW than at YWG; therefore more firms are attracted to DFW. However, Winnipeg cannot expect to become a successful growth pole just by adding more air service. Growth in service cannot create its own demand.

There are, however, some notable exceptions. Some airports, with relatively small numbers of aircraft movements, can attract disproportionate amounts of airport-related businesses. The main airport in this study that falls into this category is Alliance Airport in Fort Worth, Texas. Alliance offers no passenger service from its airport but has proved to be an outstanding success in attracting firms by relying solely on the movement of goods.[18] This fact is even more impressive when Alliance's location is considered. It is located well outside the urban area of Fort Worth in an area that, fifteen years ago, was farmland.[19]

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[17] However, it should be noted that size of the airport is not the only factor in attracting businesses. Location of the airport relative to the city, location of the city relative to other markets and several other factors are also important.

[18] This statement may be misleading. Alliance Airport is one part of a major development including an intermodal rail facility, a master planned business park, a residential community and an entertainment complex. Alliance is discussed in detail in Chapter 4.

[19] In fact, Texas longhorns still graze on land adjacent to the AFW airfield.

The main advantage held by air cargo over other modes of transport is speed. Speed associated with air cargo service leads to a number of savings that are passed on to manufacturers, retailers and consumers (O'Connor 1995).

While location near or adjacent to an airport is not crucial for most companies, many find such a location to be advantageous. For instance, integrated express companies require space at airports for loading and unloading cargo for transhipment, as well as for parking airplanes. Pharmaceutical companies would seemingly have little to gain from an airport location. However, in the case of a particular drug company, an airport location allows immediate shipment of drug orders using an integrated express company at the same airport.

As more companies follow this trend and choose airport locations, they combine to solidify air cargo's role in both airport and regional development. Some of these issues become apparent through an examination of empirical evidence in later chapters dealing with specific airports and specific companies. To revert to the main theme, however, requires a closer examination of the growth pole concept.

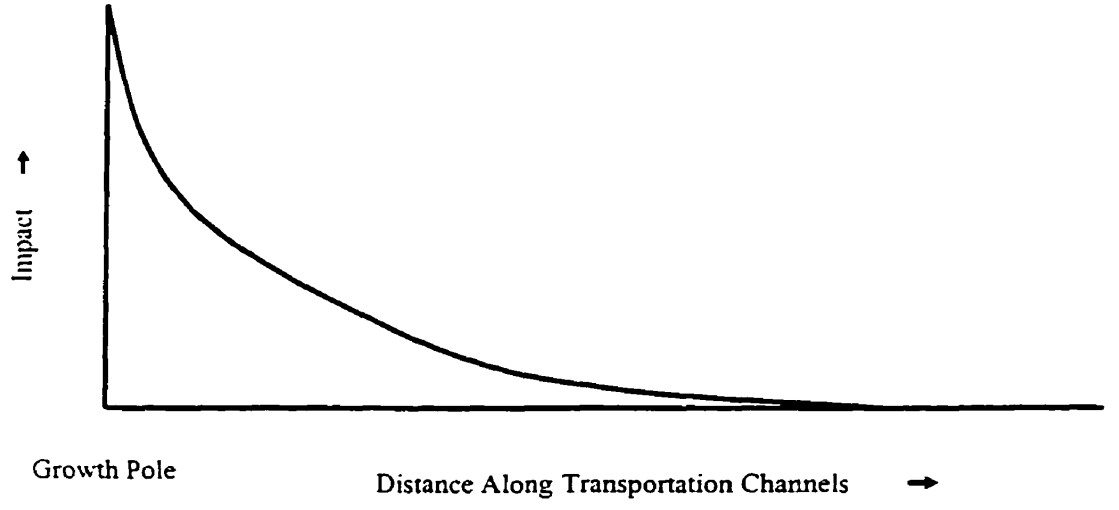
1.5 – An Introduction to Growth Poles

According to Hirschman (1958, p.183), "economic progress does not appear everywhere at the same time" and "that once it has appeared, powerful forces make for the spatial concentration of economic growth around the initial starting point". This statement is the basis of the growth pole concept.

Perroux (1955) originally developed the growth pole concept during the 1940s and 1950s (Todd 1974; Miyoshi 1997). Perroux theorized that agglomeration of economic activities would bring about development in a particular space. In other words, "a concentration of economic activity stimulated further centripetal movements to the pole" (Todd 1974, p. 292). Perroux advanced the notion that one firm or industry would establish a dominance within a growth pole. The dominant firm could achieve more effective use of

innovations than other firms, thereby increasing output. From that dominance, inter-firm and inter-industry linkages would develop, inducing further economic development at the growth pole. The dominant firm or industry would foster both forward and backward linkages with other firms.[20] Through these linkages, polarization would "benefit the masses" (Miyoshi 1997, p.5). Todd (1974, p.293) downplayed the role of the dominant firm: "At best, advocates of dominance can claim it as merely one conditional form of development out of several alternatives". In Chapter 6, it is noted that Todd's statement holds true for cargo-based growth pole airports.

Figure 1.4 – Spatial Model of a Growth Pole



Growth poles have several effects on their hinterlands. Parr (1973) provides the following breakdown of positive and negative effects:

[20] Evidence of this effect is shown in the case studies of Chapter 3, most clearly at Alliance Airport.

Table 1.3 – Effects of Growth Poles on Their Hinterlands

Positive Effects	Negative Effects
▪ raise demand for goods and services ▪ increased productivity of manufacturing firms ▪ stimulation of primary activities ▪ increased demand for labour ▪ shift of services from other locations to the pole (business services and transportation) ▪ eventual decentralization	▪ high income may lead to more purchasing of imports rather than locally produced goods ▪ brain-drain from other areas (mostly rural)

By the 1960s, growth pole strategies were implemented in many developed and developing countries (Miyoshi, 1997). Most planned growth poles – whether implemented in the 1960s or more recently – have not been successful. "The recent history of regional economic planning in many parts of the world is littered with examples of growth pole strategies having failed or having been prematurely abandoned" (Parr, 1996, p.2). By the mid-1970s, growth pole strategy was generally rejected as an economic development tool by governments because of its high rate of failure. Since then, academic growth pole literature has been sparse as well.[21]

Besides the failure common in growth pole regional development efforts, the method of implementation for growth pole policy was never firmly defined. For instance, it was disputed whether growth poles should be established in higher-order cities (to achieve trickle-down effects in smaller centres) or in lower-order cities (generating multiplier effects benefiting higher-order centres) (Todd 1974). Some growth poles were never given a legitimate chance to succeed.

In the United States, two regional development programs attempted to use growth pole strategies: the Appalachian Regional Commission (ARC); and the Economic Development Agency (EDA), both established in 1965. According to Todd (1995a), the failure of these growth poles stemmed from insufficient investment in any one pole. The ARC funded thirty development centres, while the EDA funded over two hundred (Todd

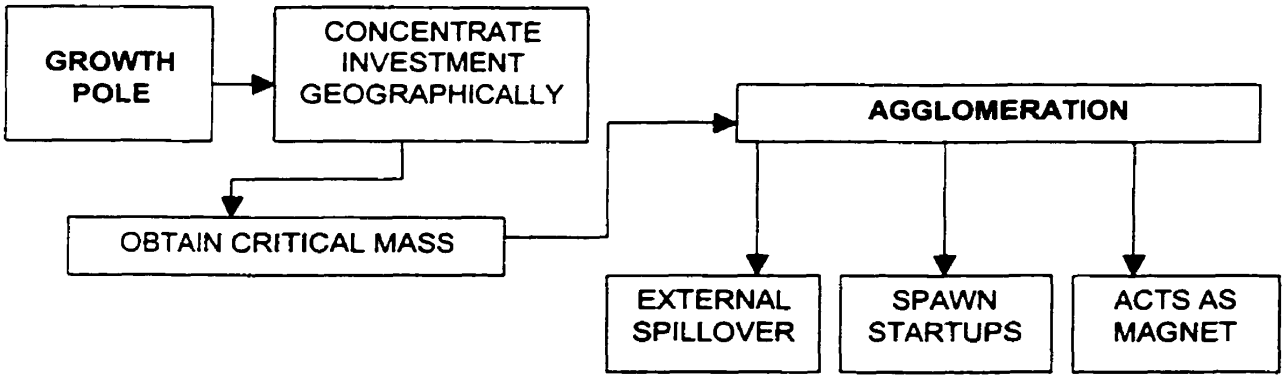
[21] This is true despite the fact that in the 1960s, the growth pole concept was one of the great "mythic catchwords" in regional development planning (Lasuen 1969, p. 20).

1995a). Inadequate funding can be a problem even with fewer growth poles as was the case with the eight *metropoles d'equilibre* in France (Hansen 1972).

Fewer growth poles with greater investment in each may have provided a better opportunity for success in the American examples. If investment is concentrated geographically in order to create a critical mass of manufacturing and service industries – unlike the "spread-the-wealth" ARC and EDA strategies – then agglomeration economies will exist.[22]

Klaassen (1972) agreed that more growth poles led to slower development and a longer period of time before the "take off" size – or critical mass – of each pole is reached. Agglomeration acts as a magnet to other firms, spawns start-up businesses and has an external spillover into the region. Figure 1.5 is a conceptual diagram of the relationship between growth poles and agglomeration.

Figure 1.5 – Growth Pole Conceptual Diagram



Firms experience three types of agglomeration economies at growth poles: localization economies; urbanization economies; and industrial complex economies.[23] *Localization economies* are spatial externalities accruing to a firm from the expansion of other firms of the same industry in the same place. Examples include the ability to poach labour from

[22] "Rapid industrialization prompts urbanization, and urbanization in turn promotes efficiency in production and management by diffusing new innovations. Agglomeration economies ... are ... a way of measuring such efficiency gains" Yuhn and Lee (1998, p. 2).

other firms, take advantage of supply-chains established by other firms, and take advantage of existing infrastructure, including transport infrastructure and educational infrastructure (like colleges and training programs tailored for similar firms). *Urbanization economies* are spatial externalities benefiting a firm through the expansion of firms in other industries in the same place. Examples of urbanization economies are the provision of municipal services, public utilities, communications, and commercial services. *Industrial-complex economies* are the beneficial inter-industry linkages that exist where many firms are located in close proximity to each other. Examples are savings in transport costs, power costs, and the easy exchange of information.

Some researchers have deemed agglomeration analysis unsatisfactory with regard to the spatial aspects of growth poles (Parr 1973). The reasons Parr provides are the static nature of agglomeration analysis and that it neglects the distribution of growth in the region. This study resolves that problem by examining growth poles through a dynamic (analysis of the time-pattern) process that considers the spatial distribution and organization of the growth pole.

Essentially, this study considers new and expanding industries in a region to have an impact, particularly on an expansion of employment and population, and on ancillary industries that are related to the expanding industries (Todd 1995a). The expansion of the economy usually attracts capital, which leads to an expansion of wealth and aids in leveraging additional government funding. This leads to better infrastructure, which, as is noted in the following chapters, can attract new industries. This is simply another way of considering the critical mass.

As mentioned in Table 1.3, potential positive and negative effects are tied to the growth pole process. The positive effects can also be referred to as spread or trickle-down effects, while the negative effects are referred to as backwash or polarization effects (Myrdal 1957; Amos 1996). Spread effects occur when investment in a growth pole

[23] Todd (1974; 1995a) and Yuhn and Lee (1998) agree on the first two types of agglomeration economies while Parr (1973) considered the third.

results in an expansion of the economy that benefits the periphery of the growth pole. Backwash effects are negative impacts in the periphery because of expansion at the growth pole. However, backwash effects may be experienced despite an overall improvement to a regional economy.

Growth pole theory usually bears little resemblance to growth pole policy. Parr (1996, p.3) stated "there has never existed an adequate framework or general theory of regional economic policy within which growth pole strategy could be evaluated, either conceptually or operationally". According to Miyoshi (1997), some researchers were of the opinion that growth poles fostered regional inequality rather than regional development, and that growth pole theory was too quickly applied as a regional development tool in the 1960s. Despite the negativity surrounding it, growth pole theory and practice should not be abandoned as useless or ineffective.

With that in mind, a differentiation must be made between growth poles as instruments for regional economic development – planned growth poles – and growth poles as economic and geographic phenomena – natural growth poles. Perroux originally envisioned the growth pole as an occurrence, not necessarily as a strategy. Parr (1996, pp.6-7) agreed by rejecting "the assumption that the natural growth pole in geographic space could be replicated in the form of a planned growth pole, by the implanting of propulsive industries at particular urban centres". This thesis expands upon that idea with the examination of natural (or unplanned) growth poles. Regional development resources should be focused on existing, natural growth poles to achieve maximum spread effects (Higgins 1988; Miyoshi 1997). Trying to force a growth pole in a naturally retarded region is difficult. In this study, the area around DFW is definitely a natural growth pole, while the areas around AFW and HSV could be considered to be either natural or planned growth poles. Development at AFW and HSV was carefully planned. However, both are located in regions with strong, growing economies. Similar circumstances currently exist

in Winnipeg, indicating that future development at YWG has potential to be a successful growth pole.[24]

In recent work dealing with growth poles, Parr (1996) describes the general characteristics of growth pole strategy as:

- encouraging the growth of employment and population within a region at particular locations or planned poles over some specified period;
- requiring a limitation on the number of locations or centres which are designated as planned poles – a problem pointed out by Todd (1995a);
- necessarily requiring spatial discrimination or selectivity among locations – a characteristic noted early on by Hansen (1972); and
- inevitably involving a modification of the spatial structure of employment and population within a region.

Winnipeg fits these characteristics reasonably well. For instance, the closest major urban centre to Winnipeg – Minneapolis-St. Paul – is 621 km away (as the crow flies), thus providing it with natural spatial discrimination. The Winnipeg case is further examined later in this thesis.

The question remains as to whether or not an airport itself can act as a growth pole. Parr (1979, p.200) points to "airports, freight terminals and motorway connections" as growth pole locations that could be attractive to industry in an urban setting. Parr goes on to call infrastructure investment at these locations a more effective allocation method than a population- or need-based system. Horonjeff and McKelvey (1994) list the potential land development activities associated with an airport:

- plant relocation from outside the region requiring construction activity;
- increases in the production of existing businesses requiring new or expanded facilities;
- increases in tourism and recreation requiring new or expanded facilities;
- expansion of agricultural markets resulting in increased productivity and resource utilization;
- increases in demand for business and convention facilities; and
- expansion of commercial and financial markets resulting in a demand for additional facilities.

[24] While not necessarily as economically advanced as Dallas-Fort Worth or Huntsville, the Winnipeg region is not *retarded*. It has a healthy economy and an existing agglomeration (albeit relatively small) of industry around the airport. Therefore it is a good candidate for growth pole investment.

As this study unfolds, it is noted that many of these activities take place near the airport growth pole case studies.

The remainder of this thesis establishes the extent of the cargo-based airport's ability to be a growth pole. The background information about the air cargo industry and growth poles lays the groundwork for discussing the case studies in depth and finding conclusions. Before that, however, some hypotheses are put forth.

1.6 – Hypotheses

The following hypotheses about airport growth poles were made prior to the analysis of any observations or collected data. They have been made based on background reading and personal observations. In the final chapter of this study, these hypotheses will be revisited and their accuracy assessed.

1. Firms will only locate adjacent to a particular airport if the necessary infrastructure is provided *and* if that location does not put the firm at a competitive disadvantage compared with other firms in the region in the same industry. Infrastructure includes road access, municipal services, and airside taxiways and aprons immediately adjacent to the cargo-based businesses.

2. An airport development must offer more than just available land and infrastructure in order to attract firms. Incentives and abatements are part of doing business in a competitive environment.

3. Having a major anchor tenant is crucial. It is vital to identify that first major firm that is willing to move away from the rest and choose a new location. Part of the importance of the anchor tenant is brand-name recognition. A well-known company moving to a particular airport location will help convince other firms that it is a good strategic location.

4. Any airport authority may model itself after other communities, but the type of firm attracted should complement the existing strengths of the region.

5. The more transport modes located at an airport, the better its chances of being a successful growth pole. Specifically, high-quality highway connections and a rail container terminal are important components of an airport growth pole. Marine infrastructure could also provide an airport with an advantage. It is not included in this study because none of the airports considered is on a coast.[25]

There is no magic formula for the development of a cargo-based growth pole airport. Successful methods at one location may not work in another. Each airport has strengths and weaknesses that must be identified and utilized. In addition, some cases are sure to have unexpected "wild-cards" that aided the development of the airport. For example, the Alliance development has been largely funded privately by the noted American entrepreneur Ross Perot Jr. The difficulty in recreating that variable in other locations is discussed in Chapter 6.

1.7 – Outline

With the stage set, the remainder of the thesis is organized as follows. Chapter 2 provides a review of relevant literature dealing with transportation infrastructure and regional economic development. Some examples of transport infrastructure's effect on regional development are examined. Also in the second chapter, investment in transport infrastructure is shown to have a positive – or at least permissive – effect on economic development. Chapter 3 outlines the reasons for selecting personal observations, semi-structured interviews and a survey as the method of data collection. It also describes the design of the survey and how it was implemented. The fourth chapter discusses the observations made at each airport, while Chapter 5 shows the results of the study as the

collected data are analyzed and ideas take shape. The final chapter, Chapter 6, consists of the conclusions and recommendations of this study, demonstrating the utility of the study in a practical sense. The recommendations consist of positive statements of the applicability of this study in general terms with specific reference to the potential of Winnipeg (and other Canadian airports) to become growth poles. The lessons learned from other locations lead to this set of recommendations.

The discussion now moves to transport infrastructure, beginning with a brief definition of infrastructure in general, followed by an in-depth examination of the role of transport infrastructure investment in regional economic development.

[25] Two points are worth noting here: (1) Huntsville is considering adding a port facility on the Tennessee River south of the airport and (2) some cities – such as Dubai and Singapore – do combine marine and air infrastructure.

CHAPTER 2 – INFRASTRUCTURE, GROWTH POLES AND REGIONAL ECONOMIC DEVELOPMENT

2.1 – Introduction

The main purpose of infrastructure – "the physical facilities which move people, goods, commodities, water, waste, energy and information" – is to support human activities (Infrastructure Technology Institute, June 1999). Broadly defined, public infrastructure includes transport, power, telecommunications, water services, health services, prisons, and emergency services (AusCID, December 1996). What all these activities have in common is joint consumption. General examples of infrastructure are bridges, canals, harbours, railways, wires and cables (telegraph, telephone, television, data and electric), pipelines, roads and highways, pipes, treatment plants, traffic signals, street lights, and – vital to this thesis – airports.

The observation is evident from these descriptions that efficient transportation is a prime category of infrastructure. Transport infrastructure encompasses pipelines, road, rail, sea and air infrastructure. Pipelines, however, can also be considered to be power infrastructure.

Transport infrastructure relates closely with growth poles. Specifically, Perroux (1955) indicated that development expands from a growth pole along channels of distribution. Because Perroux considered the growth pole to be located in abstract space rather than geographic space, he was never definitive in terms of describing these channels.

Transport infrastructure is critical to the creation and distribution of economic wealth. The case could be made that infrastructure in general is more important to development than the specific case of transport infrastructure, but it should be fairly evident that while communications, health or educational infrastructure do aid development, these types of infrastructure do not provide channels along which economic development can expand.[26]

[26] In recent times, communications infrastructure has become more sophisticated and far-reaching and may have the capability to distribute some economic development.

Transport infrastructure can have the specific purpose of enabling the expansion of economic development. This chapter focuses on transport infrastructure and the growth pole concept, and relates both topics to the economic development on regional and national scales.

Companies experience agglomeration advantages through their locations at growth poles. Apart from the external economies resulting from the location of nearby companies (as discussed in Chapter 1), firms also receive benefits through the lower overhead costs resulting from the shared use of transport infrastructure. This concept is apparent when growth pole theory is related to central place theory – a commonly cited idea in geography.[27] The growth pole – even by its name – is similar to central place theory. Both focus on a centralized location around which other activities revolve and upon which other activities depend.

Central place theory is defined as "an attempt to explain the spatial arrangement, size, and number of settlements" (Leeds University, May 1999). Christaller, a German geographer, first published the theory in 1933 with reference to towns in Southern Germany. Christaller noted that towns of a certain size were approximately equidistant, and studied the settlement structure and hinterland size for the region, with respect to the size and spacing of cities that specialize in selling goods and services. The theory consists of two basic concepts:

- The threshold, or the minimum market needed, to bring a firm, or firms operating collectively in a city selling goods and services into existence and to keep it, or them, going; and
- the range, or the average maximum distance people will travel to purchase goods and services (Leeds University, May 1999; Norton 1992).

These concepts are important parts of growth pole theory. A minimum city size, and proper spacing of planned growth poles, are concepts frequently discussed in growth pole literature.

[27] For a further explanation of the applicability of central place theory, see Norton (1992) or Preston (1991).

"A body of theory which has been developed to deal with the spatial structure and functional composition of a regional (or national) urban system", central place theory and growth pole theory are complementary concepts (Parr 1999, p. 59). For instance:

- Growth poles are concerned with change over time, while central place theory is concerned with spatial change.[28]
- The growth pole (at least according to Perroux's original theory) is a single entity with the important task of being the centre of development. The central place system is a network of interrelated centres that respond to the movement of people, goods and services.
- The growth pole "deals with internal economic relations of a centre" while central place theory focuses on the economic relations between the centre and the hinterland.

The terms "growth pole" and "central place" are complementary concepts, but cannot be used interchangeably. While Parr does go into detail about the role that a growth pole can play within a central place system, he does not address the issue of shared transport infrastructure as a benefit of growth poles and central places. Central place theory generally ignores transport infrastructure in favour of the relationship between the central place and its dependent hinterland.

However, the benefits of the central place system are closely tied to the transportation network. Firms find the central place to be the optimal location because of the agglomeration of other firms that are there, and from the shared use of transport infrastructure. Firms located outside the central place do not have the advantage of the quality of infrastructure found where the majority of economic activity takes place. Furthermore, by being in a central place, a firm is automatically close to a market centre. Christaller introduced other aspects of the theory, including the marketing and administration principles, but the transportation principle – that larger central places would be located along transport axes – is the most relevant to this thesis (Norton 1992).

Todd (1974, p. 296) points out many of the shortcomings of central place theory with respect to growth poles, calling the concept – with particular reference to its static nature – "directly at odds with the motivating theory of development poles". Later in the same

[28] However, Todd (1974, p. 292) notes the "spatial-sectoral-temporal" nature of polarized growth.

paper, Todd (1974, p.301) states that the regional processes of central place theory conflict with the "spatial growth factors essential for pole functionings".

The following discussion separates growth pole theory from central place theory and examines the relationship between transportation infrastructure in the development of the former. The discussion of transport infrastructure and economic development follows the section on the development of growth poles. Then some specific examples highlight an examination of airport growth poles. The final section of this chapter discusses the pros and cons of investment in transport infrastructure and investment in airport growth poles.

2.2 – Growth Poles and Development

"Growth does not appear everywhere and all at once; it appears in points or growth poles with variable intensity, it spreads along various channels and has varying terminal effects for the whole of the economy" (Perroux 1955, p. 309).

This passage – mentioned earlier in this chapter – is the basis upon which growth pole theory has been built. This section relates growth poles to national and regional economic development and outlines the development path of growth poles through an examination of case studies. This path is compared with that followed by the relationship between transport infrastructure on both national and regional development, later in this chapter.

2.2.1 – National Economic Development

Most nations have traditionally pursued measures fostering natural growth poles without necessarily setting a growth pole policy (Miyoshi 1997). Capital cities tend to be the locations in most countries – especially developing countries – where investment and economic development are concentrated.[29] Capital cities, besides being home to the

[29] One notable exception is Brasilia, Brazil, which is a planned capital city distant from the major urban centres of Sao Paulo and Rio de Janeiro.

government sector, are usually the location of major industrial companies. In fact, such cities are generally chosen as capital cities because of their natural growth tendencies. In the early stages of economic development, governments tend to invest first in the capital city because the population is usually concentrated in and around the capital and there is greater potential to bring about rapid growth by investing in infrastructure in the capital (Miyoshi 1997).

In cases where government focuses its investment in one region – usually the capital, or the most industrialized region – it has implemented a growth pole policy for national economic growth. The growth pole strategy often involves investment in transport infrastructure, but may also involve social infrastructure development "engines" (housing, schools, hospitals, water and electricity supply). Amos (1996) notes the central role of transportation in growth pole development and the reciprocal benefits stem from this growth pole development; namely, improved efficiency and lower transport costs.

Growth poles may eventually approach a limit to success imposed by the size of the city. For example, Mexico City is finding air quality is a limiter to additional manufacturing industry. Expensive public services, underutilized infrastructure, overpopulation, traffic congestion and pollution all lead to the diseconomies of large cities. Furthermore, inequalities between the urban and rural areas of a nation may increase. Therefore, according to Miyoshi (1997, p.15), "an objective of national economic growth should not be a priority of ... growth pole strategies for regional planning, although the 'national' government naturally tends to do it in reality".

A national growth pole policy can lead to national economic development while simultaneously creating regional inequalities. As the heartland of a nation receives investment and develops, the hinterland tends to be ignored and receives little in the way of regional development resource allocation. Simultaneously, the region may experience significant out-migration. To remedy regional disparities, some nations have implemented growth pole policies with regional economic development objectives.

Regional economic development instances of growth pole policies are far more prevalent than national development settings. Todd (1974) addresses the difference between national and regional approaches to growth poles by pointing out the conceptual difficulty concerning the larger-scale application. With that in mind, most of the emphasis in the evolution of growth poles has been regional in nature (Todd 1974).

2.2.2 – Regional Development

A key element in using growth pole policy to effect regional economic development is to focus investment around a single propulsive industry or company. This "leading sector" is expected to boost economic growth in the region. Growth poles for regional development can have both economic and egalitarian goals. However, Miyoshi (1997) points out that egalitarian goals may lead to the negative effect of investment in transport infrastructure on development.[30]

For example, if one region lags behind another, then government may implement a growth pole policy in the lagging region, which involves linking the region by improved infrastructure with other, more developed centres. Two problems can potentially arise from this scenario (Miyoshi 1997). First, because migration tends to be rural-to-urban, improved transport links with the developed region may increase out-migration from the lagging region, thus counteracting the regional development objective of the growth pole policy, further polarizing the region.[31] Second, the growth pole(s) in the lagging region may appear to improve the region's economy, but may in fact be causing inequality within the region – similar to the case of national development. The growth pole(s) may be achieving the objective of economic development, but the regional aspect of that development has not occurred. The rest of the region is the same or worse than it was before the implementation of the growth pole policy. These problems accentuate the importance of transport infrastructure within growth pole policies to operate as channels facilitating the distribution of growth to the region.

[30] This concept is further discussed later in this chapter.

Miyoshi (1997) recommends multiple growth poles as a method of effecting egalitarian development within a comprehensive regional development plan. However, as noted in Chapter 1, some programs consisting of multiple growth poles were unsuccessful. Miyoshi cites the possibility of establishing one growth pole in a highly industrialized urban city with several agricultural centres linked by transportation with the major growth pole. For the purposes of this thesis, it is economic development that is assumed to be the primary objective of growth pole policy, not egalitarianism.

Not all aspects of growth poles are negative. Like national development, growth poles often occur naturally to aid regional economic development. In fact, this notion is the focus of the case studies of AFW, DFW and HSV, particularly DFW. Many instances of economic development can be traced back to some form of natural growth pole, whether as a part of an investment plan or merely through entirely natural growth.

Parr (1999) examines growth pole theory from all angles, including past policy implementations and the reasons behind the frequent failures and abandonment of these policies. A large section of Parr's paper discusses the settings for growth pole strategies. While merely listing the topics covered does neither the topic nor Parr's paper justice, the detail of Parr's discussion is beyond the scope of this thesis. Parr's (1999) growth pole problem settings include:

- reviving a depressed area;
- encouraging regional deconcentration;
- modifying the national urban system (this may fit better in the previous section dealing with growth poles and national development);
- attaining interregional balance;
- expansion of recreational or tourist activity;
- improvement and rationalization of regional service provision (for example, public transportation); and
- the promotion of rural development (Parr 1999).

[31] This is revisited later in this chapter as one of the potential negative effects of investment in transport infrastructure on regional development.

It is difficult to say where airports fit into Parr's problem settings. Surely Northern Alabama was a depressed region once, but the Dallas-Fort Worth area had a relatively strong economy before AFW came into existence. Perhaps the best fit for cargo-based growth pole airports is in the setting associated with attaining interregional balance.

Four characteristics are common to each setting, despite the differences noted above (Parr 1999). In brief, growth poles in all settings:

- encourage the growth of employment and population at planned poles over a specified period;
- limit the number of planned poles, depending upon the nature of the setting;
- are selected based on their potential for supporting economic activity and growth; and
- modify the spatial structure of employment and population in the region.

These characteristics – which define growth poles by their collective presence in each of the settings – are revisited in Chapter 4 with specific reference to the airport growth pole case studies.

With Parr's article in mind, it is important to stress that this thesis considers growth poles in an almost entirely new form. However, much of the theory behind growth poles as outlined thus far, is relevant to the case of airports acting as centres for regional growth. In this regard it is reasonable to apply growth pole theory as a background for a study about airports as an instrument for regional economic development. Having said that, it is important to note some vital differences. Because airports require an enormous amount of investment in infrastructure, international-scale facilities cannot be built in multiple locations based on regional development policies. If airports are to be a component of such policies, investment should be concentrated at locations where airports already exist.

The tendency of growth pole policies to result in failure may lead one to believe that there is no point to pursuing growth poles any further (Todd 1974). However, as is pointed out in the discussion of Parr's recent paper, there are positive and negative aspects of growth poles. The growth pole – as it was implemented in the past – may not

be effective at lessening regional disparities. Traditional growth poles may be ineffective for helping many lagging regions, but can be used to enhance the advantages possessed by particular locations – especially ones that can afford further investment from public and private organizations. Perhaps the best place for investment in growth poles is to reinforce natural growth poles.[32]

Investment in growth poles should be focused upon reinforcing natural growth poles.

Finally, Todd (1974, p.304) suggests five factors that should be considered during the creation of any growth pole policy or strategy. In brief, they include:

- an appreciation of the existing regional structure,
- a forecast of economic growth focusing on industries compatible with the region's advantages,
- choosing new industries based on their economic growth potential,
- measuring spatial linkages as a proxy for agglomeration economies resulting in local spin-offs, and
- providing investment options dependent upon possible development paths.

As this study progresses, it becomes evident that these factors do come into play, especially at the US case-study airports.

Case studies show how growth pole strategies have affected regional development, including the role played within them by transport infrastructure. In addition, the development path is determined by examining specific growth pole cases.

2.2.3 – Examples of Growth Poles

An assessment of growth pole policy case studies is difficult because they are limited in availability and are usually quite dated. Most research on growth poles dates from the 1970s and relatively few studies have carefully examined cases where growth pole strategies were implemented by a government (Miyoshi 1997).

[32] However, investment in growth poles should not encourage development at the expense of other regions.

In many cases, regions affected by growth pole policies have been problem regions for some time and have undergone other regional policies. While this does not directly undermine the success of a growth pole strategy, it does cloud its measurability, as the benefits of other policies may be wrongly credited to the growth pole strategy. Furthermore, economic development in the region may be sparked by some other, non-policy-oriented factor. For instance, a major industry may choose to locate in a particular region for reasons unrelated to regional policy, thus further clouding the measurable effect of the growth pole strategy. Chapter 1 mentioned the growth pole policies implemented in the United States under the ARC and EDA. In this section, those two Acts are addressed in more detail and are followed by an assessment of Italy's *Cassa per il Mezzogiorno*. However, many others could be included in such a discussion: Canada's Western Economic Diversification and Brazil's *Superintendencia do Desenvolvimento da Amazonia*. As their results merely duplicate the findings of those that are detailed, they are not considered further.

2.2.3.1 – United States: Appalachian Regional Development Act / Public Works and Economic Development Act

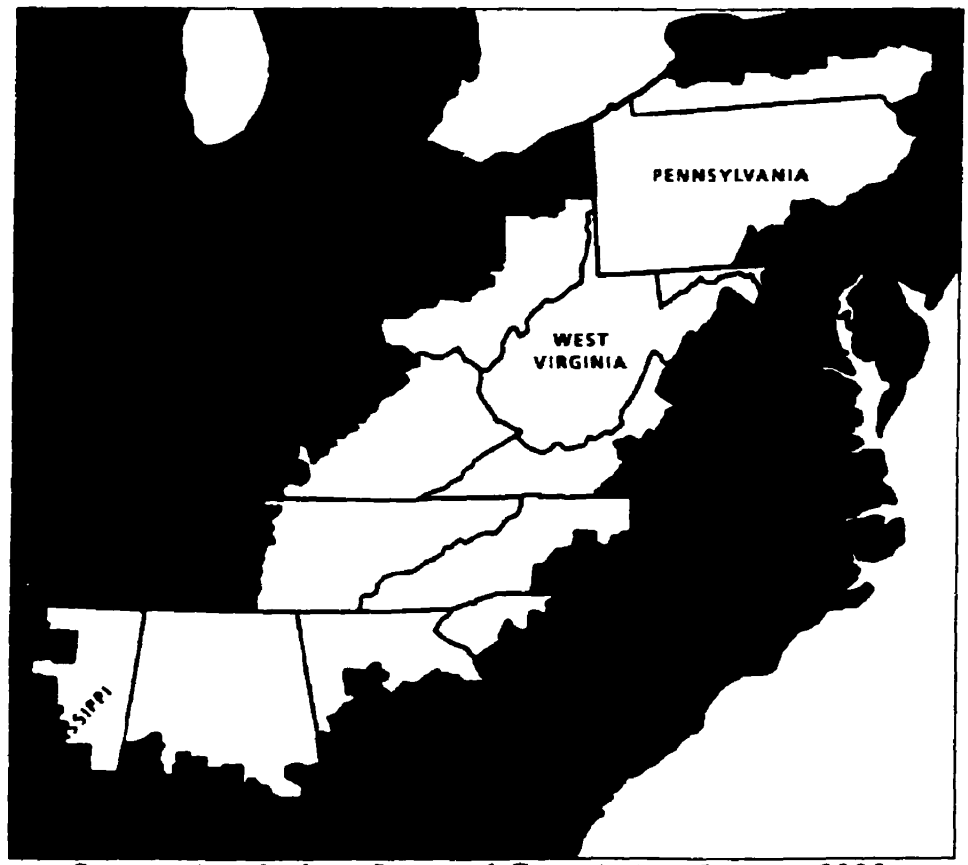
Both the Appalachian Regional Development Act (ARDA) and the Public Works and Economic Development Act (PWEDA) were passed in 1965 in the United States and led to the creation of the Appalachian Regional Commission (ARC) and the Economic Development Administration (EDA).

The prime objective of the ARC – which is still in existence today – was to support economic and social development in the 13-state Appalachian region, stretching from New York to Mississippi (Figure 2.1). At the time of the ARC's inception, one-third of the region's population lived in poverty, per capita income and education levels were extremely low, and unemployment and out-migration were high. Development plans were aimed at achieving five goals:

- developing a knowledgeable and skilled population;

- strengthening the region's physical infrastructure;
- building local and regional capacity;
- creating a dynamic economic base; and
- fostering healthy people (Appalachian Regional Commission, May 1999).

Figure 2.1 – Map of Appalachian Region



Source: Appalachian Regional Commission, January 2000

Infrastructure projects have been an important part of the ARC's efforts, along with education and training programs and small-business assistance. Of interest to this thesis is the notion of growth poles. The ARC established growth poles in the region in an effort to attract workers from other areas, and to keep the workers who already lived in the region. The ARDA specified that investment in the region was to be concentrated in locations – eventually over sixty areas were designated – with the greatest potential for growth and where the greatest return for public dollars could be expected (Miyoshi 1997). The growth pole notion was also employed to give all people in the region

relatively equal access to health and education services as well as transport facilities (Gauthier 1970). Approximately two-thirds of the ARC's initial budget was for highway infrastructure.[33]

In 1997, a total of over US$300 million in regional development projects were approved. Despite similar huge annual investments over the thirty-year history of the ARC, the region's per capita income (US$19,318) is still lower than the national average (US$23,196) (Appalachian Regional Commission, May 1999). However, net migration to the region was positive, at 3.6 percent between 1990 and 1997, even higher than the national average of 2.5 percent. This is in stark contrast to the situation before the ARC, when two million people migrated out from the region between 1950 and 1960 (Hansen 1972). A further success of the program has been the reduction in the disparity between the national unemployment rate and the regional rate. Unemployment in Appalachia (at 5.7 percent) was comparable with the national average (5.4 percent) in 1997 (Appalachian Regional Commission, May 1999).

Contrasting the modest success of the ARC is the failure of the PWEDA. The program targeted several underdeveloped regions: the Ozarks, New England, the Four Corners, the Coastal Plains and the Upper Great Lakes (Miyoshi 1997). Like the ARC, growth poles were selected in each region on the premise that investment at these poles would create jobs for residents in depressed rural areas. Miyoshi (1997) points out three key factors that led to the failure of the EDA program.

- The EDA budget was inadequate to properly implement a growth pole policy.
- The centres selected as growth poles were too small to create enough jobs. Most centres were under 50,000 in population.
- The EDA ignored the importance of fostering links among related organizations.

The result was that investment was made at discrete points throughout the system, but that investment was not at all integrated with the rest of the program. "They could not

[33] Because cost estimates were significantly lower than actual costs, the Appalachian regional highway system was never completed. The patchwork of isolated highways – mostly around already developed cities

achieve agglomeration effects as the Appalachian Regional Development Act did" (Miyoshi 1997, p.20). However, the EDA still exists under the US Department of Commerce. It provides "grants for infrastructure development, local capacity building, and business development to help communities alleviate conditions of substantial and persistent unemployment and underemployment in economically distressed areas and regions" throughout the US (Economic Development Administration Fact Sheet, 1999).

The lesson from the two American examples is that to have any hope of success, the entire regional development program – including the implementation of a growth pole policy – must be carefully integrated in a comprehensive approach. Such was the case with the Italian government agency responsible for regional development in Southern Italy. However, even with its comprehensive approach, the *Cassa per il Mezzogiorno* was not entirely successful.

2.2.3.2 – Italy: *Cassa per il Mezzogiorno*

The *Cassa per il Mezzogiorno* (Agency for the South) was an early multi-sectoral growth pole strategy implemented by the Italian government in 1957 to promote regional development – in the form of industrialization and urbanization – in the southern half of the country, the area to the south of the line near Rome in Figure 2.2. One of its main instruments for effecting regional development was to construct infrastructure in designated southern growth poles in an endeavour to attract regional development (Petrella 1972). The Italian government believed that the provision of infrastructure would provide the external economies that firms would find attractive when selecting industrial locations.

– had little effect on regional development.

Figure 2.2 – Map of Italy

Source: University of Texas Libraries, January 2000

The Italian growth pole policy focused investment in areas "already possessing an agglomerative force, with the aim of also drawing in industrial activities not linked to factors of geographical location or to the availability of raw materials, manpower, etc." (Petrella 1972, p. 200). The program eventually consisted of 34 "nuclei of industrialization" in Southern Italy. Along with expansion of infrastructure the *Cassa* addressed two other components: industrial development and agricultural reform.

In terms of infrastructure development, rail lines, highways, power and water supplies were all improved to provide better links between industry, commerce, primary activities, and key markets. If industrialization was going to take place as planned, then the infrastructure would need to be in place as it was needed (Todd 1994). The chief industrialization component of the *Cassa* was that 30 to 40 percent of all state investment in industry had to be in the South. In addition, the government gave small and medium-sized enterprises (SMEs) generous tax breaks and training programs to encourage their growth in the South (Todd 1994). Agricultural reform essentially consisted of

consolidating many of the extremely small farms that existed at the time in the region. Larger, more efficient farms would better support the use of mechanized farming techniques, which in turn would lead to economies of scale – a benefit to the region (Todd 1994).

Unfortunately, as was the case with most growth pole policies, the *Cassa per il Mezzogiorno* met with only marginal success. Todd (1994) assessed the success of the three components:

- **Industrialization**: Although there was much investment in the South, the repositories of it were like oases in the desert, as the rest of the region did not develop.
- **Infrastructure**: Many kilometres of railways and highways were developed and power capacity increased. These were the most successful component of the *Cassa*'s agenda.
- **Agriculture**: Because land owners manipulated politicians, they only ended up giving part of their land, not enough to effect any real growth. This was the least successful component.

Overall, Italy's regional disparity did not change, although some progress was made in the South. However, unemployment remained higher in the South after the growth pole policy was implemented and out-migration was not reduced. Furthermore, the migratory patterns within the region intensified as the coastal zones benefited most from the program at the expense of the inland regions. Petrella (1972, p.201) notes the negative impact of the Southern Mafia "who, by their actions and presence, void any possibility of reform and have largely profited from" the government efforts at regional development.[34] Appropriately, Petrella (1972, p.201) also puts a large share of the blame on the government itself, claiming that it applied the logic of "unplanned spontaneous industrial location while it was a question of a planned and voluntary policy by the public authorities."

[34] Organized crime is still most marked in the regions of Campania, Apulia, Calabria and Sicily – all in Southern Italy (Development and Legality in Southern Italy, June 1999).

If growth poles are only partially successful, why should anyone continue to promote this concept? The answer has already been noted. In the cases of "partial success stories" like the ARC and the *Cassa*, investment was focused on areas already experiencing growth and areas with the best potential for growth. This supports the notion that investment should go to growing areas, because investment usually cannot create growth by itself.

The relationship between growth poles and economic development has been introduced, the discussion now turns to the linkage between infrastructure and economic development.

2.3 – Infrastructure and Economic Development

"In certain ways, the story of infrastructure is the story of civilization" (Infrastructure Technology Institute, January 1997). Infrastructure is a necessity for any type of trade to take place. In the earliest days, local paths were required to travel between settlements, or even within the same community. In recent times, increasing amounts of trade take place electronically but even this trade is enabled by telecommunications infrastructure in the form of computers, wires and cables transmitting data.

Transport infrastructure is vital to economic functioning because trade is the basis upon which economies are built, and because trade requires transportation.[35] According to Kissling (1974), transport infrastructure – by enabling the movement of goods and people between locations – is truly the crux of economic functioning. Hurst (1974) wrote that economic functioning requires transport infrastructure, and that relatively more transport is required as economies develop. Another advocate of this theory was Gauthier (1970) who stated that the adequate effective transportation required by economic development is "axiomatic". Rietveld and Nijkamp (1993) cite a study by Bruinsma (1990) that

[35] Of course, the reverse is also true. Transportation requires trade in order to have any purpose. The two are interdependent.

actually determined the amount of investment in transport infrastructure required to create one permanent full-time job.

2.3.1 – Theoretical background

Several theoretical bases regarding transport and regional development have been put forth. For instance, Hoyle and Smith (1992) cite five essential components upon which transport and development are based:

- the continuing relevance of the historical dimension;
- the degree of intermodal choice;
- the relative significance of different transport modes;
- the critical role of the seaport (indeed, both the seaport and the airport are called "indispensable" by Hoyle and Smith); and
- that transport systems are dynamic wholes.

While these five ideas are important to transport and development, they are fairly general in nature and do not adequately address the impact of transport infrastructure on development. However, Hoyle and Smith (1992) do state that the effect of transport on development combines with several other factors, including

- environmental characteristics and constraints;
- historical trends and conditions;
- economics;
- politics;
- demographics;
- changing technology; and
- trading conditions.

Amos (1996) cites a dual role for transportation in socio-economic development. First, transportation governs the accessibility to resources and determines the related transport costs. Second, investment in infrastructure generates a cumulatively reinforcing expansion in income, consumption, employment and other economic indicators throughout the economy.

Some other characteristics of transport infrastructure make its effect on development unique among government investments. Infrastructure is lumpy, meaning that it must be

built in sizeable pieces in order to have any impact. For instance, Confederation Bridge linking the Canadian provinces of Prince Edward Island and New Brunswick would be useless if it were only built halfway; therefore it was built in one large "lump". Secondly, transport infrastructure has more longevity than most other government programs. For example, a road built between Winnipeg and Brandon will exist for decades even if the government stops funding it after it has been built and even if it is used sparingly. The same cannot be said for most programs, which require annual funding.[36]

Infrastructure facilitates development in several ways. Better infrastructure translates into lower transport costs and, therefore, higher transport volumes (Rietveld and Nijkamp 1993). Kessides (1993) lists the following examples to illustrate the relationship between infrastructure and development:

- Infrastructure allows the regional economy to diversify by encouraging the growth of alternative employment and consumption while increasing access to new technology.
- Infrastructure is essential to create productivity gains from urbanization.
- Infrastructure reduces non-productive time, including health concerns.
- Infrastructure helps to reduce wasteful consumption.

These characteristics further solidify transport infrastructure's role in effecting regional development and in creating agglomeration advantages for firms through the shared use of infrastructure, especially in urban areas as noted in the second point above.

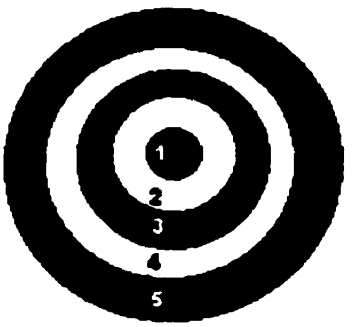
Von Thünen's model relating transport and spatial development proposes that the location of economic activity in a region is directly related to the distance from a centrally located market centre (Chisholm 1962; Hall 1966). Von Thünen's theoretical region is a flat, unbounded plain called the "Isolated State", as it is not affected by any external power.[37] According to von Thünen's theory, concentric rings – or zones of

[36] Of course, transport infrastructure requires annual funding as well. Maintenance and upgrading of current infrastructure are just as important as funding new infrastructure. The two countries represented in this study both have significant infrastructure gaps. In Canada, governments spend approximately C$44 billion less than what is required to maintain – not improve – the state of Canadian infrastructure. In the United States, the infrastructure gap is approximately US$40 billion (Crockatt 1999).

[37] Von Thünen's assumptions were very similar to those of Christaller with respect to central place theory.

production – form around the market centre, each specializing in a different type of economic activity. The farmers of the Isolated State balance the cost of land and transportation with profit to produce the most cost-effective product for the market, depending on their distance from the market, as shown in Figure 2.3. However, the key link between von Thünen's theory and this thesis is the introduction of a preferred transport axis – a canal for example. Improved transport infrastructure changes the location of economic activity – and therefore the development – of a region. Von Thünen's zones of production expand along the transport axis, rather than remaining in perfect circles, as displayed in Figure 2.4. While the physical distance between a given point and the market centre does not change, the economic distance is shortened with the appearance of a simpler, more cost-effective mode of transport.

Figure 2.3 – Von Thünen Concentric Zones of Production



Zone 1: Central City
Zone 2: Intensive Farming/Dairying
Zone 3: Silviculture
Zone 4: Extensive Field Crops
Zone 5: Ranching

Figure 2.4 – Introduction of a Preferred Transport Axis to Von Thünen Concentric Zones of Production

Zone 1: Central City
Zone 2: Intensive Farming/Dairying
Zone 3: Silviculture
Zone 4: Extensive Field Crops
Zone 5: Ranching

Source: Northeastern Illinois University, January 2000; Chisholm 1962

Von Thünen's theory is still apparent today. In most major cities, it is along preferred transport axes – like urban freeways or commuter rail lines – that urban expansion tends to take place. Despite the seemingly easy application of von Thünen's theory, it is also clear that he made several unrealistic assumptions, including:

- uniform productive capacity throughout the region;
- uniform transport mode throughout the region (prior to the introduction of a preferred mode);
- even distribution of population in the region;
- identical incomes, demand schedules and propensity to consume throughout the region; and that
- transport costs are strictly proportional to distance.

Despite these drawbacks to his theory, von Thünen showed the importance of improved transport infrastructure to the location of economic activities and regional economic development.

There are numerous other readings available on the topics of transportation and development and the location of economic activities (See Weber 1909, Townroe 1971, Hilling 1996). Meanwhile, Todd (1974) combines location theory, central place theory and growth pole theory.

The next two sections focus on the economic impacts of transport infrastructure at the national level and at the regional level. In Section 2.3.2, historical examples show the potential effects of infrastructure investment on a nation. Section 2.3.3 discusses the three potential regional effects of infrastructure investment before moving on to some examples of infrastructure investment and regional development. In both sections, one of the key points to note will be the developmental path. This path will be compared with that experienced by growth pole strategies.

2.3.2 – National Economic Development

Transport infrastructure connects the regions of a country, whether by cross-country highways and railways, or airports and seaports linking more remote communities. Furthermore, transport infrastructure facilitates communication, travel and trade within a country and with other nations. Without it, national development would be very fragmented, as each region would develop independently of the others.

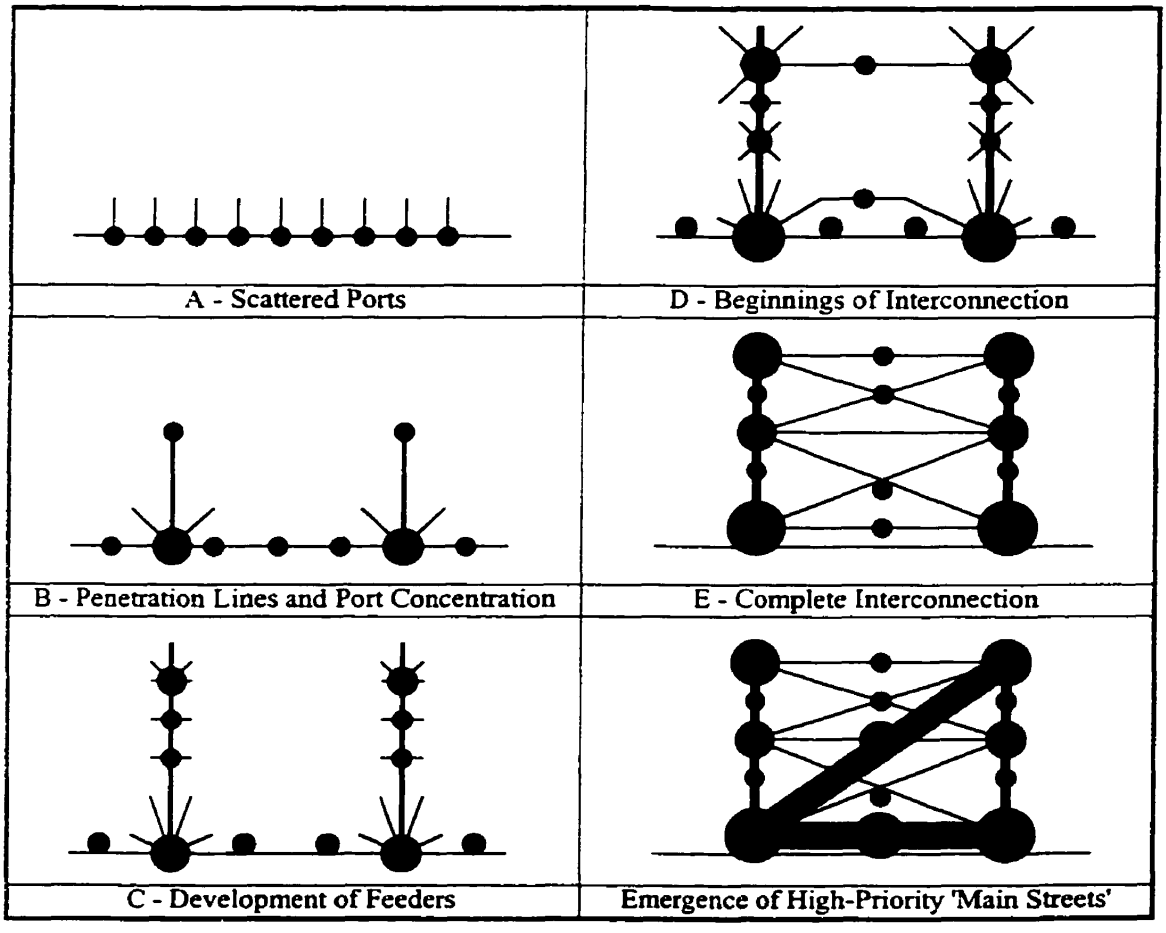
Fogel (1964) showed that the development of American rail network was vital to the growth of the American economy in the 19th Century. Among Fogel's conclusions were that railroads:

- reduced transport costs significantly compared with wagons and water transport;
- enabled national income to rise due to regional specialization in agriculture; and
- positively impacted iron, coal, lumber, machinery, and general manufacturing industries.

While Fogel admits that no single innovation was absolutely indispensable for 19th Century American development, the railroad deserved the distinction more than any other innovation. Without railways, some other improved mode of transport would have been necessary to open up the American West. Otherwise, the vast, productive farmlands would not have been able to get commodities to markets as quickly or efficiently. The high transport costs associated with wagon and water transport would have significantly hampered the export capabilities of western farmers. Railways, because of better flexibility, could be set up to serve the rich, fertile farmlands where water transport was not available. The railways were the enabling technology for expansion into the Western United States. With 19th Century America as evidence, transport infrastructure is indispensable both to the opening up of markets and to the improving of the export capabilities of a nation. However, some have argued that the expansion of America's rail network followed demand rather than creating it (Gauthier 1970).

Taaffe, Morrill and Gould developed a model that applies more to national development than to regional development, but is certainly relevant to both. Originally applied to the authors' research in Ghana and Nigeria, the model simplifies the evolution of a nation's – or region's – transport network. The model begins with an underdeveloped transport system and evolves through colonization and political independence to arrive finally at a developed transport system (Taaffe et al. 1963; Hoyle and Smith 1992). The model is shown and described in Figure 2.5.

Figure 2.5 – Taaffe, Morrill and Gould Model

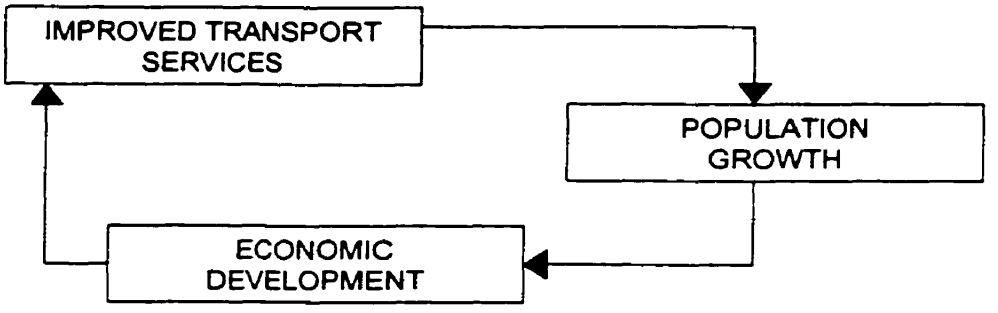


Source: Taaffe et al. 1963

The Taaffe, Morrill and Gould model demonstrates the cyclical pattern of the relationship between transport, population and development (Crockatt 1997). Beginning with better transport services, population growth is encouraged, aiding economic development, thus

creating a higher demand for improved transport facilities. Cities with the most and highest priority links will develop more quickly than the other cities.

Figure 2. 6 – Cyclical Nature of Transport, Population and Development



Source: Crockatt 1997

Some authors (Hoyle 1967; Crockatt 1997) have adapted the model to other geographic locations, demonstrating its applicability beyond West Africa. Most significantly, the Taaffe, Morrill and Gould model shows that transport infrastructure plays an important role in development on a national scale.[38]

What impact does transport infrastructure have on a regional scale? The following section provides a detailed response to this question, beginning with a discussion of the three possible effects of transport infrastructure on regional development.

2.3.3 – Regional Development

Transport infrastructure investment can have a positive, neutral, or negative effect on a region (Gauthier 1970; Hoyle and Knowles 1992; Wilson 1966; Rietveld and Nijkamp 1993; Hoyle and Smith 1992). While there are proponents that support each effect to the exclusion of the other two, there are historical examples of each.

[38] A similar model is the Rimmer Model as noted in Hoyle and Smith (1992).

The **positive effect** – sometimes referred to as the causal effect – means that an improved transport network directly results in the expansion of productive economic activities. An alternative interpretation is that new economic opportunities can be created through improved transport service. Gauthier (1970) notes that some have supported the notion of a causal relationship between improved transport and economic development. Improved transport can also help existing enterprises expand markets or increase market share.[39] Kessides (1993) notes that most macro-economic, or industry-wide, studies have shown that investment in infrastructure has a positive effect on regional economic growth. As mentioned earlier in this chapter, Amos (1996) notes that regional development is enhanced as the transportation system improves.

The **neutral effect** is also called the permissive effect, and builds upon the notion that there is a derived demand for transportation. It is also the most widely accepted effect of transport infrastructure on regional development. Under this theory, the provision of transport infrastructure creates one circumstance of many (the rest are mentioned in Section 2.1) that are necessary for economic development to occur. Infrastructure is a requisite for development, but not a factor in production (Kessides 1993; Hoyle and Knowles 1992; Gauthier 1970). In essence, the neutral viewpoint is a more realistic version of the positive viewpoint.

Transport infrastructure rarely has a **negative effect** on development, but, when it occurs, the negative effect can manifest itself in three ways. The first manifestation, particularly relevant in developing countries, stems from scarcity of resources. Funds spent on transport infrastructure can often better promote development by being directed to other areas. This is also true if a region is already well-served by infrastructure. Any further investment is wasteful (Rietveld and Nijkamp 1993). Secondly, the protectionist viewpoint suggests that high transport costs arising from current infrastructure protect a region from lower-cost competition from outside the region (Wilson 1966). If the infrastructure were improved, the results could harm local enterprises. Thirdly, it is

[39] Adam Smith, the father of classical economics, first recognized that transport could combine with beneficial financing, production capacity, entrepreneurism, and trading conditions to achieve these goals.

important to recognize that occasionally the best interests of regional planning backfire. As discussed earlier, improved infrastructure between major urban centres and outlying regional growth poles is intended to enhance the economic development of the outlying regional centres through reduced transport costs. However, the opposite effect could happen; improved transport could increase the urban centres' agglomeration advantages at the expense of the development centres (Gauthier 1970; Miyoshi 1997). Another example prevalent in developed countries is the extension of transport infrastructure that spurs ex-urban development at the expense of the urban core.

Politicians may find investing in transport infrastructure attractive for two reasons. First, people generally believe that transport infrastructure is important for them and their region. Therefore, it pleases them when a politician invests in transport in their region. Second, it is an investment that cannot be proven wrong in advance. By the time an investment in transport infrastructure is proven wrong, the politician who made the choice to invest is invariably out of office.

2.3.4 – Examples of Transport Infrastructure and Regional Development

Some cases of transport and regional development have already been touched on in previous sections of this chapter. Taaffe et al. (1963) assessed the impact of transport networks on West Africa, while Fogel (1964) wrote of the railroad's importance to the development of the interior of the United States. Transport infrastructure and regional development examples are numerous. Three – albeit salutary instances – are discussed here: Quebec, North Texas, and Zimbabwe.

2.3.4.1 – Quebec, Canada

The Canadian province of Quebec owes much of its development to transport – in particular the St. Lawrence River (Hoyle and Smith 1992). It is important to note that with initial dependence on the river rather than a port facility, no infrastructure investment was required. Nevertheless, the region developed because of transport and

later because of transport infrastructure. The river is still home to a large amount of Canada's maritime traffic, moving Canada's key exports to international destinations, while facilitating the importation of important products as well. The earliest European settlements in Quebec used the river to facilitate the exploitation of the region's vast resources. From the 1600s to the mid-1800s, Quebec was dependent upon maritime transport along the St. Lawrence (Hoyle and Smith 1992).

Between 1850 and 1880, rapid urban economic development occurred in the region – particularly in Montreal – as Montreal-based railways radiated out across the young country (Hoyle and Smith 1992). The railways gradually shared with the river and enhanced its role as the key to regional development in Quebec. The railway enabled distant farmers and industrial firms to ship products to Europe through the port of Montreal. The expanded transport network also opened up or improved industries like hydroelectric power, mining, chemicals, forestry and paper. These new industries expanded, resulting in a demand for even more transport infrastructure, following the cyclical process noted by the Taaffe et al model.

Figure 2.7 – Map of Quebec

Source: Magellan Geografix, January 2000

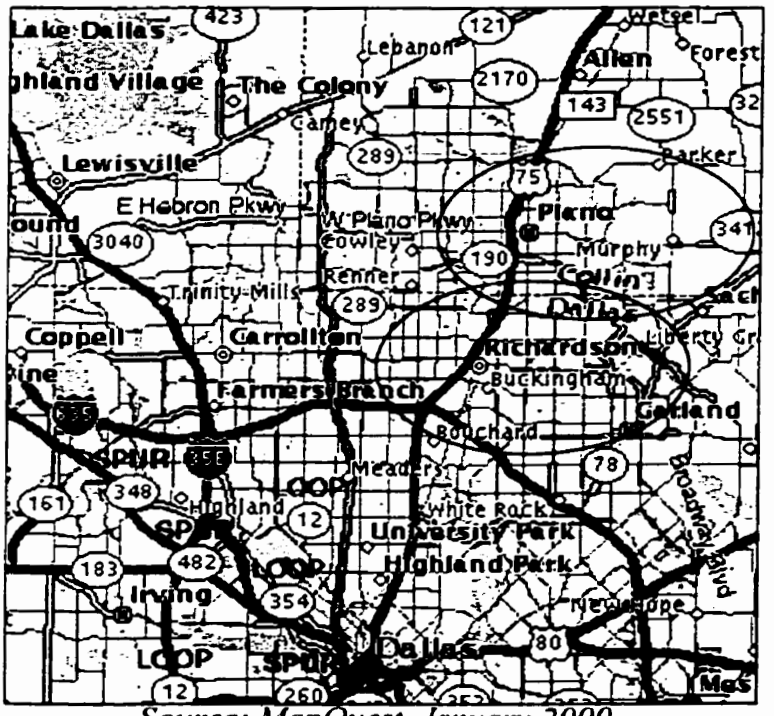
Although Western Canada has become more important than Eastern Canada to both Canadian National Railways (CN) and Canadian Pacific Railway (CP), and although the port of Montreal is less important globally than some of its East Coast counterparts (New York-New Jersey and Charleston, in particular), Quebec's economy is now diversified enough to withstand the impacts associated with these changes. However, transport has played a significant role in enabling the region to reach such a point. The next example –

that of North Texas – reflects the modern-day impact of transport infrastructure while still following the theme of natural development, as was the case in Quebec.

2.3.4.2 – North Texas

Since this thesis shrinks the growth pole concept from a city to an airport, it should also make note of a few microcosms of the relationship between transport and regional development. A prime example of this is North Texas – specifically, the northern suburbs of Dallas.

Figure 2.8 – Map of North Texas



Source: MapQuest, January 2000

Plano and Richardson are former bedroom communities to the north of Dallas. Now, however, they are the location of hundreds of thousands of residents and also hundreds of thousands of jobs. Plano is home to such national and international companies as Electronic Data Systems (EDS), SkyTel Communications, Dr. Pepper and JCPenney,[40]

[40] The web site for Plano Economic Development (Plano Economic Development, May 1999) lists the following companies employing more than 1000 people in the city: Alcatel, City of Plano, Citizens Communications, Collin County Community College, Countrywide Funding Corporation, EDS, Ericsson,

while Richardson is the location of Dallas' "Telecom Corridor", with huge campuses for Nortel, Ericsson, Fujitsu and MCI.[41] Officials from both communities claim that the rapid growth of the cities is largely due to their location along US Highway 75 (or Central Expressway), a north-south freeway connecting the communities with downtown Dallas. In Richardson, a "flurry of housing" followed the opening of Central Expressway in the 1950s. Similarly, Plano's development plans were based upon the presence of the freeway (Patrick 1999). Now another suburb, Frisco, is experiencing the same kind of growth that Plano and Richardson experienced when US 75 opened.

Frisco, TX – slightly further north than Plano – has grown from 6,400 to 26,200 residents between 1991 and 1999 (Patrick 1999). Whether the recent extension of the Dallas North Tollway – another urban freeway connecting the bedroom community to downtown – is responsible for this rapid growth is debatable. Frisco is also served by Central Expressway. Owing to the growth in Plano, Richardson and Grapevine (to the north and west of Dallas), these northern suburbs have been growing and expanding geographically much more quickly than suburbs to the south or east of Dallas.[42] It is likely a combination of this growth north of Dallas and the provision of infrastructure (the Tollway and improvements to State Highway 121) that have led to the rapid growth of Frisco. However, this is puzzling if only highway infrastructure is considered. To the east, I (Interstate)-20 and I-30 link Dallas with centres like Little Rock, Memphis, Shreveport and Atlanta. To the south, I-35 connects Dallas with Austin, San Antonio and Laredo, while I-45 is the main route between Dallas and Houston. These routes are at least equal in stature and quality to the routes in the northern suburbs, and the connecting

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Frito-Lay, Inc., JCPenney, Inc., JCPenney Direct Marketing Services, Medical Center of Plano, Plano Independent School District (PISD), and Texas Instruments.

[41] The Richardson Chamber of Commerce (Richardson Chamber of Commerce, May 1999) lists the following companies employing over 1000 people: Nortel, Richardson Independent School District, MCI, Blue Cross & Blue Shield, Ericsson, Alcatel, Fujitsu and the University of Texas at Dallas. It should be noted that Ericsson, a Swedish telecommunications-equipment company, appears in both Plano's and Richardson's list since the company is moving approximately half of its Richardson employees to Plano (Plano Economic Development, May 1999), while Alcatel, a French engineering and information technology firm, has facilities in both cities.

[42] To the west of Dallas, there is not much space to develop or grow. The cities of Grande Prairie, Arlington, Irving, and a few others are sandwiched between Dallas and Fort Worth.

cities are at least as impressive as the northward links of Oklahoma City and Wichita. The answer may lie slightly to the northwest of Dallas.

DFW Airport appears to be the epicentre of development in North Texas. The fastest growing suburbs in the region are close to the airport – as are the most affluent. Residential and commercial growth is most notable along State Highway 114. This may seem innocuous at first, but one of SH 114's key characteristics is that it is the most direct route linking DFW Airport with Alliance. Families and businesses – and therefore economic development – congregate around and between these airports, thus earning them the distinction of serving as growth poles.[43] Perhaps the best way to describe the development of Dallas' northern suburbs is "growth breeds growth". As the region develops – at least partly due to improved highway infrastructure and at least partly due to DFW and AFW – it attracts more development.

> Fueling the growth [of the region] are economic magnets such as Dallas/Fort Worth Airport and Alliance Airport, as well as easy access to commercial corridors between and along Interstates 35E and 35W. Area communities credit location, ease of highway access, affordable housing and aggressive economic development for the growth (Chada 1998).

Transport infrastructure has facilitated regional development as once-rural North Texas communities develop.

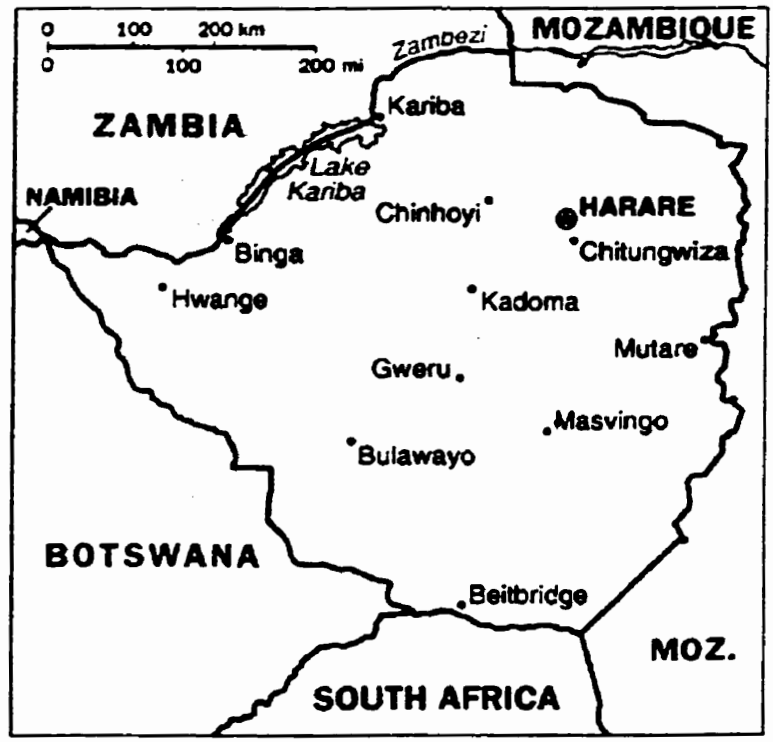
The discussion of development relative to the airport is better suited for Chapter 4, where observations at each case-study airport are described, and also for the next section, which discusses the notion of airports as growth poles. Before that, however, the case of transport infrastructure and rural development in Zimbabwe is examined.

[43] The same can be said for Huntsville as well. The fastest growing community in the Huntsville area is Madison, a town that is actually closer to the airport than the built-up part of Huntsville itself.

2.3.4.3 – Rural Zimbabwe

Having included examples from well-developed nations like Canada and the United States, it is useful to examine the case of transport and development in a less-developed country like Zimbabwe.

Figure 2.9 – Map of Zimbabwe



Source: National Geographic Society, January 2000

Zimbabwe became an independent nation in 1980. At that time, the new government needed to help the country's transport network evolve into a system designed for an independent country rather than perpetuating the colonial linkages that were in place. Furthermore, President Robert Mugabe had to give priority to the needs of rural people in the Communal Areas – who made up approximately 57 percent of the total population. The Communal Areas – formerly known as the Tribal Trust Lands – were home to subsistence farmers on poor quality land and were characterized by frequent droughts and out-migration (Hoyle and Smith 1992). To make matters worse, the region had an

exceptionally poor road network. The government, realizing that it could control neither the quality of the soil nor the frequency of drought, embarked on an emergency road construction program, eventually evolving into the Rural Roads Program in 1984. The program was designed to:

- facilitate the marketing of surplus agricultural produce;
- provide equal access for all households to basic facilities and service centres; and
- implement a system of all-weather roads, suitable for passenger bus transportation in the Communal Areas (Hoyle and Smith 1992).

The Rural Roads Program established over 16,000 km of roads at a cost of approximately US$60 million. The road network was designed so that all residents of the Communal Areas were no more than 10 km from a primary road and within 5 km of a secondary road. This ensured that rural farmers had access to markets in order to sell surplus agricultural product. The result was positive. Zimbabwe is self-sufficient in its staple crops and now exports cotton, tobacco and corn. Farmers also sell horticultural crops for additional income. Hoyle and Smith (1992) credit improved marketing and improved domestic transport for the increased agricultural exports.

Of course, transport infrastructure – while having played a very important role in linking the Communal Areas with key markets – worked in combination with several other factors to produce this positive result. This was also the case in Quebec and North Texas and could be the case in Winnipeg.

2.3.4.4 – Winnipeg

Winnipeg's historical development is closely tied to transportation, beginning with the confluence of the Red and Assiniboine Rivers, the presence of three Class I railways, strong highway links, and its international airport. However, Winnipeg is a slow-growing region with limited industrial diversification. If airport infrastructure were improved or expanded (including a business park), it is possible that Winnipeg's economy may diversify – opening up new markets – with more high-tech companies that tend to depend

on air transport. Infrastructure encourages the growth of alternative employment and consumption while increasing access to new technology (Kessides 1993). This process directly leads to regional economic diversification – an advantage from which Winnipeg could benefit.

2.3.5 – Development Patterns Compared

This section is devoted to comparing the development pattern of growth poles with the pattern of transport infrastructure and development. The evidence disseminated by the preceding case studies shows that the two patterns have clear similarities, but some key differences as well. This is also the most appropriate place to discuss the relationship of infrastructure with development within a growth pole strategy – since the topic fits neatly into neither section alone.

Todd (1974) notes the similarity between the development pattern of growth poles and that of central place theory. The central place developmental path consists of four stages corresponding to the four sectoral divisions of economic activities. The pattern begins with (1) primary – mainly agricultural – activity, followed by (2) manufacturing, then (3) secondary processing and specialized services and finally an emphasis on (4) financial and administrative activities. This is likened to the evolution of the growth pole. Growth centres around the dominant firm or industry, gradually expanding outward through related industries, which locate at the growth pole as it passes particular thresholds – or critical masses. However, central place systems rarely diffuse spread effects to lower-order centres – in other words, many linkages apparent in successful growth poles are lost to the region in central place theory's development path (Todd 1974).

Todd (1974, p. 298) notes the concept of transport axes, locations that channel growth spin-offs from development poles and which take the form of "linearities in the spatial expression of growth". This is an important point. The idea that a transport axis acts as a medium for development from a growth pole supports the argument to be made in the

final section of this chapter. In terms of growth poles, however, transportation has been inadequately addressed (Gauthier 1970).

There is no escape from the necessity of transport infrastructure for economic development, even in growth pole policies. The growth pole policies that have been acclaimed e.g., Italy, are those that have experienced success in their infrastructure investment programs. The ARC's transport investment plan was a failure because it was poorly integrated. This underscores the importance of a comprehensive development plan, with a particular emphasis on a complete infrastructure investment plan, not a piecemeal plan as was the case in Appalachia. Also common to both development paths is the need for complementary investment – like education and health services.

Investment in transport infrastructure – whether operating in the *positive* or *neutral* manner – can clearly benefit a region. Transport infrastructure is a prime location for spin-offs from growth poles. Therefore, investment in transport infrastructure should have doubled its attractiveness. While building infrastructure does not guarantee success, not building infrastructure virtually guarantees failure.

Transport infrastructure is a necessity along the developmental paths of both regional development and growth poles.

2.4 – Airports as Growth Poles

This section explores the creation of a planned growth pole surrounding an airport. In general, airports are not considered in growth pole theory. Usually growth poles are thought to be an area in a city – or a city as a whole – that spurs economic development through a key industry or company. According to Parr (1999a, p.5), a planned growth pole involves "the planned location within a region of a firm belonging to a propulsive industry, with the expectation that this would stimulate the development of linked industries at the planned pole and/or cause growth to be diffused throughout its zone of influence". A number of items must be noted in this passage.

First, the remainder of this thesis makes the case that the airport and its related infrastructure *is* the firm belonging to the propulsive industry. The propulsive industry is either transportation, or air transportation, or a derivation of the propulsiveness of several other industries that demand air transportation. Additionally, an airport is not a firm in the traditional sense of the term. Airports are not mobile as industrial firms are, and, in most cases, some form of public ownership exists. Nevertheless, all indicators show that demand for air transportation – both passenger and cargo – has increased consistently since the mode's inception early in the 20th Century. Furthermore, continued growth in air transportation is expected. As the globalization of commerce continues and airline fares decline, passenger traffic is expected to increase annually at a rate of 5.0 percent over the next ten years (Boeing, May 1999).[44] Air cargo should show even more rapid increases.

> Air cargo demand continues to grow as a result of expanding logistics systems that emphasize higher processing speeds, greater efficiency, enhanced customer service, and activity-based costing. Demand growth should drive significant changes in airport cargo operations.
>
> Air cargo should be stimulated as individual firms focus on reducing order-cycle times including all of their integrated logistics strtegies – just-in-time (JIT), make-to-order, quick response, etc. – as a source of competitive advantage. Furthermore, deregulated competition should force carriers to become more efficient. Holding fuel prices constant, efficiency gains could translate into declining freight rates that induce shippers to use more air freight (Thompson et al 1999).

As Chapter 1 indicated, more and more goods are becoming eligible for air transport, meaning that Boeing's forecast of a 6.4 percent annual growth rate is realistic (see Table

[44] Airbus Industrie (May 1999) agrees that passenger growth should average 5.0 percent growth over the next ten years.

2.1).[45] Given these characteristics of air transportation, it is acceptable to consider airports as members of a propulsive industry – even if that industry has developed out of the growth and evolution of other industries.

Table 2.1 – Passenger and Cargo Traffic Forecasts, 1999

Category	10 Year Forecast	20 Year Forecast
Passenger Traffic	5.0%	4.3%
Cargo Traffic	6.0%	6.4%
World Economic Growth	2.9%	3.0%

Source: Boeing Corporation (Boeing, May 1999)

Second, as it is a member of a propulsive industry, the airport is expected to stimulate the development of linked industries. A high degree of linkages between industries (between the airport and its related industries, in this case) is a requirement of a growth pole (Todd 1974). The dominant industry (the airport) affects the expansion of input supply industries – known as backward linkages – and the growth of industries demanding the dominant industry's outputs – or forward linkages (Todd 1974). One need look no further than any airport economic impact study to find the firms and industries that are directly and indirectly linked with air transportation. Major airports help stimulate linked industries. Examples of linked industries are:

- air carriers;
- general aviation;
- air support services;
- airport operations and administration;
- on-site and nearby retail; and
- ground transportation (Shurvell et al 1998).

Furthermore, Todd (1974, p. 299) lists four spatial linkage types that can be noted within growth pole theory. They are certainly applicable to the aforementioned airport linkages with some minor adjustments from the industrial setting noticeable in the following list:

1. *Process spatial link* – the movement of commodities between different plants as stages in the manufacturing process (including subcontracting).

[45] MergeGlobal forecasts an average of 6.2 percent growth in world air freight tonnage over the next five years, despite current crises in Asia and South America (Hoppin and Clancy 1999).

2. *Servicing spatial link* – the supply of equipment and maintenance services undertaken by firms external to the production plant.
3. *Marketing spatial link* – firm interdependence for the purpose of product distribution (including wholesaling and transportation).
4. *Financial spatial link* – ties with financial and business advisory services.

Third, Parr notes the important geographical aspect about growth poles when he mentions that the linked industries are at the growth pole and that growth should be diffused throughout the pole's zone of influence. These characteristics are very applicable to airports. Included in a recent economic impact study of Winnipeg International Airport was an innovative approach to map the airport's Area of Economic Influence (AEI) (Shurvell et al. 1998). The location of firms that were included to determine the direct and indirect impacts of the study were mapped to show the spatial impact of the airport. In Chapter 4 of this thesis, the AEI of each of the four airports in this study are discussed.

While airports may not be directly responsible for the economic development of a region, it can be stated with considerable certainty that the three American case-study airports being considered in this thesis are very important components of regional economic development in Dallas-Fort Worth and Huntsville. By the same token, why should Winnipeg not be allowed to join this group? Are the other advantages possessed by AFW, DFW and HSV so much greater than YWG that it has no hope of joining this "club"? And what about the other airports that model themselves after the "Alliances" and "Huntsvilles" of the worlds? For instance, the North Carolina Global Trans Park and Portland, Oregon's airport business park have not been nearly as successful as Alliance and Huntsville – let alone DFW – despite the grand plans and artists' conceptions of the former two projects. Is Winnipeg more like North Carolina and Portland or is it more like Alliance and Huntsville? What mistakes were made by the places that have been unsuccessful? Can Winnipeg avoid those mistakes and use the developmental keys established through studying Alliance and Huntsville to become a successful cargo-based growth pole airport? While it is apparent that there are still more questions than answers regarding YWG's future, it is important to consider examples of what should *not* be done, as well as what should be done.

Plans are underway to develop the west side of Winnipeg International Airport into a business park. AFW and HSV are important models for those planning YWG's park. However, instead of starting from scratch and trying to attract a major tenant to a currently unused area – as is the case with the lands assembled under the Winnipeg Airport Land Corporation (WALCO) – the boundaries of the West Side Business Park could be slightly expanded to include companies already there. Two of these companies would make excellent additions to any airport business park: Boeing and Air Canada. Furthermore, NavCanada's Winnipeg Area Control Centre is located in the same area. Meanwhile, Standard Aero and Bristol Aerospace are on the east side of the airport. With expansion of the companies, land becomes more difficult to find on the east side, so these firms may wish to join the likes of Boeing, Air Canada, and NavCanada on the west side. In this respect, YWG is already on the path to creating an attractive environment for firms. If those companies were brought under the umbrella of a Winnipeg Airport Business Park, it puts YWG ahead of many other locations purporting to be more advanced in terms of development.

Winnport Logistics was a company established in 1993 in an effort to create an international air cargo gateway, intermodal rail terminal and business park at YWG – much like the efforts being undertaken by WAA and WALCO in 1999. Winnport even built its own warehouse facility on the west side of the airport in an effort to enhance development there. However, Winnport strayed from its initial plans and became immersed solely in the air cargo industry. After securing the Canadian bilateral rights to fly cargo aircraft from Winnipeg to Shenzhen and Nanjing in China, Winnport began operating a Boeing 747 freighter three times per week between North America and Asia. Winnport suspended operations in January 1999 – less than three months after the commencement of service to China – due to the continued Asian economic crisis and subsequent deflation of that market, in combination with severe undercapitalization of the company and an oversized aircraft. In addition, although unintentionally, Winnport made as many enemies as friends while establishing itself, not the least important group that Winnport alienated was the city's freight forwarding community. Requesting anonymity,

one official involved in Winnipeg's air cargo industry at the time said: "At a time when businesses were looking for faster-cheaper-better, Winnport offered a service that was slower-expensive-worse, and told shippers that they'd like it."

Winnport has resumed operations domestically in partnership with Royal Air Cargo, serving primarily Calgary and Hamilton with a 727 freighter. However, the failure – or lack of success at least – of Winnport's initial effort does not mean that air cargo cannot work at YWG. Winnport owes its problems to poor business planning, poor management, and unlucky timing. Furthermore, Winnport's record to date does not rule out Winnipeg International Airport as a cargo-based growth pole airport.

An important part of establishing a cargo-based growth pole airport – at least based upon the evidence at DFW, HSV, and AFW airports, and the plan at YWG – is the existence of a nearby industrial park. While the term "industrial park" may conjure up images of smokestacks and heavy industry, this is never the case for airport industrial parks. Heavy industries are generally not permitted to locate near an airport because their emissions hamper aircraft and control tower visibility. Today, many airport industrial parks receive the more appropriate name of "business parks".

The concept of the airport business park is not new. In 1965, the FAA published a report entitled "Planning the Airport Industrial Park". Even then,

> the specific goal for the development of an airport industrial park is economic gain for the community through increased employment and the expansion of industry and commerce by the provision of attractive, efficient sites for industry (FAA 1965, p. 21).

The prime objective behind the establishment of Huntsville's airport industrial park and intermodal centre was economic development for the city and county. Ed Mitchell – a man many in Huntsville call the "visionary leader" for the airport, business park and intermodal centre development – claims that for any city, and specifically Winnipeg, the need for economic development justifies plans modelled after Huntsville (Mitchell 1999).

As mentioned earlier in this chapter, economic development – not egalitarianism – is assumed to be the impetus for investing growth poles at airports. So, while much about airport business parks has changed since the 1965 FAA report, the chief objective has not.

This study ignores the financing and physical planning and construction of airport business parks. These are of vital importance to the success of an airport growth pole, but they are large enough subjects to be the topic of separate theses in their own right and, therefore, they are not considered here.

2.4.1 – Examples of Airport Growth Poles

Although there are dozens of cases of airports acting as regional growth poles only two are considered in this section. The main reason for this is that the remainder of the thesis is a further discussion of three growth pole airports: DFW, AFW and HSV. Nevertheless, YWG is included here to show that, while more growth is desired for the airport region, it has not been entirely devoid of growth pole attributes for at least two decades. Before that discussion is a brief summary of one of the few studies extant that considers an airport as a growth pole: the case of London Heathrow Airport.

2.4.1.1 – London-Heathrow

Hoare (1974) examined London Heathrow Airport (LHR) as a growth pole. This growth pole was typical of natural growth poles in that it met with only moderate success. Therefore, because it was at least partially planned as a growth pole, it was atypical because of its success.

Figure 2.10 – Map of London-Heathrow Airport

Source: MapQuest, January 2000

At the time of Hoare's study, Heathrow was the world's eighth busiest airport, but handled more international passengers than any other airport (Blankenship 1974). It is now the world's fourth busiest passenger airport with over 60 million passengers in 1998 and thirteenth busiest cargo airport (ACI, June 1999). Heathrow was considered to be a good candidate for a growth pole due to the natural attractive nature of airports that had already been noted at that time. Hoare (1974) found both positive and negative impacts of the airport on its region.

Many of the negative impacts, however, were typical of airport-related problems. Noise levels – a perpetual problem at most busy airports – were high, causing many firms to soundproof and air-condition their buildings. Some business expansion requests were turned down because of the potential for radar interference or road congestion in the region. This led to the possible out-migration of firms from the region. However, according to Hoare's study, some factories but no offices considered moving.[46] Increased economic activity near the airport led to labour competition that drove wages upward and created a negative effect for the firms.[47] These negative effects, for the most part, are minor and appear to be inconveniences more than negative impacts (with the exception of the out-migration of firms).

The chief positive impact was the attraction of firms to the region due to the airport's presence. Both office-oriented firms and manufacturing firms established new locations along major roads near the airport, but more offices did so (Hoare 1974). Existing firms and relocating firms experienced many of the same positive impacts from Heathrow, particularly those with overseas offices or foreign owners. Other types of firms finding the airport to be advantageous had generally high proportions of research staff and skilled workers, indicating that these firms were likely producers of high-value goods, which is also likely if the firm were a user of air freight. At the time of the study, a high proportion of firms near Heathrow belonged to Britain's key growth industries: engineering, chemicals, and motor vehicles (Hoare 1974). Firms relocating to the region put a higher value on proximity to the airport than established firms. Furthermore, it was also noted that construction, ventilation and electrical contractors benefited from proximity to the airport with the increase in new and expanding businesses in the region. These firms tended to be clustered around Heathrow more strongly than the offices or manufacturing firms that claimed Heathrow as an advantage to them.

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[46] This is consistent with the discussion in Section 2.4 of this chapter. Industrial firms – i.e. factories in Hoare's (1974) study – are not appropriate for airport locations. Conversely, offices are excellent candidates for airport locations.

[47] Of course, this was a positive impact for members of the labour force, as their services were in demand and their wages were high.

Despite the positive impacts noted, Hoare questioned whether Heathrow should be considered an unqualified successful growth pole. However, most of the evidence shows that the airport has been beneficial to its immediate region and all of Southeast England. Beyond approximately 16 km of the airport – the area within which the negative impacts are noted – the effects of Heathrow are almost entirely positive (Hoare 1974). While this does not fit the growth pole concept perfectly, the overall spatial impact of LHR does conform to growth pole theory.

Hoare's study does not detail the social impacts on the region – such as out-migration, income levels, and unemployment. However, because it is the impact on firms that is the key issue of this thesis, Hoare's study is very appropriate nonetheless. For the sake of comparison, employment at Heathrow doubled between 1956 and 1967 and, by 1966, approximately 14 percent of the jobs in Middlesex were located at the airport (USHUD 1974).

As was the case with the Heathrow study, the primary goal of establishing a growth pole at Winnipeg International Airport would be to encourage firms to relocate near the airport – i.e. economic development. Benefits such as rising income levels and decreased out-migration and unemployment would be expected to follow. As the following section shows, air cargo is flourishing at YWG and demand for industrial land near the airport is high, indicating the presence of at least two key characteristics of growth pole airports.

2.4.1.2 – Winnipeg

The ultimate goal of this thesis is to determine the path leading to a critical mass for a cargo-based growth pole airport. Specifically, this information is intended for application at Winnipeg International Airport. An important element of the air cargo aspect of successful growth pole airports is the evolution of the airport into a hub for air cargo. Rudolph (1994) discussed the economic benefits of a hub airport combining passenger and cargo – as a "marginal joint product" – operations with specific reference to Winnipeg International Airport. The premise behind this idea is that increased frequency

of passenger flights (to meet the demand at a hub airport) brings with it increased frequency of air cargo capacity by utilizing the belly space on the passenger aircraft. In the five years since that study, however, the air cargo situation at YWG has changed dramatically. Purolator and FedEx have made significant investments in cargo sorting and distribution facilities and a privately funded apron. The two integrators move more cargo through the airport than the major passenger airlines.[48] The argument can be made that the integrators are more important than belly freight because they treat YWG as a hub. Deregulation did not turn YWG into a major passenger hub. Consequently, no corresponding increase in air cargo capacity occurred as suggested by Rudolph (1994). In fact, the opposite has happened. The passenger airlines have reduced the size of their aircraft serving Winnipeg, so that palletized or outsized cargo cannot be shipped in the belly of the regularly scheduled passenger aircraft serving the city. Nevertheless, the air cargo industry as a whole has grown, and Winnipeg is an increasingly important location for companies that specialize in the movement of air cargo.

A related issue is the advantages of moving air cargo through a hub airport. Integrators such as FedEx and UPS believe there is an advantage. While these two major global players still move the majority of their packages through a few select regional hubs, it was not long ago that FedEx moved all of its inter-city packages through its main hub in Memphis, TN. Rudolph (1994, p. 91) calls YWG "a viable environment for future air cargo hubbing operations... due to its geographical location within North America and its direct ground transportation links to the United States". However, each of the other three airports in this study – as well as dozens of other airports worldwide – also claim to have the "ideal" location for air transportation and ground distribution. Some examples from a single trade show are shown in Table 2.2.

Air cargo development at YWG depends on the economic situation in Winnipeg and on the extent to which air transportation interacts with surface transportation (Rudolph 1994). In Winnipeg, the economy has been strong throughout the late 1990s, the rail

[48] Rudolph (1994) predicted that YWG's air cargo capacity in 1994 would be inadequate if air cargo experienced rapid growth. This is quickly becoming the case, since apron space is at a premium at peak

industry is well represented by CN, CP, Burlington Northern Santa Fe and OmniTRAX (although, in December 1999, CN and BNSF have announced plans to merge), and the trucking industry in Manitoba is relatively larger than its counterparts in other provinces. Given the above set of circumstances, air cargo should be expected to continue its growth in Winnipeg.

Table 2.2 – Airport Location Claims

Airport	City	Claim
McGhee Tyson Airport	Knoxville, TN	"...about as close to the center of the eastern U.S. as you can get... more than 70% of the American population within a day's drive."
Philadelphia International Airport	Philadelphia, PA	"PHL Means Prime Location"
Halifax International Airport	Halifax, NS	"The closest continental North American link to Europe."
Ottawa International Airport	Ottawa, ON	"... our central location ..."
Griffiss Airport	Mohawk Valley, NY	"... a prime location within 300 miles of most major northeast metropolitan areas..."
Alliance Airport	Fort Worth, TX	"Our central U.S. location offers easy access to and from domestic and international markets."
Lester B. Pearson International Airport	Toronto, ON	"... within a one day drive of 46% of the U.S. population..."
Hamilton International Airport	Hamilton, ON	"... access to over 120 million consumers within one day's trucking or less ... in the heart of the largest manufacturing and population base in Canada."

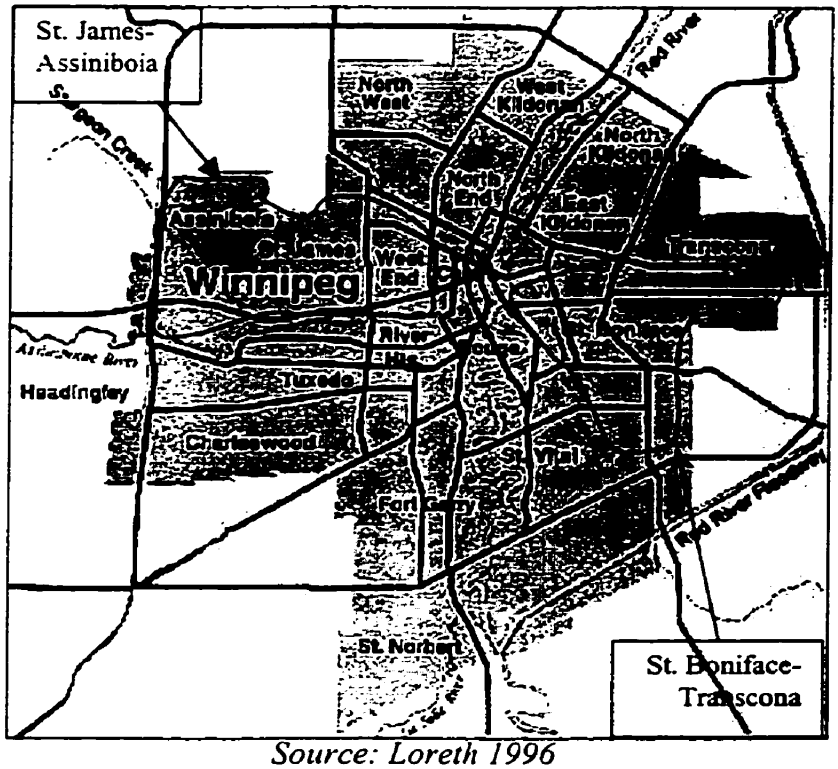
Source: International Air Cargo Conference 1999

Before moving on with any further discussion about turning YWG into a growth pole, it is prudent to show that it already has certain growth pole qualities. Loreth (1996) examined the role of transport infrastructure in determining the demand for industrial land in Winnipeg. Not surprisingly, the major conclusion from the research was that location and proximity to transport are the prime determinants of industrial growth in

overnight times. WAA is considering new cargo apron space, but how to fund it remains a question.

Winnipeg. Loreth's study is included in this section rather than the section dealing with transport infrastructure and development, because it was also found that proximity to Winnipeg International Airport was an even stronger determinant than proximity to either trucking or rail facilities. This is best demonstrated by comparing two parts of the city: St. Boniface-Transcona and St. James-Assiniboia (noted in Figure 2.12).

Figure 2.11 – Map of Winnipeg: Industrial Areas



Source: Loreth 1996

St. James-Assiniboia contained 6.6 percent of Winnipeg's vacant serviced or partially serviced industrial land in 1981, and only 4.7 percent by 1990 (Loreth 1996). By contrast, nearly half of the city's serviced or partially serviced vacant industrial land was in St. Boniface-Transcona in 1990. St. James-Assiniboia – in conjunction with Inner City Wards 2 and 3[49] – has accounted for 51 percent of Winnipeg's vacant industrial land sales since 1971. So, regardless of the location, quantity or availability of the supply of vacant industrial land, it is the demand for this land that drives development. The

demand for industrial land has historically been greater in St. James-Assiniboia than in St. Boniface-Transcona.

Development in the St. Boniface-Transcona area has traditionally been centred upon easy access to the large supply of rail infrastructure provided by CN's and CP's railway networks. Furthermore, several major trucking routes serve the area, including Lagimodiere Boulevard, the Trans Canada Highway, the Perimeter Highway, and Provincial Trunk Highway 15. These transport axes have not been enough, however, to attract a similar scale of development to that which has occurred in the western part of the city.

St. James-Assiniboia also has access to rail facilities (CP's Marshalling Yards in particular) and trucking routes (Trans-Canada Highway West, Perimeter Highway, and Winnipeg Route 90). Tipping the scales in favour of St. James-Assiniboia is the location of Winnipeg International Airport. "By itself, proximity to the airport is clearly more significant than either trucking and/or rail combined" (Loreth 1996, p.10). This is similar to the gravitational pull of DFW Airport on the suburban areas of Dallas as mentioned earlier in this chapter. YWG has acted as a growth pole in creating a dependent industrial hinterland around it. However, development is still very slow and Winnipeg needs to exploit the opportunities and advantages it possesses.

Loreth (1996, p.10) further supports the notion of YWG as a growth pole by stating that "this economic base now serves to attract additional industrial growth to this part of the city." To a certain degree, agglomeration advantages have become evident in the area immediately southeast of YWG and other activities have located in the area. Other major gravitational forces in the same area include: Polo Park Shopping Centre (the city's largest mall); Winnipeg Arena; and Winnipeg Stadium.[50] It is beyond the scope of this thesis to disaggregate the demand for land in the area into airport-related demand, mall-related demand, arena-related demand and stadium-related demand, but it can certainly

[49] St. James-Assiniboia made up well over half of the total amount of serviced or partially serviced land in this area, which, as a whole, accounted for only 8 percent of the city's total in 1990.

be said that not all development is because of the airport. Furthermore, the development that has taken place in the area, while the most significant in Winnipeg, is still less substantial than that occurring at AFW, DFW or HSV.

The key to developing Winnipeg's airport as a growth pole – more than it already is – is investment. Investment in transport infrastructure is further discussed in Section 2.5. Next is a discussion of the regional development implications of airport growth poles.

2.4.2 – Airport Growth Poles and Regional Development

The goal of airport growth poles – and indeed, all growth poles – is to effect regional economic development. While not explicitly called growth poles, it has been the objective of many airport projects to influence positively regional development. The importance of an airport to its particular region is frequently promoted through economic impact studies and other utilities showing how the airport benefits its region.

Each of the four airports included in this thesis have recently completed economic impact studies. In 1998, the Alliance Corridor Economic Impact Report indicated that 12,000 permanent jobs have been created along with 6,500 part-time jobs and 18,000 construction jobs. Additionally, Alliance has contributed nearly US$4 billion in new investments (96.3 percent of which were privately funded), and over US$13 million annually split between six taxing jurisdictions (Alliance Airport, April 1999, Hillwood Development Corporation 1998).[51] Furthermore, Alliance is still rapidly growing with frequent announcements of new businesses and new transport services. DFW's estimated annual regional impact is US$11.2 billion with 211,000,000 jobs and US$6,100,000,000 in labour income (Dallas/Fort Worth International Airport, March 1999). HSV's total multiplier impact in 1996 was US$970,911,000 in labour income, 28,594 jobs, and US$107,700,000 in taxes paid to the numerous jurisdictions (Huntsville-Madison County Airport Authority, March 1999; Port of Huntsville 1998). The economic impact of YWG

[50] Loreth's model, however, did attempt to take Polo Park's influence into account.

was found to be 7,220 jobs, C$287,516,548 in airport-related expenditures, and CS221,422.093 in labour income for 1996 (Shurvell et al 1998). Rudolph (1994) found that air cargo at YWG accounted for over 500 jobs, nearly $8 million in employee income and contributed over $100 million to the gross domestic product of Manitoba.

A meaningful analysis is difficult because of several problems encountered when comparing economic impact (EI) studies. The most notable is that EI studies use different methodologies for determining the economic impact.

> Inconsistent use of terminology and method leads to skepticism about the validity of EI study results. Terms are either loosely defined or simply left without definition. EI methods are inadequately explained and often lack references that justify approach. To put it bluntly, many EI studies are "unscientific" at best. This makes comparisons across studies difficult (Shurvell and Prentice 1999, p. 727).

Shurvell and Prentice (1999) proposed that a standard methodology be agreed upon. Mazerolle and Bisson (1989) and the FAA (1992) have put forth potential standard methodologies for airport EI studies, but neither has been universally accepted. In addition, it is generally impossible to include a "before and after" comparison of the economy of a region affected by a growth pole airport. For instance, in the case of the ARC, unemployment and income figures could be compared before and after the implementation of the program. No such opportunity exists in the case of airport economic impact studies. The numbers cited, while impressive, should not be the only measure of success.

Other elements of airports and economic development may be better measures of the airport's effectiveness as a growth pole. Although Horonjeff and McKelvey (1994) do not discuss airports within the context of growth poles, they do discuss the economic

[51] The taxing jurisdictions are the City of Fort Worth, Denton County, Tarrant County, the Northwest Independent School District, the City of Roanoke and the City of Haslet.

ramifications of airport infrastructure. Airports impact regional development in the following ways:

- the relocation of firms from outside the region requiring construction activity;
- increased production or sales of existing firms requiring new or expanded capital facilities;
- increased tourism and recreational expenditures requiring new or expanded facilities, and the related increase in retail sales;
- expansion of agricultural markets leading to higher productivity and better resource utilization;
- higher demand for specialized business or convention facilities; and
- expansion of commercial and financial markets resulting in a demand for more facilities.

These are all possible features of growth pole airports.

Knowing the potential impacts of airport development is an important preliminary for justifying investment in airport infrastructure. The next section examines the positive and negative sides of investing in transport infrastructure and growth poles.

2.5 – Investment in Transport Infrastructure and Growth Poles

In order for transport infrastructure to have a measurable effect, it requires a significant investment. Usually this investment comes from some level, or combination of levels, of government. However, private investment in infrastructure is increasing. In order for private companies to invest in infrastructure, one of two things must occur. First, the organization must be able to get a return on its investment (through tolls or other associated revenue streams). An appropriate example would be the investment by a bank to build a road that would experience high levels of traffic – high enough to support a toll that would pay back the investment. Second, the company must see a benefit to itself resulting from the improved infrastructure, such as a rail company investing in its own port or intermodal facility.

2.5.1 – Pros and Cons of Investment in Transport Infrastructure

Building infrastructure to effect regional development carries risk. The case studies in this chapter were chosen to emphasize the positive – or at least permissive – role that investment in transport infrastructure can have on development. Even in the cases with the most positive of results, the development that did take place required more than just infrastructure. In Zimbabwe, marketing played an important role in expanding the export of agriculture. Quebec depended greatly on natural resources, and later, on its manufacturing industry to use its transport infrastructure for developing the region. North Texas would not be expanding were it not for the transport infrastructure in place, but the expansion is also due to the growth of major international companies with bases in the area. It was also noted that the most successful part of the *Cassa per il Mezzogiorno*'s investment scheme was infrastructure.

The moderate success of the ARC was not attributable to transport infrastructure. Most of the development took place because of the social infrastructure investments.[52] In addition, firms near Heathrow Airport in England perceived some minor negative impacts. Both of these cases represent opportunities to improve the likelihood of success for future investments in transport infrastructure.

Generally speaking – and despite the predisposition to select positive cases in this study – investment in transport infrastructure has beneficial results for the affected region (Kessides 1993). Economic activity is attracted to transport infrastructure, and, as Loreth (1996) showed, particularly to airport infrastructure, at least in the case of Winnipeg. When there have been negative impacts (with Heathrow's "negative" impacts discounted, because they are the byproduct of any airport), they have been because of poor planning and/or implementation.

[52] The highway investment portion of the ARC was a failure and a waste of money. The saving grace was the investment in schools, health care facilities and the like that were a part of the growth pole strategy.

If resources are allocated efficiently to both infrastructure and other productive activities, a positive outcome is more likely. The other activities must have economic potential in order for the infrastructure to help develop that potential (Kessides 1993). The quality of service provided, as reflected in user satisfaction, best measures the success of infrastructure investment.

2.5.2 – Investment in Airport Growth Poles

One intention of this thesis is to determine whether investment in an airport growth pole is worthwhile. While the majority of planned growth poles have resulted in disappointing outcomes, closer inspection usually identifies mistakes in the implementation of these programs. Investment in planned airport growth poles (at AFW and HSV) *has* proven to be successful – a concept explored in the remaining chapters.

Winnipeg is a case where the airport has acted as a natural growth pole to a moderate degree without any specific investment to enhance its attractive nature. This chapter points out that the best locations for growth pole investment are those that already possess advantages and growth pole characteristics. The same should hold true for the specific case of airport growth poles. The best candidates for airport growth pole investment are those that have already shown the potential for growth. Therefore, YWG appears to be the perfect fit for investment.

This chapter also finds that investment must include more than transport infrastructure. Investment in complementary productive activities best supports the development of growth poles, whether at airports or elsewhere. Examples of such activities related to airport growth poles would be those that support or rely on air freight. Of course, as these activities expand, an airport is better situated to attain the critical mass required to become a cargo-based growth pole airport.

Definite cases of misdirected investment at airports exist with Montreal's Mirabel Airport being the most obvious example. Built at a time when passenger air travel forecasts were

far too optimistic. Mirabel's infrastructure is second to none in terms of Canadian airports. However, the airport now has less than half the annual passengers of Winnipeg International. Part of Mirabel's downfall is a location approximately half an hour from urban Montreal, and at least one hour from downtown. This is similar to the discussion about investment in transport infrastructure earlier in this chapter. The failure of this project is at least partly due to poor planning or poor integration.[53] Mirabel, like YWG, is attempting to reach that critical mass en route to becoming a growth pole airport.

With the remainder of this thesis focusing on the case study airports and the results of a close examination of them, it is important to consider the methodology used to determine the growth pole characteristics of the three American airports. Chapter 3 outlines the personal observation and survey methodologies.

[53] Other cities have been successful at relocating airports to areas outside the city. However, success has often been forced by closing the older airport (Denver) or placing restrictions on the type of flights that can use the older airport (Dallas). Montreal has attempted to place restrictions of various sorts on flights to and from Mirabel and Dorval, but none has worked to aid development of air services at Mirabel. None has changed the preference of the people of Montreal for Dorval.

CHAPTER 3 – METHODOLOGY

3.1 – Introduction

Secondary sources on the airport growth pole concept are scarce. The topic of economic development around airports tends to be given more weight by business interests than by the academic fraternity, but even then it is relatively unappreciated. Therefore, it was necessary to engage in first-hand, original research for this study. This was accomplished in three ways, each with its own source or sources of information.

(1) Personal interviews were conducted with airport authorities or airport managers, and with local planners at the city, county, provincial, state or even chamber of commerce level.
(2) Postal questionnaires were sent to managers of airport-related industrial and commercial firms.
(3) Personal observations were made at each of the case-study airports.

One key element of this study is the location of airport-related firms, a focus that renders the study inherently geographic. The study is also closely intertwined with economics, transportation and logistics. Therefore the primary research undertaken during the course of this study is partially drawn from similar studies in each of the aforementioned fields. The study largely ignores environmental issues at airports.[54] While all airports have to deal with issues like noise and air pollution, some airports have more exclusive concerns. For instance, it is certain that YWG is more concerned with glycol pollution (used to de-ice aircraft) in nearby tributary streams than its US counterparts, AFW, DFW, and HSV. However, Huntsville has expressed concerns over the amount of pollution it contributes to the environmentally-sensitive Tennessee River. DFW Airport has major noise problems, but not because of lack of planning on the part of the airport. DFW was established well outside the urban parts of both Dallas and Fort Worth. At least partly due to the importance and success of the airport, suburban development has flourished

[54] Environmental issues are ignored in this thesis because they tend to be less connected to economic development than other airport issues, such as cargo facilities and infrastructure, which receive much closer

around DFW, as noted in Chapter 2. Some of the wealthiest neighbourhoods in the Metroplex are affected by noise from DFW. The Airport has two full-time employees – and a state-of-the-art noise monitoring office – dedicated to managing noise problems, complaints, and litigation. Alliance is in the best position in terms of limited environmental impacts. However, it too is beginning to be surrounded with development – mostly commercial and industrial, but growing residential development as well.

Volumes of research have been done on the detrimental effects airports can have on resources and environmental systems. Apart from those concerns raised in the previous paragraph, airports are also prone to sanitary sewage pollution, the extensive use of non-renewable resources (particularly petroleum), water quality impacts, air quality impacts (CO, NO, NO_2, NO_X), traffic congestion and solid waste – both hazardous and non-hazardous (Rudolph 1994). Environmental issues are sufficiently complex as to warrant a major study in their own right.

One obvious means of showing the success of AFW, DFW and HSV as cargo-based growth pole airports is to examine the historical trends displayed by both airport statistics and socio-economic data. This approach includes, but is not necessarily limited to, investigation of cargo volumes, air movements and number of cargo carriers in terms of air cargo statistics, with average income, migration, regional tax base, and unemployment among the socio-economic indicators.[55] These figures help to demonstrate that the airports *have* been successful as growth poles and help to indicate the strength of their impact. However, it is often difficult to obtain historical data for some of these indicators. This analysis constitutes significant parts of Chapters 4 and 5. At this juncture it is appropriate to review the tools used in analyzing the data.

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attention. Environmental issues at airports are given extensive consideration in many other resources. See Patterson (1999).

[55] This is consistent with the measurements outlined in Chapter 2 for the ARC. The primary indicators were average income, net migration and unemployment. Taxation information, where available, further helps to show the direct positive impact deriving from cargo-based airport growth poles. However, positive trends in most of these figures are normal, so care must be taken to consider other data as well.

3.2 – Survey Methodology

For some projects, a survey is nonessential if previous research has been done. The seaport hinterland is frequently considered in books, articles, and theses,[56] but, with the exception of economic impact studies, the geo-economic influence of airports tends to be ignored. Therefore, without significant volumes of previous research in the field, the aforementioned combination of interviews, postal questionnaires and personal observations was determined to be the best approach.

Each survey method was originally considered separately as a means to obtain the necessary data for this thesis. Originally, a postal questionnaire appeared to be the only viable method of obtaining data from locations distant from the University of Manitoba, as costs for travel and/or telephone would have been prohibitive.

Three factors led to the additional option of interviews. First, postal questionnaires typically have low response rates, often 30-40 percent or lower (Parfitt 1997; Townroe 1971; Chan 1996), making them difficult to use, particularly with small populations. Second, preliminary research determined that interviews allow more detailed information to be obtained. Finally, when the opportunity arose to conduct research on a first-hand basis in Dallas-Fort Worth and Huntsville, then the best choice was to incorporate personal and telephone interviews.

3.2.1 – Interviews

Carefully and fairly formulated survey questions ensure that none of the interviewees' valuable time is wasted. Interviews also allow the researcher to clear up any confusing questions immediately. An unclear postal questionnaire does not provide the researcher with this capability. Interviews allow for the greatest amount of information to be transferred. In this case, the interviews were standardized to some degree, as all respondents in each category were asked the same questions. The interviews in this study

[56] For example, see Amoyaw (1999), Hayuth (1982), Van Cleef (1941), and Weigend (1956).

would best be described as "semi-structured" rather than structured or unstructured (Parfitt 1997). The interviews followed the flow of the conversation, something that cannot be replicated with a postal survey. Speaking in-depth with one interviewee allows the researcher to understand that person's experience rather than extracting a sample from a large population to find characteristics of that population.[57]

Understanding such experiences is the single most important key to determining the factors that have made AFW, DFW and HSV successful cargo-based growth pole airports. Chapter 2 shows the characteristics of what can be considered cargo-based growth pole airports – a category into which each of DFW, AFW and HSV falls. The following two chapters show how the airports in this study match those traits. This chapter, as stated, describes the methods used to learn about the experiences of people, organizations, airports and companies that have been components in the development of airport growth poles; it constitutes, in essence, the bridge between Chapters 2 and 4. However, it is still important to gather sufficient information. Data collected from more sources help to give credibility to any study, especially one with a small base from which information can be drawn, such as this thesis.

A complete set of personal interviews for the planners and airport authorities would have been ideal, but supplemental telephone interviews were necessary due to time constraints. "A good compromise between postal and interviewer-administered questionnaires" (Parfitt 1997, p.102), telephone interviews tend to have higher response rates than postal questionnaires allowing for more respondents per time frame than personal interviews. With a limited amount of time in Dallas-Fort Worth and Huntsville, as many interviews as possible had to be undertaken as quickly as possible. With telephone interviews, all respondents could be reached from one location, and time between interviews could be spent on other productive activities. Usually, the major cost associated with the telephone interview process is the cost of any long-distance calls. However, since most subjects were within the local calling area while based in Dallas-Fort Worth and

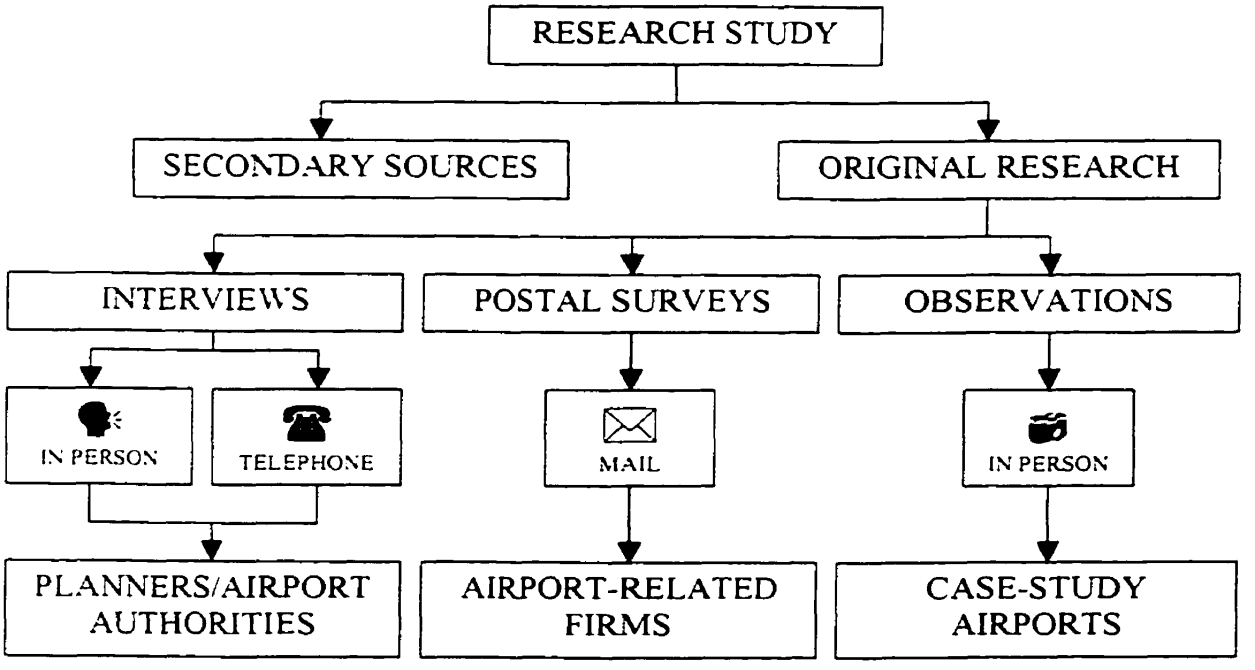
[57] Although, it should be pointed out that this is exactly what the intention was for the survey of airport-related firms.

Huntsville, that cost was negligible. Therefore, a combination of personal interviews and telephone interviews was used to obtain information from airport authorities and planners.

Similarly, the survey of airport-related firms used more than one method to gather information. The postal questionnaire was the primary method used to contact airport-related firms in the US, but it was supplemented by e-mail and telephone contacts. For Canadian airport-related firms, a combination of telephone and personal interviews was used again.

Figure 3.1 is a conceptual diagram showing how this study combines numerous methods in a triangulation of sorts to obtain the desired results. The diagram shows the split between secondary sources and original research, which is then broken down into the sections discussed above for the purposes of this particular study.

Figure 3.1 – Conceptual Diagram of Methodology



3.2.2 – Survey Design and Testing

Separate questionnaires were designed for each group of respondents. The surveys were originally modelled after two other similar surveys completed in recent years. First, the type of information being sought was very similar to a survey carried out by Chan (1995). Chan's study, however, focused on the ability of science parks and electronics firms to effect regional development. The second study that the survey used as a model was the 1998 economic impact study of Winnipeg International Airport (Shurvell et al.).[58] This study is closely intertwined with economics, as well as geography, transportation and logistics, as mentioned earlier in this chapter.[59]

Pre-testing of the surveys took place in order to help identify potential problems or misunderstandings. The subjects for this pilot testing included transportation experts from:

- the Department of Geography, University of Manitoba;
- the Transport Institute, University of Manitoba;
- the Texas Transportation Institute, Texas A & M University; and
- Winnipeg Airports Authority.

As a direct result of this pilot testing process, the wording was changed for two questions, one entire section was eliminated, and three new questions were added. While the survey could have gone ahead without them, these changes helped make the survey clearer and more comprehensive without adding greatly to its length.

Similar to Townroe's 1971 study entitled *Industrial Location Decisions*, this thesis may be open to criticism because of its small sample of airport-related firms. Critics may claim that this lacks both true representation and quantification. McGrew and Monroe (1993) argue that small samples may be statistically valid but may also have limited practical implications. This study is not an attempt at a comprehensive, continent-wide search for answers. It is a case study of three specific airports and the experiences of

[58] The study was published in 1998, but accounted for economic activity in 1996, the final year the airport was operated by Transport Canada before privatization.
[59] Besides Shurvell et al. (1998), Rudolph (1994) assessed the economic impact of air cargo at YWG. Therefore it was important to avoid replicating these studies and to ensure that original research was done.

specific planning organizations and industrial/commercial firms. Townroe (1971, p.5) defended his own survey, claiming that it "was not intended to generate a calibrated general model of industrial movement, but rather to explore ... a possible widening of the frame of reference of industrial movement studies". In this study, the case studies of the three successful cargo-based airport growth poles are combined with an examination of the potential for similar situations to occur at Winnipeg International Airport.

Some of the survey questions are deliberately open-ended. Again, this could be the basis for criticism against the study, but could also be construed as a benefit.[60] Such questions enable respondents – most of whom are closely involved with the airports in question – to give responses that do not easily fit into a particular category. This is important for two reasons. First, it is difficult to create an exhaustive list of potential answers for many of the questions. Second, respondents could elaborate on issues that are important to them, including some that may not be addressed with multiple choices. This elaboration is one of the keys to understanding the success of certain airports in attracting firms. In this case, the benefit and relevance of descriptive answers to open-ended questions outweigh the cost of limited quantitative analysis.

The actual questionnaires are included in Appendix B, but it is important here to justify the questions asked. For interviews of the local planning authorities and airport representatives, the main idea was to understand the relationship between the city, county, or chamber of commerce and the airport, and the role that each plays in airport development. For the surveys sent to airport-related firms, the main goal was to determine which factors played the most important roles in their locational decisions. The firms' responses also help to demonstrate their own impact on regional economic development.

[60] Open-ended questions potentially allow respondents to stray from the issue at hand, something not allowed in multiple-choice questions. Furthermore, open-ended questions often collect far too much information, more than is needed for the purposes of the research. Finally, open-ended questions do not easily lend themselves to statistical analysis, one of the cornerstones of survey analysis.

Planners were asked to identify the chief benefits to the community from the airport, and to estimate whether the airport fulfills its role in the community. These questions were intended to show that communities benefit from airport development as well as firms. This is an important component in terms of measuring the success of an airport growth pole. Planners were also asked to comment on the role of their own organization with respect to development near the airports. Finally, the planners were asked to describe the development plans for the airport at issue and to approximate a time frame for that development. These questions were aimed at identifying future trends in airport development at the successful growth pole airports, possibly enabling better long-term planning at other airports.

The questions asked of airport personnel were very similar to those asked of the planners, but directed towards the airport point-of-view. For example, rather than asking for the chief benefits of the airport to the community, airport authorities were asked to describe how the airport aids regional development. The airport's attitude towards development would be further defined by describing how members of the board of directors are chosen. For example, a board with many business-oriented members would likely have a different perspective than one with predominantly government-appointed members. Each airport was asked to outline its own development strategy, including the type of firms that it tries to attract. This would enable the researcher to differentiate between the airport development plans and, conceivably at a later stage, provide guidance for future airports wishing to use one of the case studies as a model.

The questionnaire sent to individual firms was the longest. The survey opened with several company-classification questions, followed by a series of questions aimed at determining the key factors in each firm's decision-making process that led it to locate near the airport. The initial survey also included a section requesting information on expenditures, sales, taxation, and employment, asked in an attempt to quantify some of the benefits to the community. In the event, however, this section was eliminated from the survey because of the sensitive nature of some of the information, and because

previous economic impact studies could provide some of the information. The location-decision questions that were asked included:

- Does your company depend on airport operations?
- Could your company operate as it does today if it were not located near the airport?
- Has your company expanded since moving here?
- Could your company operate as it does today if it were located in another city?
- Could your company operate as it does today if there were no major airport in this city?
- What percentage of your business would be affected without your current proximity to the airport? *
- What were the main reasons for selecting this location? *
- Has this location met your expectations?
- What other airports in the region are used by your company? *

(The asterisks indicate questions with more than dichotomous yes/no responses.)

These questions are relatively straightforward, with the primary goals of understanding firms' decision-making factors, determining the relative drawing power of those factors, and enabling statistical analysis to determine the significance of the difference between growth pole and non-growth pole scenarios. It should be noted that some of the questions deliberately separate attraction to a particular region (the Dallas-Fort Worth metropolitan area, for example) from attraction to a specific location (like Alliance Airport).[61] This is accomplished in the fourth and fifth questions.

Questions were also designed to obtain information regarding the agglomeration of firms at the case-study airports. Agglomeration contributes to the required critical mass for a cargo-based growth pole airport. Even some of the negative responses to other questions can help to illustrate this point. As a hypothetical example, assume that an aircraft manufacturer's Winnipeg plant responded that "yes" the company does depend on airport operations, likely for timely shipment of parts and components between plants in North America. Next, assume that a key supplier of structural aluminum to the aircraft

[61] Townroe (1971) recommended making this distinction.

manufacturer chose to locate near its main customer in Winnipeg. That firm may respond in the negative when asked if it depends on airport operations, but that gives a clue that it may have made its location decision on the basis of agglomeration economies, whether explicit or implied. This type of firm contributes to the critical mass required to attract other firms, and, eventually, the growth pole attracts all types of firms. This notion is revisited in Chapter 6.

All respondents – including local planners and airport authorities – were asked to outline some of the constraints to development. These characteristics would be best avoided by future developments at other airports. When asked of Winnipeg companies, these responses could indicate some barriers to development that exist, and need to be addressed before YWG can be a successful cargo-based growth pole airport. All groups were also asked questions about the time path or development pattern of airport development in an effort to determine which types of firms tend to locate first near an airport, and which firms tend to follow others. This question is significant in determining the developmental path leading to the critical mass.

3.2.3 – Sampling

Officials from the airports – often referred to in this study as airport authorities – were also interviewed. In the cases of DFW and AFW, the interviewees were not actually airport authorities, but staff members at DFW Airport and members of the development company for Alliance.[62] The local planning officials came from a variety of organizations ranging from chambers of commerce to city officials and former mayors. Such diversity among these respondents enhanced the quality of the study.

Each airport's list of airport-related businesses was derived from a different source. However, it is important to justify the number of respondents that are used later in the following chapter. Each airport should be represented by a sample that is proportionate

[62] The difference is that the operators of DFW and AFW are not referred to as airport authorities. DFW is operated by a dual-city organization and AFW is operated by the Hillwood Development Corporation.

to the stature of the airport by some measure. For instance, if passenger information were the prime interest, DFW should have approximately sixty times the number of responses as HSV and infinitely more than AFW, which is not a passenger airport. For the purposes of this study, cargo volumes would be slightly more appropriate, but even then, DFW would have twenty times the respondents of HSV. Furthermore, although it is a cargo airport, AFW does not have a significant volume of cargo moving through it other than through the Federal Express regional sorting hub. Therefore the measure used to set an appropriate proportion of respondents for each airport is growth pole potential. Although it is a somewhat abstract concept, it can be applied to each of the four airports considered in this thesis.

AFW and HSV are both located well outside the urban parts of their respective cities, and therefore have substantial land for expansion. Similarly, YWG has a vast tract of land to the west of the airport available for business park expansion, while at the same time being relatively close to the urban core and the potential work-force. However, the actual development of YWG as a growth pole has been limited to date. DFW is hindered by the amount of non-airport-related development that has surrounded it – particularly residential development. Although it has the greatest number of passengers and the greatest volume of cargo, its potential as a growth pole is approximately the same as the other airports in the study.

The survey of firms in Winnipeg has more respondents than each of the US airports to accommodate the statistical analysis that follows, and because it likely has the most potential for cargo-based airport growth pole development.[63] The details of how the interviewees and businesses were chosen and contacted for each airport are presented below.

[63] This is true inasmuch as it has the capability to go the furthest distance in development of any of the airports. AFW, DFW, and HSV can expand their growth pole characteristics, but they will be building on an already-established base. For example, if HSV and YWG were to add the same sized building for a manufacturing company, the percentage change in development at YWG would be greater than at HSV.

3.2.3.1 – Fort Worth Alliance Airport

Four telephone interviews were completed for Alliance Airport:

- Bob Bolen of Texas Christian University, former mayor of Fort Worth,
- Tom Higgins of Fort Worth Economic Development,
- Tom Harris of Alliance Airport, and
- Tim Ward of Alliance Air Services.

Bob Bolen and Tom Higgins represent local planners while Tom Harris and Tim Ward represent the airport's interests. Cynthia Weatherby of the Texas Transportation Institute in Arlington, TX, provided the contact information for each of the interviewees. Cynthia Weatherby has been involved in transportation in the Dallas-Fort Worth area for over two decades. Consequently, she has wide-ranging contacts, some of whom willingly gave of their time to participate in this research. Furthermore, both Bob Bolen and Tom Higgins recommended speaking with Tim Ward and Tom Harris, convinced that the latter would be forthcoming with useful information.

Tim Ward and Tom Harris provided identical lists of firms located at Alliance. This was the most straightforward procedure of any applied at the three airports in order to obtain an appropriate list of contacts. AFW also has the most clearly defined geographic area for selecting airport-related firms. Because the airport is intentionally located at some distance from the urban area of Dallas-Fort Worth, all nearby businesses began operations only since the airport's foundation, and presumably, because of the existence of the airport. In any event, the list was not entirely accurate, for more than ten surveys were "returned to sender" due to inaccuracies with the mailing list. (Chapter 5 details the response rates for the entire survey process.)

3.2.3.2 – Dallas-Fort Worth International Airport

Interviews for DFW took place with the following officials:

- David Witcher of the City of Euless,

- Clay Paslay of DFW Airport,
- Jim Crites of DFW Airport,
- Andy Kahn of DFW Airport,
- Dan Truex of the City of Grapevine, and
- Ed McLaughlin of the North Texas Commission.

Clay Paslay, Jim Crites and Andy Kahn provided the airport's point of view, while David Witcher and Dan Truex represented the planning interests of two neighbouring cities. Ed McLaughlin serves in the capacity of "go-between" the two, as one of the roles of the NTC is to act as a chamber of commerce for the airport in an effort to bring development to the airport and to the surrounding cities. The interview with Dan Truex was anomalous in that it was neither in person nor by telephone, but by e-mail. Unfortunately, this eliminated the possibility of follow-up clarification of any questions.

If Alliance offered the easiest context both for obtaining a list of firms and for setting limits on the geographical area of airport-related firms, then that provided by DFW proved to be the most difficult. Ed McLaughlin made available an excellent resource in the *North Texas: World Center of Aviation® Business Directory*. However, there were two major flaws with this directory:

(1) Ed McLaughlin called it inadequate, saying that the company hired to compile the latest version of the directory did an unsatisfactory job. Many contact names and much information were out of date.
(2) The directory lists over 2000 aviation-related companies in Dallas-Fort Worth. Many of the firms listed would have been inappropriate to contact because they have nothing to do with DFW Airport. Others are ruled out because they are not airport-related in any way. For example, Bell Helicopter Textron is a major aviation-related employer located in Fort Worth but is not related to – or located near – DFW Airport. Furthermore, the directory included some firms already surveyed at Alliance.

In order to draw a reasonably-sized sample from this massive collection of firms, a preliminary sorting of the firms was necessary. A smaller list of approximately 250 firms was established from which 100 firms were drawn. Firms were placed on the "short-list" on two main grounds: first, because they were known to be airport-related or, secondly, on account of the fact that they were located within a reasonable distance of DFW

Airport. While there were certainly other firms in the *Directory* that met these criteria, it was felt that with a list of 250, a random sample of 100 would be adequate. The 250 firms were drawn from the 2000 in a random manner as well. The response rate was disappointing, reinforcing Ed McLaughlin's concerns with the directory. Again, Chapter 5 contains more information regarding response rate.

3.2.3.3 – Huntsville International Airport

A total of five interviews took place in Huntsville over two days because time was particularly short. The individuals in question were:

- Barbie Peek, Director of Marketing for the Huntsville-Madison County Airport Authority,
- Brooks Kracke, Director of the JetPlex Industrial Park for the Huntsville-Madison County Airport Authority,
- Ron Hamby, Director of the International Intermodal Center for the Huntsville-Madison County Airport Authority,
- Steve Finnell of the Huntsville-Madison County Chamber of Commerce, and
- Ed Mitchell of Mitchell and Mitchell Consulting.

Barbie Peek, Brooks Kracke and Ron Hamby were all members of the airport authority while Steve Finnell and Ed Mitchell represented the views of local planners. In addition, Brooks Kracke had many years of experience in regional economic development before joining the airport authority. Getting in touch with these contacts was considerably more difficult than was the case with DFW and AFW officials. Warren Thompson – then Director of Marketing and Business Development for Winnipeg Airports Authority – provided the name of Barbie Peek, his marketing counterpart in Huntsville. She, in turn, provided the contact information for Brooks Kracke and Ron Hamby. Steve Finnell's name and number were provided indirectly by Cynthia Weatherby of TTI. Ron Hamby provided the contact information for Ed Mitchell, although each respondent acknowledged that Ed Mitchell would be one of the best sources of information. In fact, further information has since been provided by Ed Mitchell, once in a subsequent

personal communication and once following a presentation he made in Winnipeg in May 1999.

Steve Finnell provided a document called the *Huntsville/Madison County Chamber of Commerce Industrial Directory: 1997-98*. Like the NTC directory of aviation-related businesses in Dallas-Fort Worth, this directory provided too wide a coverage of firms; nothing less, in fact, than all industrial firms in the region. Barbie Peek, on the other hand, provided a list of the firms located near the airport, including all tenants of the JetPlex Industrial Park and the Foreign Trade Zone. While there were surely some firms omitted from this list provided by Barbie Peek that would have been in the more comprehensive directory and would have been appropriate for the survey, it would have been very difficult to determine which firms should be included. The contact list provided by Barbie Peek was used for determining where surveys should be sent in Huntsville because it was easier to manage, and because it already contained approximately 70 airport-related companies. Again, problems arose with respect to the accuracy of the contact lists provided. Many surveys were "returned to sender" after failing to reach the proper destination.

3.2.3.4 – Winnipeg International Airport

Interviews in Winnipeg took place with the following officials:

- Susan Thompson, Canadian Consul General to Minneapolis, former Mayor of Winnipeg,
- Greg Dandewich of Economic Development Winnipeg,
- Warren Thompson, Regional Vice-President, INTERVISTAS Consulting, and former Director of Marketing and Business Development, Winnipeg Airports Authority, and
- Noel Dunford, Manager of Real Estate Assets, Winnipeg Airports Authority.

Susan Thompson and Greg Dandewich represented local government and planning interests, while Warren Thompson and Noel Dunford provided the airport's point of view. In addition, many other local personnel were contacted informally, and assisted with

background information about the airport and surrounding development. This list includes Coleen Rogers, Executive Vice President, Winnipeg Airports Authority; Barry Feller, Vice President, Finance, Winnipeg Airports Authority; and Robert Andriulaitis, then with Manitoba Highways and Transportation.

The list of firms was compiled based on knowledge of YWG's airport hinterland, although it was influenced by a list of firms drawn up by Shurvell et al (1998) which were deemed to be airport-related.[64] Some firms were chosen owing to the fact that they are users or providers of air cargo, others entered the list simply because they are in close proximity to the airport. Still others were chosen because they are known to be among the city's major exporters of goods, and may be important users of air cargo services. One final group of firms was selected because the firms deal primarily with goods of high value relative to weight, in other words, goods that tend to move by air cargo.

Once the data have been collected and sorted, it is necessary to subject them to systematic analysis, and that raises the issue of suitable statistical methodology.

3.3 – Statistical Analysis

Statistical analysis has long been intertwined with geography. Statistics enable researchers to summarize information, thereby producing a snapshot – or description – of its structure. In addition, statistics allow geographers to infer generalizations about a certain characteristic of a population based on a sample drawn from that population (Earickson and Harlin 1994). In the case of this study, inference will be used to make generalizations about successful US growth pole airports and potential Canadian growth pole airports.

The next chapter, in concert with the previous chapters, demonstrates through demographic and economic data that the US airports have all the hallmarks of growth

poles. The statistical analysis in this study has three phases, which are outlined in the next section. A chi-square (χ^2) test is adequate to distinguish the significance of the difference in responses for the statistical analysis.

3.3.1 – Chi-Square Analysis

Chi-square is an appropriate test of statistical significance for bivariate, or two-way, tabular analysis, such as the data obtained from the survey in this study. In more simple terms, it is useful when there is a table with multiple variables resulting from the collection of data. A "rough estimate of confidence", chi-square analysis is a non-parametric test, thus accepting weaker, less accurate data than parametric tests such as *t*-tests and ANOVA (analysis of variance) (Georgetown University, August 1999). By the same token, chi-square is applicable to a wider array of research. Contingency analysis chi-square tests a hypothesis as to whether two or more samples vary substantially enough in some characteristic that the populations represented can be generalized to differ in that characteristic as well.

In the case of this study, the two comparisons are:

Phase 1

- AFW airport-related firms *vs.* DFW airport-related firms *vs.* HSV airport-related firms. This is done to show that there is no statistical difference between the three US airports, thus justifying the use of the airports in Phases 2 and 3 in group forms.

Phase 2

- AFW airport-related firms *plus* DFW airport-related firms (combined to represent growth pole airports in the same metropolitan area) *vs.* HSV airport-related firms *plus* YWG airport-related firms (to represent airports with a local monopoly on air cargo service).

Phase 3

- AFW airport-related firms *plus* DFW airport-related firms *plus* HSV airport-related firms (as a group representing successful cargo-based growth pole airports in the US) *vs.* YWG airport-

[94] In the Shurvell et al. (1998) study, a number of "airport-dependent" hotels were also included. Since hotel development is usually a reaction to economic activity rather than a stimulator, they are intentionally omitted from this study

related firms (representing one potential cargo-based growth pole airport in Canada.

Chi-square analysis determines the statistical significance of the relationship between the two sets of data obtained through surveys and helps to determine if real and/or perceived differences exist between companies at US growth pole airports and those at Canadian airports. Therefore, the independent variable – or that which is manipulated through the research – is the location of the firm. Specifically, Phase 1 is an attempt to show minimal statistically significant difference between firms located at the three US airports. Phase 2 is designed to determine if local competition plays a role in growth pole success. However, the results may be unreliable pending the result of Phase 3, which determines how different YWG is from the US case studies, including HSV, with which it is grouped for Phase 2. For Phase 3 of the statistical analysis, airport-related firms in the US are the proxy variable for those located near a successful cargo-based growth pole airport. Airport-related firms in Winnipeg (or Canada for the sake of consistency) constitute the proxy variable for those not located near a successful cargo-based growth pole airport, but one that may have the potential to become such an airport. The intent is to show that differences between the US and Canadian experiences can help explain growth pole success.

In other words, statistical analysis should unearth a demonstrable difference between the US set on the one hand, and Winnipeg – the representative of the Canadian set – on the other. The dependent variable varies by question, ranging from "yes/no" type questions to questions with a larger number of categories, such as business type and location setting. For the chi-square analysis, only the dichotomous response questions (yes/no) are considered. The remaining questions are analyzed in Chapter 5, but without the use of statistics. This study hypothesizes that, for Phases 2 and 3, the independent variable can predict or explain the qualities represented by the dependent variables. For Phase 1, it is hypothesized that there is no difference between the US airports.

Specifically, the dependent variables help the study answer its key question: *"How can a location reach the critical mass for a cargo-based growth pole airport?"* The dependent

variables for the chi-square analysis, as represented by the questions asked of the firms, embrace the following considerations:

- whether a firm has expanded operations at its airport location;
- the degree of dependence on the particular city;
- the degree of dependence on the particular airport; and
- whether the location has met expectations.

The results of the survey allow direct claims to be made about the samples themselves, but it is only after subjecting those results to a test of statistical significance – in this case the chi-square test – that claims may be generalized about the populations represented by the samples. The chi-square test indicates the degree of confidence that can be used in generalizing the characteristics of the sample to the entire population.

The chi-square test compares measured frequencies in the samples obtained from the surveys with the frequencies that could be expected if no relationship between the independent variables existed in the larger populations (Georgetown University, August 1999). The null hypothesis is true if no relationship is shown between the two variables, or, in other words, if the observed values are identical to the expected values. This study anticipates that the null hypothesis will be accepted in Phase 1, but rejected in Phases 2 and 3, suggesting a statistically significant relationship between the variables. This is in keeping with the hypothesis introduced in Chapter 2, that the two populations in Phase 3 will differ significantly in the key characteristics of cargo-based growth pole airports.

The requirements of chi-square analysis, and how this study fulfills these criteria, are listed below (Georgetown University, August 1999; Everitt 1992; Ebdon 1985).

1. *The variable is assumed to be normally distributed in the population.*

   This assumption must be made with all chi-square populations, and is accordingly assumed in this study.[65]

[65] It is plausible to assume that the three American cases are representative of US cargo airports, since they neither single out stellar performers nor under-performers. Consequently, the firms associated with them

2. *The sample must be randomly drawn from the population.*

   The details of the random selection process are outlined earlier in this chapter, thus meeting this requirement.

3. *Data must be reported in raw frequencies.*

   In Chapter 4, the analysis tables are displayed in raw frequencies, satisfying this criterion.

4. *The measured variables must be independent.*

   In the survey, none of the dependent variables – at least those responses used for the statistical analysis – is affected by another. They are, in fact, dichotomous, yes/no questions.

5. *Independent and dependent variable values must be mutually exclusive and exhaustive.*

   Since a single firm location cannot be in both Canada and the US, and since those are the only locations from which firms were drawn, the independent variable values are clearly mutually exclusive and exhaustive. The dependent variable values are of the simple yes/no variety.

6. *Observed frequencies must not be too small.*

   This final requirement is the most problematic for this research. As discussed earlier in this chapter, this was a problem encountered by Townroe (1971) as well.[66] In this study, there are 21 and 13 respondents representing the two populations. Each cell of a bivariate table must have a minimum frequency of 5, especially the expected values (Moore and McCabe 1993; Georgetown University, August 1999). With the small sample sizes in this study, there is a definite possibility – if not an outright likelihood – that frequencies of less than five will occur. Ebdon (1985) suggests that for a table with more than two categories, no more than 1/5 of the expected frequencies should be less than 5. If there are two categories, then all expected frequencies should be at least 5.

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may be regarded as typical of such firms. Similarly, Winnipeg with its attendant firms is a typical Canadian candidate in the cargo airport stakes. Normality, then, can safely be assumed in both instances.

[66] It did not represent the same obstacle for Townroe, however, as he did not use chi-square analysis in his study.

However, there is not total agreement between statisticians on this point. Phillips (1981, Appendix C) notes that "tables with at least one dichotomous variable require a minimum expected value of at least one. Tables with no dichotomous variables are judged on the '20 percent or less with the expected value of less than five' criterion". This criterion for determining the validity of contingency tables is supported by Lewontin and Felsenstein (1965, p. 19) who state that:

> A very conservative rule of operation [one in which the true probability associated with the test is less than or equal to the tabulated χ^2 probability] would be that if the expectations are one or greater the test is certainly conservative at the 5 percent, 2 percent and 1 percent level of significance, and that for most cases even fractional expectations do not affect the test.

Craddock and Flood (1970, p. 180) "conclude that a moderate oscillation in the frequency density does not invalidate a determination of significance levels."

Due to the disagreement in general regarding minimum expected frequencies, it is best to err on the side of caution. For statistical analyses where there are expected frequencies of less than five, those questions are used merely for comparative purposes. The statistical results, whether significant or not, should only be interpreted as very rough indicators of the relationship between the variables. This includes Phase 1 in its entirety, and some questions in Phases 2 and 3.

To explain chi-square more clearly, a fictional question – with fictional data – is employed. The question is very simple, indeed one that does not give any insight into whether an airport is a successful growth pole. It is analyzed as though it were part of Phase 3, the *US airport-related firms* on the one hand, vs. the *Canadian airport-related firms* on the other.

Question 1: *Does your company own its own aircraft?*

Let us assume that the responses received are as follows:

Table 3.1 – Sample Chi-Square Observed Frequencies

Question 1	**Yes**	**No**	***N***
US Airports	15	6	21
Canadian Airports	5	16	21
Total	20	22	42

Each cell in Table 3.1 indicates the number, or frequency, of responses or observations that match the combination of independent and dependent variables. For example, the upper left cell reads "15", meaning that fifteen of the US airport-related firms responded that yes, their firm does own its own aircraft.[67] There are row and column totals as well that come into play in due course.

The next step is to calculate the expected cell values E_{ij}, which is achieved by applying the formula displayed in Equation 3.1.

Equation 3.1 – Expected Count Calculation

$$E_{ij} = \frac{(SumOfRows)x(SumOfColumns)}{SumOfAllFrequencies}$$

Source: McGrew and Monroe (1993)

For the above example the expected counts are calculated and displayed in italics in Table 3.2 below.

Table 3.2 – Sample Chi-Square Expected Frequencies

Question 1	**Yes**	**No**	**N**
US Airports	15	6	21
Expected	*10*	*11*	*21*
Canadian Airports	5	16	21
Expected	*10*	*11*	*21*
Total	20	22	42

With the expected frequencies known, it is now possible to calculate the chi-square statistic, using the formula shown in Equation 3.2.

Equation 3.2 – Chi-Square Statistic

$$\chi^2 = \sum_{i=1}^{r} \sum_{j=1}^{k} \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

Source: McGrew and Monroe (1993)

where: r = the number of rows (each row represented by i)
k = the number of columns (each column represented by j)
O = Observed Sample Count
E = Expected Sample Count

The chi-square statistic for each cell, and finally, the chi-square statistic for the entire question, would correspondingly be calculated as:

Table 3.3 – Sample Chi-Square Calculated Values

Question 1	Yes	No	Total
US Airports	2.50	2.27	~
Canadian Airports	2.50	2.27	~
Total	~	~	**9.55**

Degrees of freedom are calculated by the formula in Equation 3.3.

Equation 3.3 – Degrees of Freedom

$$df = (r-1)\cdot(c-1)$$

where: r = the number of rows, and
c = the number of columns.

In this case, df = (2-1)·(2-1) = 1. With this chi-square statistic and one degree of freedom, the null hypothesis – that country of location has no significant effect on aircraft ownership – could be rejected at the p = 0.0025 level, or with 99.75 percent confidence.

[6] Perhaps a clearer way of stating this is to ask: "How many US airports depended on airport operations?" The answer is fifteen.

There would be very little likelihood that the difference in the two samples would be by chance.

For the purposes of this thesis, Microsoft Excel was used to calculate the chi-square statistics and the *p*-values, utilizing the software's CHITEST and CHIINV functions. In all cases, the minimum level of statistical significance sought is 0.1, or 90 percent. For every set of variables found to be statistically significant at the 0.1 level, subsequent tests at the 0.05 and 0.01 levels take place.

The next step in the statistical analysis is to determine the strength of the relationship between variables, a task that can be accomplished using a measurement known as phi. Phi measures the magnitude of a statistically significant chi-square relationship. In other words, it is an index of the degree of correlation between the variables. When a chi-square analysis has a table larger than 2X2, Cramer's version of phi (denoted by V) is used. The formula for Cramer's statistic is as follows:

Equation 3.4 – Cramer's V

$$V = \sqrt{\frac{\chi^2}{N(k-1)}}$$

where: V = Cramer's statistic
χ^2 = the calculated chi-square statistic
N = the total number of observations
k = the smaller of the number of rows or columns

For a 2X2 table, phi is measured by the following equation:

Equation 3.5 – Phi

$$\Phi = \sqrt{\frac{\chi^2}{N}}$$

where: N = the total number of observations

For this thesis, Cramer's V calculations are the same as the phi calculations because all of the tables are 2x2. Therefore, in Chapter 5, which details the staistical analysis, only Cramer's V is used. The resultant value for Cramer's V and for phi is interpreted as a Pearson r. The value r^2 is the shared variance and indicates the total distribution found in the chi-square analysis that can be attributed to the statistically significant relationship that has already been determined. For example, an r value of 0.5 would give an r^2 value of 0.25, meaning that 25 percent of the dependent variable findings are explained by the independent variable.

The final part of the methodology to be outlined is the personal observations at the case-study airports, which leads into a summary of those observations at the beginning of Chapter 4.

3.4 – Observation Methods at the Airports

Opportunities made available to the researcher to perform personal observations in Dallas-Fort Worth, Texas, and Huntsville, Alabama also made visits to DFW, AFW and HSV possible. It was not feasible to observe the airside infrastructure at each airport, but it was possible to observe the business parks, intermodal facilities and cargo areas. In the case of YWG, observations of both airside and non-airside infrastructure have taken place.

Most of the observations were made by driving through the areas adjacent to the airports, making note of the ground transportation links and the layout of the business parks. Dozens of photographs were taken at each airport, and notes were taken on the distinguishing features of each. In essence, it was the purest form of observation. Maps

in Chapter 4 show the general areas in which personal observations were made. Also in Chapter 4, the observations at each airport are detailed.

The impacts of a successful cargo-based growth pole airport extend beyond the bounds of the airport property or even the related business parks and intermodal facilities. The growth pole effect permeates throughout the airport's entire hinterland. The hinterland is not a well-known concept, but is important to this thesis because it is within the airport hinterland that the concentration of airport-related – and some non-airport-related – firms occurs. Therefore it is important to note the definition, nature, and geographical extent of the airport hinterland and the similarities and differences between the airport hinterlands of AFW, DFW, HSV and YWG, a task accomplished in Chapter 4. However, the hinterland deserves more attention than it is given in the next chapter, and could be a thesis topic in its own right. With the methodology of the study now defined, the next step is to disseminate the findings of the observations, and that is accomplished in Chapter 4.

CHAPTER 4 – OBSERVATIONS

4.1 – Introduction

This chapter breaks the observations made at each airport into three distinct parts. The first part, besides introducing each city's history, economy and geography, goes on to outline the way in which each airport came to play such an important role. The second part describes the direct personal observations made at each airport, and makes reference to figures and aerial photographs, each of which helps to illustrate certain points. The final part shows the results of the surveys, first describing the qualitative responses provided by airport officials and local planners, before going on to discuss the results of the survey of airport-related firms, which entailed qualitative and quantitative aspects.

4.2 – Dallas-Fort Worth Metropolitan Area

Usually recognized as one, rather than two separate cities, Dallas and Fort Worth are often referred to as Dallas-Fort Worth, DFW, or the "Metroplex".[68] The area is the headquarters of 29 *Fortune 500* companies[69] (the third highest total for any city in the United States) and is rapidly becoming a centre for both technology-intensive and financial firms (Alliance Airport, July 1998; Airports International, September 1998). The Metroplex population is 4.3 million (United Nations, July 1998, Cynthia Weatherby), making it the ninth largest city in the United States.[70] That population is also larger than 30 individual states of the United States (NCTCOG 1998).

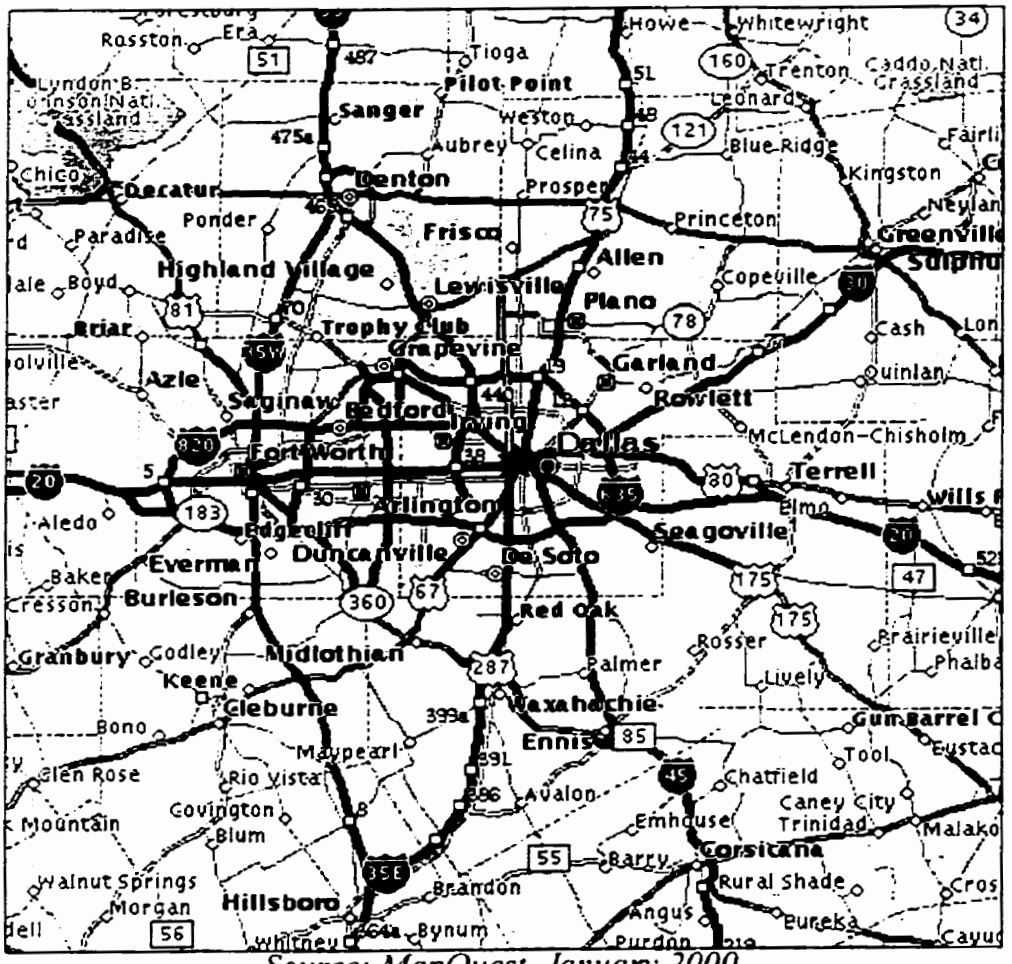
[68] The Metroplex is also composed of numerous smaller communities surrounding Dallas and Fort Worth, the largest of which are: Arlington (261,721), Garland (180,650), Irving (155,037), Plano (128,713), Mesquite (101,484), Grand Prairie (99,616), Carrollton (82,169), and Richardson (74,840) (Rand-McNally, 1997). The North Texas Commission defines the Metroplex as a 12-county North Texas region (North Texas Commission web site, October 1998).

[69] Transportation-related *Fortune 500* companies headquartered in Dallas-Fort Worth include: AMR Corporation (the parent company of American Airlines), Burlington Northern Santa Fe, and Southwest Airlines (Dallas Fort Worth International Airport, October 1998).

[70] Dallas-Fort Worth ranks ninth after New York, Los Angeles, Chicago, Washington, San Francisco, Philadelphia, Boston and Detroit (United Nations, July 1998).

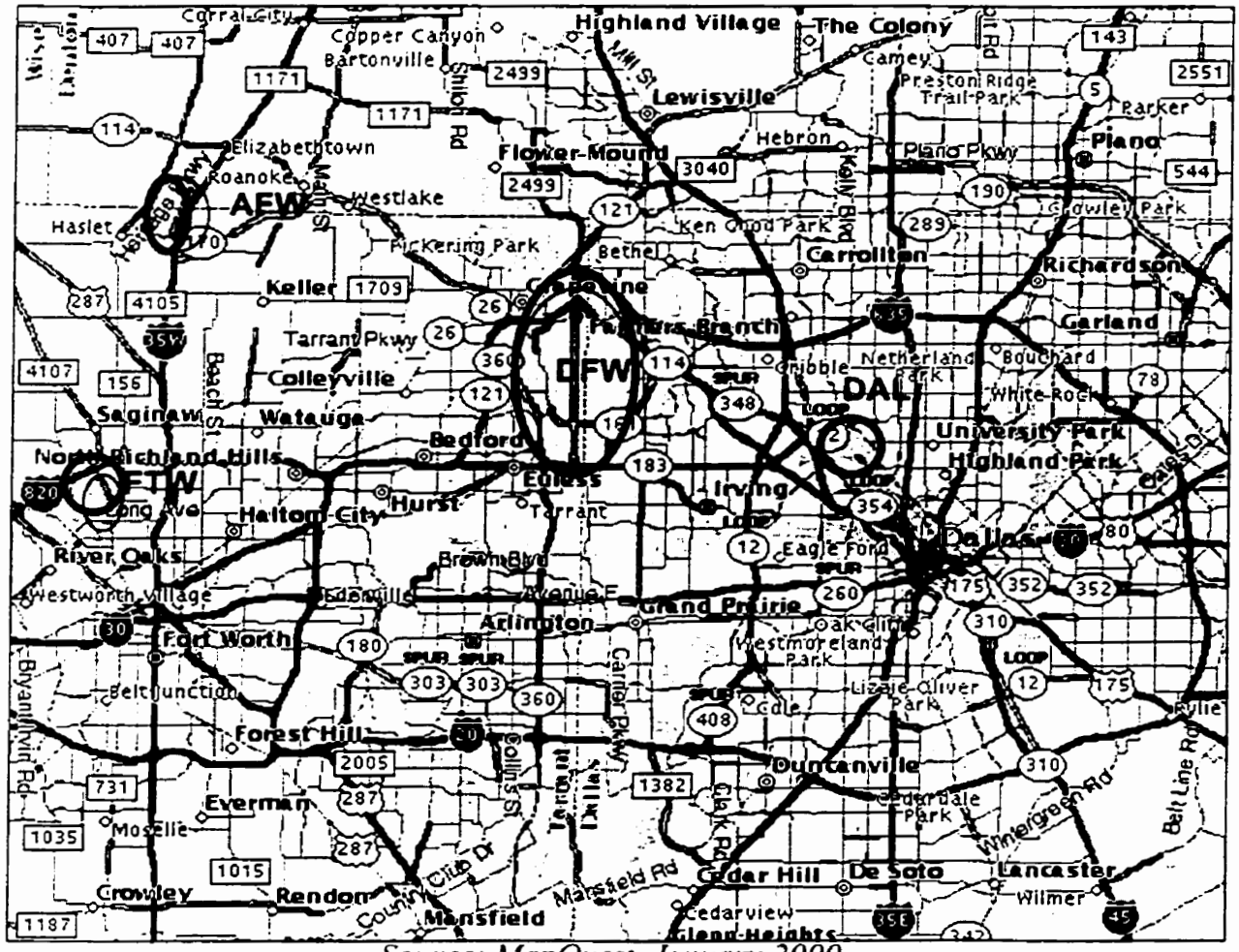
In 1989, the median income in the Dallas-Fort Worth area was US$32,825 (United States Bureau of the Census, February 2000), while the per capita income in 1997 was US$30,481 (Dismal Scientist, September 1999). In April 1999, the unemployment rate was a mere 3.0 percent (Dismal Scientist, September 1999).

Figure 4.1 – Map of Dallas-Fort Worth Region



Source: MapQuest, January 2000

Figure 4.2 – Map of Dallas-Fort Worth Metropolitan Area



Source: MapQuest, January 2000

Dallas and Fort Worth were established within just a few years of each other. In February 1841, the Republic of Texas contracted with W. S. Peters and Associates to bring settlers to the region where Dallas-Fort Worth is now situated. But before the Kentucky- and Ohio-based settlers arrived, a settlement had already been established in the area.

John Neely Bryan, a lawyer and frontiersman from Tennessee, settled along the Trinity River in what is now downtown Dallas in November 1841. In 1846, one year after Texas became a state, Dallas County was created, with the town of Dallas designated as the county seat. Both were likely named after George Miffin Dallas who was then Vice-

President under James K. Polk. The 1870s brought even more growth with the arrival of the Houston and Texas Central Railroad and the Texas and Pacific Railroad. By 1880, the population was 33,000 and this doubled by 1890. By then, Dallas County was known as the wealthiest and most populated in Texas. Newcomers to the area were now being attracted by agricultural opportunities, including cotton, wheat, corn, oats, barley, rye, fruits and vegetables (Fort Worth Star Telegram Online, September 8, 1998).

At the close of the Mexican war in 1849, Major Ripley Arnold and his Company F, 2nd Dragoons established a settlement at Fort Worth on a bluff overlooking the West and Clear Forks of the Trinity River (The Mining Company, September 1998). As the last major civilized stop on the Chisholm Livestock Trail – one of the main cattle-driving routes from Texas to Kansas in the late 19th Century – Fort Worth earned the nickname "Cowtown" by the 1860s. Also in 1860, Fort Worth became the seat of Tarrant County (The Mining Company, September 1998). The Texas and Pacific Railroad came to Fort Worth in 1876, making the town the major shipping point for livestock in Texas. In the 1900s, more railroads came to Fort Worth, making it the hub for the industry and giving the town its way of life. Soon, in 1903, livestock were bought and sold in the Livestock Exchange Building in central Fort Worth. Livestock has lost some of its importance to the city over the last few decades, but its historic Stockyards district has become a vibrant tourist attraction in which visitors can experience the old west.

Each of the other cities and towns that make up the Metroplex has its own history of playing an important role in the region. However, it is unlikely that the area would be as significant as it is today were it not for the growth of Fort Worth and Dallas.

While the advantages to businesses locating near the airports in the Metroplex are examined in more detail in Chapter 5, the advantages to people choosing to live in the area can be noted here. First, Texas has no state income tax. Similarly, neither Dallas nor Fort Worth has a civic income tax.[71] Second, the climate is warm year-round with temperatures regularly above 30°C in summer and rarely dropping below 10°C in the

[71] There are, however, civic additions to the statewide sales tax in most Metroplex cities.

winter. Third, the cost of living in Dallas-Fort Worth is lower than any larger metropolitan area in the United States. In addition, the Metroplex is home to more than 15 "world-class" museums, lays claim to professional teams in every major North American sports league, boasts several family-oriented theme parks and historic attractions, and has no less than forty-four colleges and universities, including Southern Methodist University, Texas Christian University, the University of North Texas and the University of Texas at Arlington (Alliance Airport, July 1998).

Moving goods from Dallas-Fort Worth to the top 50 American consumer markets is straightforward. By air, the Metroplex is within four hours of all major American, Canadian and Mexican cities (Dallas/Fort Worth International Airport, September 1998). While many other locations also claim to be in prime geographic locations, few US cities can challenge Dallas-Fort Worth in terms of its transportation infrastructure. As Table 4.1 illustrates, only Sioux Falls, SD and Memphis, TN have lower total annual operating costs for warehousing and distribution. Table 4.1 is based on a 42,000 m^2 (450,000 square foot) distribution centre employing 150 labourers and takes into account transportation costs, labour costs, utility expenses and occupancy charges.

Table 4.1 – Total Annual Operating Cost, Warehousing and Distribution, Selected US Cities

Location	Total Annual Operating Costs (US$)
Sioux Falls, SD	$15,513,000
Memphis, TN	16,001,000
Dallas, TX	16,508,000
Denver, CO	16, 936,000
Atlanta, GA	17,125,000
St. Louis, MO	17,163,000
Cincinnati, OH	17,281,000
Milwaukee, WI	17,312,000
Chicago, IL	17,981,000
Minneapolis, MN	19,101,000

Source: The Boyd Company 1999.

The Dallas-Fort Worth area is an important North American and global transportation hub. As noted above, transportation played an important role in the development of both cities. DFW Airport was the world's fifth busiest airport in 1998 (by passengers), but "is on the threshold of becoming the world's busiest" (Dallas/Fort Worth International Airport, July 1998). The metropolitan area is also the largest trucking centre in the American Southwest and Texas has the most extensive road network in the United States (Alliance Airport, July 1998). In terms of infrastructure, if not purely in terms of a central location, the Dallas-Fort Worth Metroplex has transportation advantages over other competing areas.

A complex network of freeways moves citizens around the Metroplex as efficiently as any other system in North America. The Metroplex is served by eight Interstate Highways (I-20, I-30, I-35E, I-35W, I-45, I-345, I-635 and I-820). In addition, parts of US Highways 67, 75, 80, 81, 175, and 287, as well as State Highways 12, 114, 121, 183, 310, 360, 408 and the Dallas North Tollway are all built to freeway standards. There is also major construction underway on State Highway 190 (George Bush Turnpike), which will act as a beltway through the suburban areas of northern Dallas. With freeways extending out from the downtown areas of both Dallas and Fort Worth, inner loops surrounding each central business district, at least one beltway or perimeter-style freeway in each city and three major freeways joining Dallas and Fort Worth, the road system is as well-developed as that in any major urban area, with the possible exception of Southern California. Dallas is still developing its light-rail transit system (Dallas Area Rapid Transit, or DART).

Several major rail networks, including Burlington Northern Santa Fe, Union Pacific-Southern Pacific, Norfolk Southern, and Amtrak serve the Metroplex. However, the "crown jewel" of the transportation infrastructure network in the region is the airport bearing both cities' names, Dallas Fort Worth International Airport. In fact, it is partly because of DFW that the Metroplex is home to a multitude of aerospace and aviation firms. This important part of the regional economy has only been strengthened by the more recent development of Fort Worth Alliance Airport.

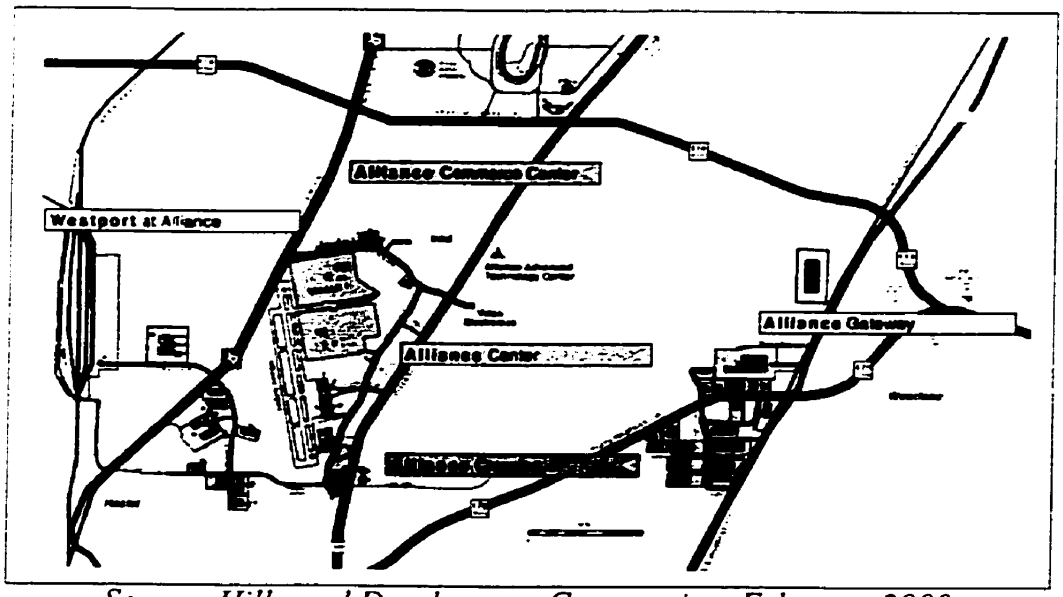
4.2.1 – Fort Worth Alliance Airport (AFW)

As just one part of a major development project, Alliance Airport's hinterland is defined simply by the limits of the Alliance development as a whole. Billed as the "international business development of the future" (Alliance Airport, July 1998), Alliance, in Fort Worth, Texas, is much more than just an airport. It is an inland container port, an industrial park, a foreign trade zone, and now a residential community. Especially impressive, all of this has been accomplished with predominantly private investment and has been achieved in only ten years.[72] By the end of 1999, the Alliance complex had attracted 80 companies, 22 of which are *Fortune 500* companies (Hillwood Development Corporation, February 2000).

The Alliance complex is located approximately 24 km north of downtown Fort Worth. Due to annexation, it still lies within the city limits of Fort Worth, although it is surrounded by open, non-urban space. It is also 24 km (15 miles) northwest of DFW Airport. Interestingly, the suburban area between DFW and AFW, including the communities of Southlake, Keller, Saginaw, and Haslet, has the fastest growing population in the Metroplex. Each of these four towns in the area had growth rates greater than 5 percent in 1996 (Freese and Nichols, September 1998). Figure 4.3 shows the layout of the airport area and the land-use plan for the entire complex. In this study, the term "Alliance" will be used in reference to the entire complex, including the airport and all of the immediately adjacent development. Sometimes, however, specific reference will be made to certain components of Alliance. For instance, the most appropriate way to begin looking at the complex is to outline the airport itself.

[72] Alliance Airport opened in December 1989 (Alliance Airport, September 1998).

Figure 4.3 – Map of AFW Area



Source: Hillwood Development Corporation, February 2000

Figure 4.4 – AFW Aerial View

Source: Hillwood Development Corporation, January 2000

While it is true that AFW is owned by the city of Fort Worth, it is the private company Alliance Air Services, under contract with the city, which is the sole Fixed Base Operator (FBO). The name Alliance was given to the airport because it represented the partnership struck between private and public interests that went on to build the facility.

Upon first impression, Alliance seems very spread out, with wide roadways and ample parking. The ground transportation infrastructure is designed to accommodate large volumes of truck traffic stemming from operations at Alliance. The roadways are directly connected to Interstate-35W, the "NAFTA Superhighway", which links the airport with Canada, Mexico and the mid-continent states. Most of the buildings at Alliance fit the stereotype of warehouses, having huge amounts of floor space, but rarely being more than two or three storeys high. Once Alliance Airport's 2,926-m (9,600-foot) runway is extended to 3,962 m (13,000 feet), the airport will be able to accommodate the largest cargo aircraft in use today.

The impact of Alliance on the region is certainly not as large as that of DFW. However, that may also work in favour of Alliance. Congestion – in the air, on the taxiways and on nearby roads at DFW – may be one factor contributing to the success of AFW. It was congestion at DFW that provided the initial planning of AFW. One of its prime purposes is to act as a reliever airport for DFW. Although DFW is still expanding in terms of surrounding businesses, "Alliance is the big growth area for distribution in the Metroplex" (Michael Frame, quoted in Allen 1997).

Of the US$3.8 billion in new investments received by the region between 1989 and 1998, 95 percent, or US$3.6 billion, came from the private sector while only 5 percent, or US$194.3 million, came from city, state and federal funds (Alliance Airport, July 29, 1998). The majority of the initial private investment has come from Hillwood Development Corporation, a firm controlled by the well-known Perot family of Texas. Ross Perot, Jr. is the President and Chief Executive Officer of Hillwood.

Alliance consists of 3,900 hectares (9,600 acres), 1.3 million m^2 (14.7 million square feet) of existing building space, with approximately 400,000 m^2 (4.3 million square feet) announced or under construction. The long-range goal of Alliance is to construct 2.3 million m^2 (25 million square feet) in the project. More than 400,000 m^2 (4.4 million square feet) of space has been built in the past five years, and more than 92,000 m^2 (1 million square feet) of new space was added in 1997 (Alliance Airport, July 1998). In

1998, Alliance leased out approximately 170,000 m^2 (1.8 million square feet) of space (Alliance Airport, December 1999). In 1999, a total of 135,000 m^2 (1.47 million square feet) and approximately 100 hectares (237 acres) of land were sold or leased (Hillwood Development Corporation web site, February 2000).

Alliance has contributed significantly to the local tax base, further exemplifying its economic impact. Table 4.3 shows the 1996 taxes paid by Alliance.

Table 4.2 – Taxation Revenue Generated by Alliance, 1996-97

Taxing Jurisdiction	1996 Revenue (US$)	1997 Revenue (US$)
City of Fort Worth	$2,647,000	$3,845,000
Northwest Independent School District	$3,908,000	$6,536,000
Denton County	$223,000	$272,000
Tarrant County	$1,729,000	$2,792,000
Total	***$8,507,000***	***$13,445,000***

Source: Alliance Airport, July 1998; November 1999

The geographic advantage of being located in the centre of North America is cited as one of the major benefits of locating at Alliance. Distributing goods from the Metroplex to other major North American markets is cost-efficient. The Metroplex is lower-priced than Chicago and Atlanta, the only other inland American cities with busier airports than DFW. Alliance shares this distinction with DFW, but does have some advantages over its nearby counterpart. For instance, Alliance does not have to contend with congestion, either in the air or on the ground. Flights into Alliance are not so frequent as to generate congestion. There is a constant stream of air traffic into DFW.[73] AFW is located far enough from the rest of the urban areas of Dallas-Fort Worth to ensure that highway congestion is kept to a minimum, despite the rapidly growing agglomeration of firms.

[73] While DFW certainly experiences more congestion than AFW, it is still minimal compared with other major airports. Chicago O'Hare, Atlanta Hartsfield and even Toronto's Pearson Airports all experience considerably more congestion than DFW. A further problem plaguing Chicago is the poor quality of air cargo service to some markets, in particular Mexico. Cargo, bound for Mexico on Mexicana Airlines, is shipped to Chicago from all over the central US, only to end up sitting on the runway for days before being loaded and flown out. For this reason, many central US shippers have sought alternative gateways for air cargo to Mexico (Bronstone 1999, personal communication)

Alliance can point to the prestigious companies that have located nearby. Some of the more notable establishments at Alliance are:

- American Airlines' 167,000 m^2 (1.8 million square foot) aircraft maintenance and engineering facility;
- Beverage Canners Texas Corporation's (BCTC) state-of-the-art bottling and distribution centre;
- BNSF's 300 hectare (735 acre) railyard, intermodal centre and automobile distribution centre;
- FedEx's seven-building regional sorting hub;
- Intel Corporation's new semiconductor manufacturing complex, planned to cover 215 hectares (532 acres) and employ 800 people in the first phase of development;[74]
- JCPenney's 83,610 m^2 (900,000 square foot) warehouse and distribution centre near BNSF's facility;
- Kraft's 60,385 m^2 (650,000 square foot) Southwest distribution complex;
- Nestlé's $20 million distribution centre;
- Nokia's 13,191 m^2 (142,000 square foot) distribution centre and 26,188 m^2 (281,900 square foot) cellular phone manufacturing plant;
- Texas Instruments' 38,000 m^2 (409,000 square foot) warehouse, distribution and value-added facility; and
- Zenith's 46,450 m^2 (500,000 square foot) warehouse and distribution facility.

The companies listed are major international firms (all American based save Nestlé and Nokia) and have all made large investments at Alliance, indicating a long-term commitment to the area. In 1999, AFW welcomed a number of new companies, totalling approximately 3,000 jobs. Companies locating at Alliance in 1999 include: John Deere, UPS Logistics Group, Hewlett Packard and Ameritrade. All of these developments will be in the range of 15,000 to 30,000 m^2. In addition, FedEx announced expansion plans in 1999 (Hillwood Development Corporation web site, February 2000)

A question arises, however, as to whether AFW fits in to the same category as the other airports examined in this study. AFW truly is in its own category. It is the first master-planned industrial airport in North America, and, by most accounts, is the most successful

[74] The construction of Intel's plant has been put on hold, tentatively until 2002-03.

at attracting businesses in an expeditious manner. All its success has occurred since 1989, making it all the more remarkable. Perryman (1998) indicates that "the development would be notable if it evolved over a century", in referring to Alliance's rapid development as "miraculous". However impressive AFW's performance, in all likelihood its impact will fall short of that of the major regional passenger hub just a few miles down the road, Dallas/Fort Worth International Airport.

4.2.2 – Dallas/Fort Worth International Airport (DFW)

Dallas/Fort Worth International Airport touts itself as "the fastest growing airport in the world with more than 2500 flights daily to nearly 200 destinations worldwide" (Dallas/Fort Worth International Airport, September 1998). It has also been billed as the "key economic engine" of the region (North Texas Commission Online, September 1998; Cynthia Weatherby, June 1998), and the "single most important catalyst for economic growth in the Metroplex" (Charles Wills & Associates, 1992, p.11). The airport operates as a hub for two airlines, American Airlines and Delta Airlines. American controls the airport to a large extent, as approximately 70 percent of all flights at DFW are operated by American, while Delta has approximately 20 percent of the market (Dana Ryan, personal communication, November 1998). Despite a levelling of passenger traffic in recent years, DFW is still the most important economic entity in the region.

The joint owners of the airport are the cities of Dallas, which owns 7/11ths, and Fort Worth, which owns the remaining 4/11ths (Cynthia Weatherby, personal communication, September 1998). DFW Airport came to fruition after 1964 when the Civil Aeronautics Board (CAB) deemed the smaller airports in each city (Meacham Field in Fort Worth and Love Field in Dallas), as well as Amon Carter Field in Arlington, unsuitable for future needs. The CAB then ordered the two cities to find a site for a new airport to serve both communities (Dallas/Fort Worth International Airport, September 8, 1998; Cynthia Weatherby, personal communication, September 1998).

Figure 4.5 – DFW Aerial View

Source: MicroWINGS, January 2000

In December 1968, construction of the new airport began in a cotton field 28 km (17.5 miles) from both downtown Dallas and downtown Fort Worth. The airport's first commercial flight was on January 13, 1974. By 1999, DFW Airport had seven runways and was "the world's first airport capable of handling four takeoffs or landings simultaneously during instrument landing conditions" (Dallas/Fort Worth International Airport, September 1998). The ultimate plan for DFW Airport includes eight runways and twelve terminals (Robart, 1995; Trans21, 1994). The airport – including the land, the infrastructure, etc. – consumes over 7000 hectares (17,000 acres), an area larger than the island of Manhattan.[75] In addition, much of the industrial and commercial development nearby falls within the DFW FTZ, giving firms even more advantages associated with locating near the airport. Figure 4.4 shows an aerial view of the airport area, including its abundant infrastructure.

[75] G. Chambers Williams III cites the area covered by the airport as 7361.7 hectares or 18,177 acres in the *Fort Worth Star-Telegram* (August 6, 1998). Gordon Dickson and Andrew Backover provide an estimation of 7290 hectares or 18,000 acres in the *Fort Worth Star-Telegram* (April 12, 1998). However, the airport

Intermodal transportation and air freight are important parts of the DFW Airport mix of activities. Six major rail lines serve the airport along with dozens of trucking companies. Immediately around the airport are several major limited-access highways, making truck access to the airport simple. Cargo can be trucked overnight to a market of over 50 million people and within 48 hours to most American cities (Airports International, September 1998). In terms of freight capabilities, DFW Airport handled over 800,000 tonnes (900,000 tons) in 1998 (ACI, January 2000). United States Customs clears 98 percent of that cargo electronically. Air freight is usually processed within 100 minutes of arriving at DFW Airport, approximately 20 percent faster than most airports (Airports International, September 1998).

An indication of the growth trend of passenger traffic at DFW Airport is displayed in Table 4.3.

Table 4.3 – DFW Airport Passenger Traffic, 1982-2010

Year	Air Passenger Traffic (millions)	Cargo (tonnes)
1982	24.7	N/A
1986	39.9	N/A
1990	48.5	573,258
1991	48.0	570,156
1992	51.9	603,143
1993	49.7	658,165
1994	52.6	725,708
1995	54.4	777,695
1996	58.0	774,086
1997	60.5	810,687
1998	60.4	801,968
2000 (projection)	73	875,430
2010 (projection)	104	1,643,302

Source: Trans21, 1994; Airports Council International, December 1999); Dallas-Fort Worth International Airport, December 1999

On its own web site, Dallas-Fort Worth International Airport states that it has been "a significant factor in the relocation and expansion of more than 400 businesses" to the Metroplex (Dallas/Fort Worth International Airport, September 1998). According to

itself claims the area is 7143 hectares (17,637 acres) (Dallas/Fort Worth International Airport, September

other sources, "40 percent of area businesses relocated here or expanded because of DFW Airport" (Airports International, September 1998) and "almost every major company in North Texas credits the airport with adding oomph to its bottom line" (Moffeit 1999, p. 20A). However, none of these statements provides any further support information, such as survey data. One of the main goals of this study is to determine the actual role that an airport location plays in a firm's locational decision. It is hypothesized that many businesses *have* chosen their location because of the airport's influence. However, this study is not merely interested in examining the firms that have chosen to locate in Dallas-Fort Worth, but is more concerned with the circumstances influencing those firms that have located near the airport itself.

DFW Airport takes an active role in attracting businesses to locate near it. The airport's main method of doing this is through the direct and indirect control it has over much of the undeveloped land near the airport. There are over 2000 hectares (5379 acres) of undeveloped land on DFW Airport property – most of it with easy access to freeways and rail lines. The airport and its neighbouring cities are in the process of planning the development of that prime vacant commercial property (Dickson and Backover 1998). "In 10 to 20 years, the airport property could attract an influx of industrial companies, creating millions of dollars in additional airport leases and tax revenue every year" (Dickson and Backover, 1998, p.7).

The airport has jurisdiction over the land within the airport boundaries, but that land also lies within the boundaries of several surrounding cities; namely, Grapevine, Euless, Irving, Coppell and Bedford. The advantage held by these cities is that, until recently, they all received 100 percent of all sales taxes (including city and school district taxes that may be added on to the state sales tax) generated by businesses on land falling within the boundaries of the city. A business may be located at the airport, and may never deal with ordinary citizens outside the airport, but its taxes would go to the "local" city rather than to the airport, or to Dallas and Fort Worth. More desirable from the standpoint of Dallas and Fort Worth is for each of these subsidiary cities to agree to share airport-

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23, 1998).

generated tax revenue with the larger cities. So far, such an agreement has been reached with only one of the cities. The city of Euless, (directly south and west of the airport) has agreed to a revenue-sharing system whereby each of Dallas, Fort Worth and Euless receives one-third of future airport revenues from airport land technically in Euless. Other cities (Irving, Coppell, Bedford and Grapevine) have not reached such agreements and have been left out of development projects already underway. For instance, DFW Airport will consolidate its two rental car facilities in Euless, eliminating the facility in Grapevine. The facility will definitely be a benefit to the small community of Euless. For Grapevine, just north of the airport, the decision spurred renewed negotiations with airport officials to minimize the chances of it being overlooked in future decisions taken by the airport.[76] The city of Irving is also close to a similar agreement with the airport.

Two major business parks are located adjacent to DFW. To the north is DFW Freeport and to the south is CentrePort. Both have numerous airport-related firms as tenants, but also a number of firms, like Alliance, that do not seem to be dependent upon the airport. Some of the notable firms at DFW Freeport – so-called because of the tax exemptions firms enjoy in the business park – include the various major hotel chains in the area, Honda and NEC. At CentrePort, the most important tenant is the corporate headquarters for AMR Corporation, the parent company for both American Airlines and Sabre Technologies. Other tenants are a multitude of hotels, Union Pacific Railroad, Mattel, Keebler, Johnson and Johnson, Mercedes Benz (now DaimlerChrysler) and call centres for OfficeMax and Southwestern Bell. Both parks have room for expansion and both are undergoing construction of new facilities.

[76] It should be pointed out, however, that Euless is also the most logical location for the rental car facility. Its location to the south of the airport is on the route taken by the vast majority of airport users, who generally come from Dallas (to the southeast), Fort Worth (to the southwest), and Arlington (due south). Grapevine is directly north of the airport, where fewer rental cars would be heading or returning.

4.2.3 – Other Airports

Despite DFW Airport's importance in the region's economy, and its importance as an international hub, it is not the only airport in the Dallas-Fort Worth area. The Metroplex is home to several other airports. A 1988 study by Wilbur Smith and Associates concluded that the next largest 23 airports in North Central Texas generated 36,000 jobs and US$3.2 billion in economic impacts. Already mentioned are Fort Worth's Meacham Field (FTW), which is now a busy general aviation airport, and Dallas' Love Field (DAL), which is an important passenger airport and corporate headquarters for Southwest Airlines. The locations of these airports are noted in Figure 4.2. In addition, several of the surrounding communities in the Metroplex have small, commuter-style or general aviation airports.

Meacham Field (FTW) was an important passenger airport for Fort Worth for about 50 years after its opening in 1925.[77] Now, however, the activities at Fort Worth Meacham International Airport centre on general aviation, executive airlines, and pilot training (Meacham International Airport, September 1998). Meacham is only 8 km from the city centre of Fort Worth.

Dallas Love Field (DAL) was the primary airport for the City of Dallas until DFW Airport was built. When DFW Airport was being planned, the major airlines at Love Field agreed to move their operations to the new airport. However, Southwest Airlines was not part of this agreement because they were not operating out of Love Field at the time. So, when American Airlines, Continental Airlines, Delta Airlines, and others moved to DFW Airport, Southwest moved into Love Field with something akin to "squatter's rights" following airline deregulation in 1978 (Cynthia Weatherby, September 24, 1998).

[77] The airport was called Fort Worth Municipal Airport when it opened, but changed its name to Meacham Field in 1927. In 1985, it became Fort Worth Meacham Airport and finally Fort Worth Meacham International Airport in 1995 (Meacham International Airport, September 1998).

After Southwest's move, in 1979, United States House of Representatives Speaker Jim Wright established an amendment to protect DFW Airport from expanded service at Love Field (Amarillo Globe News Online, September 1998; Hunt and Lopez 1998). The Wright Amendment originally limited the destinations served by Love Field to those within the state of Texas and the immediately surrounding states, Louisiana, Arkansas, Oklahoma, and New Mexico.[78] Recently, the states of Mississippi, Alabama and Kansas have been added. This allowed DFW Airport to corner the market on long-haul national and international flights (Amarillo Globe News Online, September 1998). Some, including Southwest Airlines, the dominant airline at Love Field, support repealing the Wright Amendment – specifically so that flights can serve larger markets, like Kansas City. Others, in particular American Airlines, which controls the majority of the gates and flights out of DFW Airport, vehemently oppose repealing the Wright Amendment.[79] Love Field may be good for the users of the airport because it is conveniently placed for Dallas – only 11.2 km (7 miles) from downtown, but continued expansion of airlines and destinations is thought to have detrimental consequences for DFW Airport.[80] In fact, the City of Fort Worth sued the City of Dallas for a violation of bonds for DFW Airport. Fort Worth's claim is that the expansion of services from Love Field jeopardizes the vitality and growth of the shared airport (Cynthia Weatherby, September 24, 1998).

To balance the odds, Alliance Airport has been envisaged by the city of Fort Worth as a weapon in its armoury. AFW, while not a passenger facility, enables the city of Fort Worth to plan the development and expansion of its own airport. Like Love Field, this has spurred opposition from DFW officials. Ironically, it has also sparked opposition from Love Field. A confusing picture has emerged: DFW's position is that Alliance takes away commercial business, while Love Field's grievance rests in the possibility that

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[78] The Wright Amendment also prohibits a passenger from remaining on the same plane from Love Field to, for example, Oklahoma City, and then continuing to Kansas City. Instead, a passenger would have to deplane in Oklahoma City, get re-ticketed, pick up and re-check baggage, and board another airplane to fly to Kansas City (United States House of Representatives, October 1998).

[79] There are many in support of repealing the Wright Amendment who feel that American Airlines' support for it derives from their belief that it helps them keep air fares artificially high in the region (Dallas Observer Online, September 1998; Dallas.Org, September 1998).

[80] This is separate from any negative impacts perceived within the city of Dallas because of increased noise or increased traffic in the area around the airport. While these concerns are important, they are not within the scope of this study.

Alliance could extend its service geographically further than Love Field is capable of doing so by itself.[81]

There are no such disputes in Huntsville, Alabama. With only one major airport in the region, Huntsville International Airport finds regional interests to be much more sympathetic to its own interests.

4.3 – The City of Huntsville, Alabama

The city of Huntsville and its surrounding metropolitan area defy common stereotypes of Alabama. The population resident in the Huntsville region in Northern Alabama is wealthy and well-educated, contrasting markedly with the common preconception of Alabama as a state inhabited by poor, largely uneducated people.[82] Steve Finnell of the Madison County Chamber of Commerce stated that Huntsville has closer relations with Tennessee than with the rest of Alabama and that it would be more fitting if Huntsville were a part of Tennessee (personal communication, 4 December, 1998). Huntsville has the highest annual median income in the Southern United States. Huntsville International Airport is a major contributing factor, as is the presence of the military and the National Aeronautics and Space Administration (NASA). Indeed, Madison County has the highest per capita income in the southeastern United States (Huntsville Convention and Visitors Bureau, February 1999). However, the per capita income was lower than the median income, at $23,459 in 1997 (Dismal Scientist, September 1999).

[81] To further exemplify the relationship between the cities, when Dallas proposed building a commercial airport south of the city – one that would compete with AFW – Fort Worth proposed a plan to expand a nearby landfill. The FAA prohibits airports near landfills because birds, which are attracted to landfills, are hazardous to aircraft (Garrison 1997). For a summary of the dispute over Love Field, see Hunt and Lopez (1998).

[82] This "stereotype" of Alabama is not entirely unfounded. Ron Hamby of the International Intermodal Center and Dr. Ed Bruning of the Faculty of Management, University of Manitoba (a graduate of the University of Alabama in Tuscaloosa) agree that much of Alabama fits that negative profile.

Table 4.4 – Median Income, Selected Alabama Cities

Alabama Cities	Median Income
Huntsville	$29,400
Decatur	$23,420
Birmingham	$17,100

Source: Huntsville Convention and Visitors Bureau, February 1999

In terms of unemployment, Huntsville's figures have traditionally been similar to those of the Dallas-Fort Worth Area, between 3.5 and 4.5 percent. In April 1999, the unemployment rate for the Huntsville metropolitan area was 3.2 percent (Dismal Scientist, September 1999).

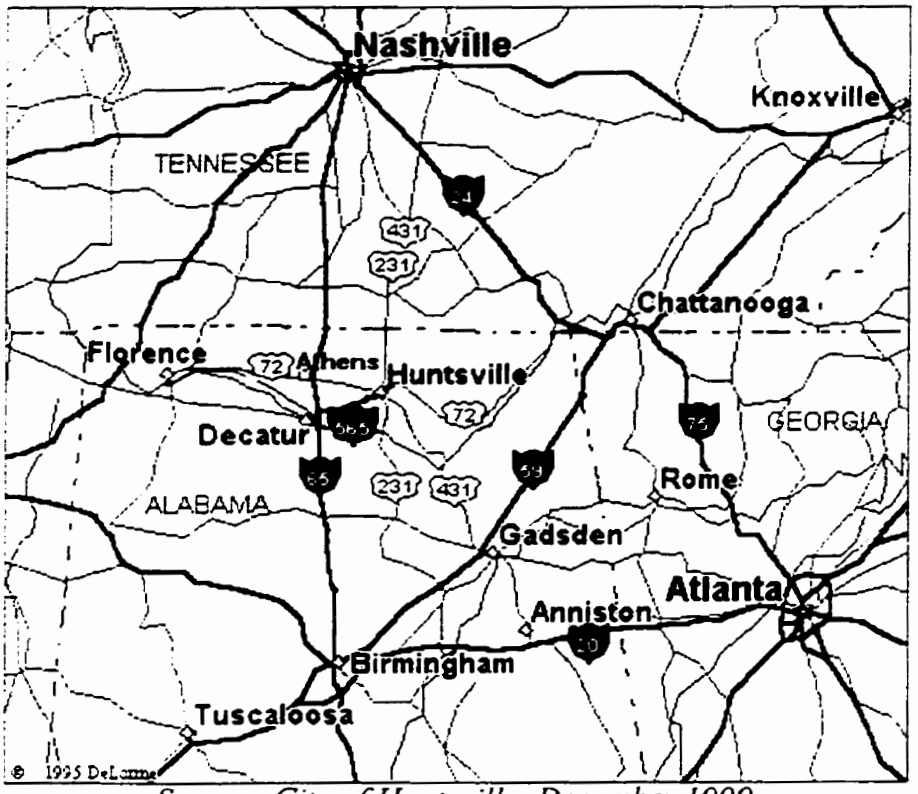
European settlement in the region began in 1805 when John Hunt of Virginia arrived. The community was called Twickenham until 1811, when it incorporated and was renamed Huntsville for its original settler. In 1819 the Alabama Territory constitutional convention met in the city, as did the first state legislature. In 1862, during the American Civil War, Union troops occupied the city (Huntsville Convention and Visitors Bureau, February 1999).

Huntsville "was high-tech before high-tech was cool" (Infanger 1998, p. 2). In the earlier half of the 20th Century, Huntsville did conform more closely to the rest of Alabama. It was shortly after World War II that Huntsville adopted its current characteristics. Wernher von Braun and his team of 117 German rocket scientists were brought to Huntsville at the end of World War II.[83] The German influence was – and still is – profound in the region. Apart from their considerable achievements at the US Army Redstone Arsenal just outside Huntsville, the Germans helped turn Huntsville into a high-tech city with a well-educated and cultured population. Von Braun became the nucleus of NASA's George C. Marshall Space Flight Center (MSFC) at Redstone Arsenal. The MSFC was home to the Apollo moon program. During the four years leading up to the successful launch in 1969, Huntsville's population grew by more than

[83] However, von Braun's original American location was at White Sands, New Mexico, from 1945-1950. It was not until 1950 that he relocated to Redstone Arsenal in Huntsville (Microsoft Encarta Encyclopedia 1998).

50,000. Between the time of von Braun's arrival and the end of 1999, the population of Huntsville increased tenfold. The estimated 1997 population of Huntsville was 174,842, with a metropolitan area population of 347,036 (Huntsville-Madison County Chamber of Commerce 1998a).[84]

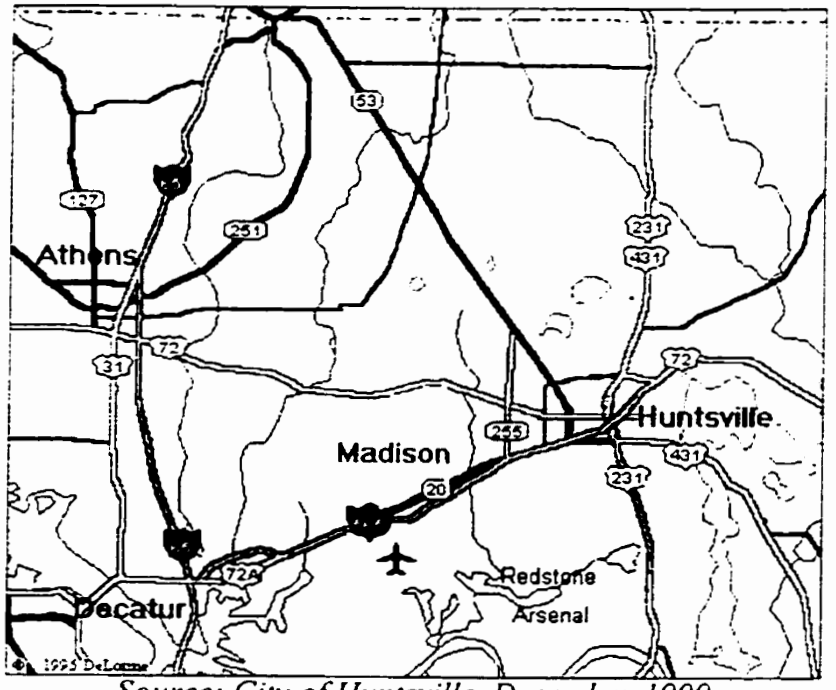
Figure 4.6 – Map of Huntsville/Northern Alabama Region



Source: City of Huntsville, December 1999

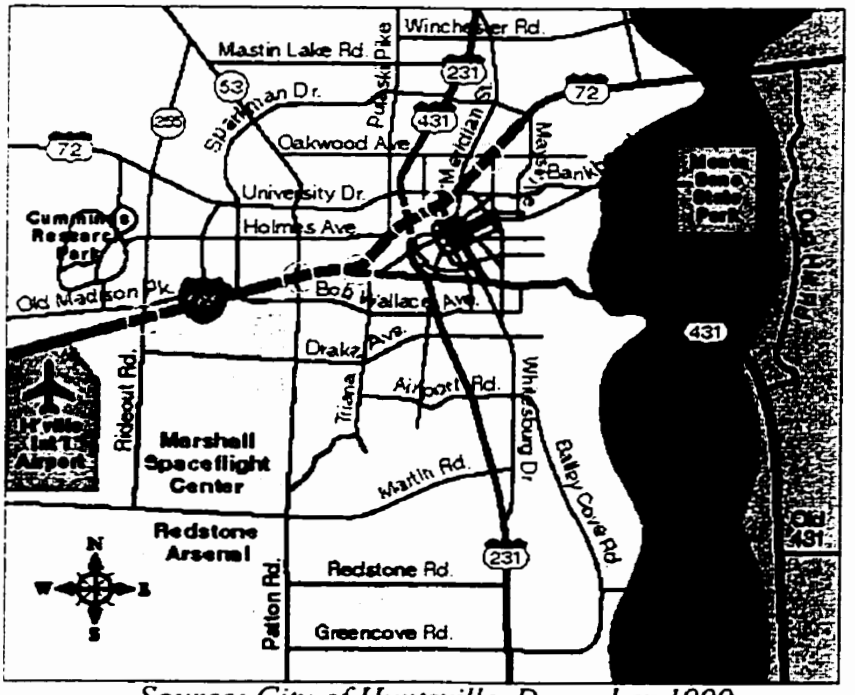
[84] The metropolitan area is defined, in this case, as Madison and Limestone counties.

Figure 4.7 – Map of Huntsville Metropolitan Area



Source: City of Huntsville, December 1999

Figure 4.8 – Map of Huntsville



Source: City of Huntsville, December 1999

In the 1960s, Huntsville was still too small to influence the location of Interstate Highway 65 when the Interstate System was being established. It was only in the 1980s that Huntsville was connected with the Interstate System, the result of the completion of I-565 (Barbie Peek and Brooks Kracke, personal communication 3 December, 1998). In Huntsville, this connection is considered to be of vital importance. Currently, Huntsville is lobbying to be incorporated into the route of a proposed Memphis-to-Atlanta highway (Barbie Peek, personal communication, 3 December, 1998).

Huntsville is also home to the United States Army Missile Command, the U.S. Army Space and Strategic Defense Command, and the Army Corps of Engineers (Microsoft Encarta Encyclopedia 1998). The US Army employs approximately 16,000 people in Huntsville, with an additional 3000 employed by NASA and MSFC.

The 1540 hectare (3800-acre) Cummings Research Park (CRP), one of the top research parks in the United States, employs 26,000 people (Huntsville Convention and Visitors Bureau, February 1999) and is the second-largest in the country (Huntsville-Madison County Chamber of Commerce 1997-98). CRP has an excellent strategic location between downtown Huntsville and the airport. It is also adjacent to the University of Alabama in Huntsville and very close to Redstone Arsenal and MSFC. Huntsville's other major university, Alabama A&M University, is to the northeast of CRP.

The JetPlex Industrial Park, near the airport is another important industrial location in Huntsville. Although this particular facility is examined in greater detail in Chapter 5, it should be noted that there is a significant agglomeration of technological and electronics firms in this area of the city.

The diverse nature of local firms, the strong presence of CRP and the various industrial parks have all contributed to Huntsville having stable economic growth that has been recognized by the *Wall Street Journal* and the *Nation's Business and Employment Review* (Huntsville-Madison County Chamber of Commerce online, February 1999). Local

economic development efforts, primarily by the Huntsville-Madison County Chamber of Commerce, focus on six key initiatives:

1. *Image Enhancement* – Promote the region as a leading technology-based community in the world.
2. *Retention and Expansion* – Enhance business growth opportunities for industries and entrepreneurs.
3. *Space and Defence* – Expand existing local federal, industrial, and academic capabilities and enterprises in the space and defence industries.
4. *Targeted Marketing* – Attract specific value-added industry sectors to complement and diversify the existing economic base.
5. *Technology Initiatives* – Augment research and development in information technology, life sciences, physical sciences, and manufacturing.
6. *Work-force Development* - Ensure an available labour force with the skills and education levels necessary to meet future employment demands.
   (source: Huntsville-Madison County Chamber of Commerce online, February 1999)

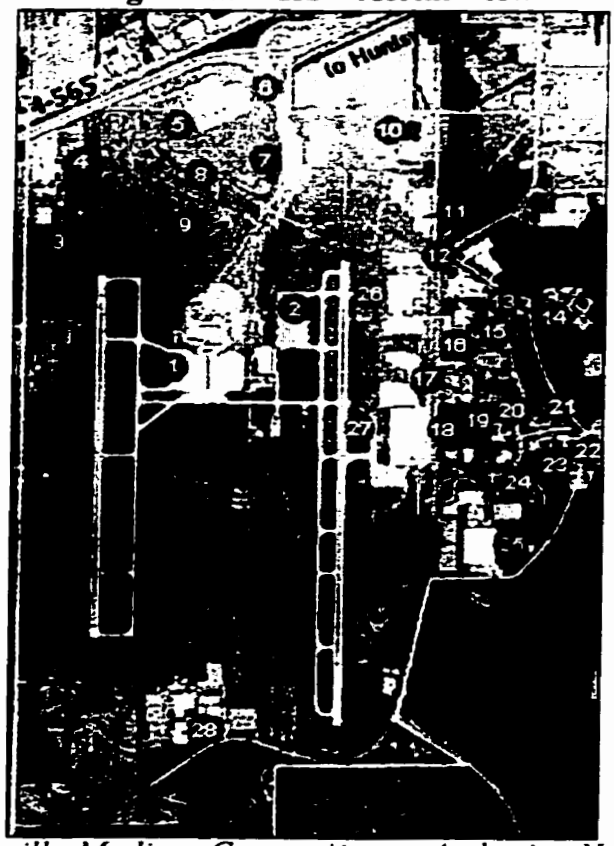
4.3.1 – Huntsville International Airport (HSV)

Huntsville International Airport is owned by the City of Huntsville and Madison County, and is operated by the Huntsville-Madison County Airport Authority. The area surrounding HSV is well planned and organized. The airport was intentionally located several kilometres outside the city of Huntsville so that its negative impacts on the city would be minimal. The airport encompassed over 1200 hectares (3000 acres) in 1967 when it was first constructed. Today, the airport covers 2350 hectares (5800 acres), with the potential to grow to 3400 hectares (8400 acres) as the airport authority continues to acquire land to "ensure the airport's long-term future success" (Infanger 1998, p. 16). The extra land is planned for both airfield use and for further industrial and business park development. The two parallel runways – 3,000 m (10,000 feet) and 2,400 m (8,000 feet) – are separated by almost 2 km, allowing simultaneous operations.

The area south of the airport is mainly undeveloped, but is controlled by the Airport Authority. The main airport-related firm south of the airport is Boeing, but there are other heavy industries located in this area as well.[85] Private farms take up most of the land to the west of the airport. However, should the airport need to develop this land, it has the authority to do so. The airport is directly connected to Interstate-565 to the north of the terminal. To the east of the airport are the JetPlex Industrial Park and the International Intermodal Center. This is the part of the airport hinterland that qualifies it as a planned growth pole (as described in Chapter 1). The Industrial Park is home to many airport-related firms and falls within the Huntsville Foreign-Trade Zone No. 83. The Intermodal Center combines air cargo loading, unloading and warehousing with an efficient rail container facility operated by the Airport Authority and served by Norfolk Southern Railway. Some of the key tenants near the airport include: Chrysler (now DaimlerChrysler), LG Electronics, Lockheed Martin, Raytheon, TDK Electronics and Navistar. Figure 4.9 shows the airport area and tenant locations.

[85] Boeing's Huntsville location specializes in air-defence systems and space operations rather than commercial aircraft.

Figure 4.9 – HSV Aerial View



Source: Huntsville-Madison County Airport Authority, November 1999

1. HSV Terminal and Sheraton Four Points Hotel
2. Signature Flight Support
3. SAIA Motor Freight Line, Inc.
4. Teledyne Tungsten Products
5. LG Electronics
6. Zenith
7. Raytheon
8. Airport Executive Park/ Turner Development Corporation
9. Sunset Landing Golf Club
10. Parfums de Coeur
11. 359,304 sq. ft. Building Available for Lease/Sale
12. Industrial Properties of the South
13. Industrial Properties of the South
14. R.O. Deaderick Company
15. Perfect Home
16. Jetplex Distribution Services
17. Chrysler National Training Center & Daycare
18. Futaba Corporation of America
19. J.I.T. Services
20. Prep-tech
21. Toko America
22. TDK Corporation
23. T.H. Marine
24. Scientific Utilization
25. Daimler Chrysler Corporation
26. NAVISTAR
27. International Intermodal Center
28. The Boeing Company

As mentioned in Chapter 2, Huntsville's International Intermodal Center was partially funded by the ARC and EDA, with those two organizations providing approximately US$9 million. That funding was complemented by US$4 million generated by airport bonds. The incentives provided by the federal regional development agencies – both of which employed specific growth pole policies among their programs – have been returned to the federal government many times over in the form of duty and taxes generated by imports at the International Intermodal Center and the International Air Cargo Center (Infanger 1998).

The hinterland of Huntsville International Airport (HSV) is nearly as well-defined as the hinterland at Alliance. The two airports hold an important factor in common: both are located outside their respective cities. HSV is located to the west of the city of Huntsville and is well removed from any residential areas and other incompatible land uses in Huntsville. The main problem associated with land use at HSV concerns the town of Madison, AL, discussed in detail in Chapter 5.

The most telling measure of HSV's effect in the community is the change in total regional impact between 1988 and 1996. The figures cited earlier in this thesis (28,594 jobs and $970.1 million in income) represented increases of 25.8 percent and 78.5 percent respectively since 1988 (Huntsville-Madison County Airport Authority 1997).

Six passenger airlines serve HSV: Delta Airlines, ComAir, American Airlines, Northwest Airlines, US Airways and US Airways Express. In 1998, HSV's passenger traffic totalled 1,037,676. Accentuating the airport's cargo presence, cargo airlines outnumber passenger airlines, with seven: CargoLux/Panalpina, FedEx, UPS, Atlas Air, DHL, Airborne Express and Emery Worldwide. The most important airline is CargoLux, which operates 14 flights per week between Luxembourg, Huntsville and Mexico City, using Boeing 747s. To recall, the total air cargo through HSV in 1998 was 44,825 tonnes.

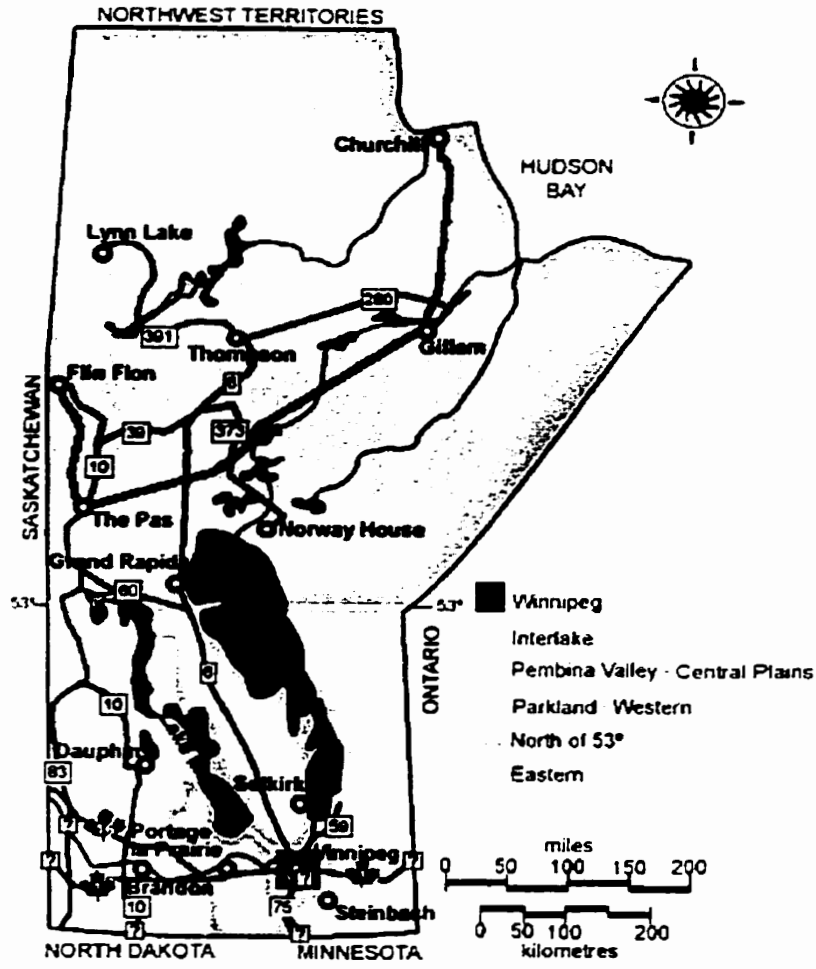
4.4 – The City of Winnipeg, Manitoba

Winnipeg, like Dallas and Fort Worth, owes much of its history to transportation. Its original First Nations' settlements chose the location because Winnipeg was at the junction of two important transportation waterways, the Red River and the Assiniboine River. When Europeans began to immigrate to the region in the 1700s, Winnipeg became one of the key fur-trading posts in Western Canada. More than a century later, Canada's first transcontinental railway was routed through Winnipeg. It was, however, originally planned to run north of Winnipeg, through the town of Selkirk. The City of Winnipeg promised the railway that it would never have to pay any property taxes if it chose to run its main line through Winnipeg.[86]

Winnipeg is located in Southern Manitoba, near the precise east-west centre of Canada, and approximately 100 km from the Canada-US border. This provides many advantages for the movement of cargo, especially as a North American transshipment point for other transcontinental routes. For example, Winnipeg is along the New York-Tokyo flight route and the Los Angeles-London route. Loreth (1996) notes that it is more economical to ship by air between Europe or Asia and Winnipeg, and subsequently truck goods between other North American cities and Winnipeg, than to have the entire journey by air. Loreth (1996) estimates cost savings of up to 20 percent by using this routing.

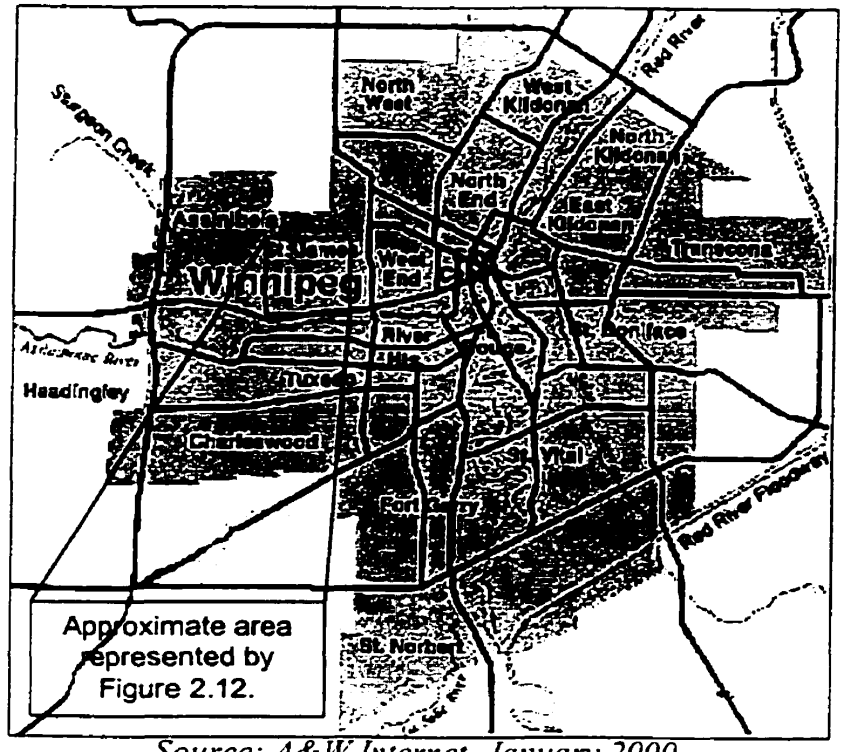
[86] This has since been amended. The Canadian Pacific Railway now pays a grant, equal to the value of its assessed property taxes, in lieu of those property taxes.

Figure 4.10 – Map of Manitoba



Source: Travel Manitoba, February 2000

Figure 4.11 – Map of Winnipeg Metropolitan Area



Source: A&W Internet, January 2000

The city's population is in excess of 620,000, but the city has been experiencing slow growth in comparison with most other Canadian cities. Economic Development Winnipeg (EDW) is a non-profit organization charged with improving the quality of Winnipeg's economy. Like the Huntsville-Madison County Chamber of Commerce, EDW implements a number of initiatives aimed at improving the city's economic welfare. However, EDW's initiatives differ vastly from those on offer in Huntsville. EDW initiatives include Aboriginal Economic Development, Young Leaders Committee, Francophone Economic Development and the Manitoba Call-Centre Team (Economic Development Winnipeg, December 1999). These pale in comparison with the ambitious technology and aerospace initiatives launched in Huntsville. However, EDW represents a key potential partner in creating initiatives aimed at developing a cargo-based airport growth pole in Winnipeg.

Winnipeg does have a very diverse manufacturing industry, particularly compared with other Western Canadian centres. According to Economic Development Winnipeg

(February 2000), some of the major industries in and around Winnipeg – including the growth industries – are:

- agriculture (Canadian Wheat Board, Canadian Grain Commission, Winnipeg Commodity Exchange, and nearly every Canadian grain company);
- financial and insurance services (Great West Life, Investors Group, Assante Corporation);
- aerospace (Standard Aero, Bristol Aerospace, Boeing Canada, Air Canada Maintenance);
- fashion industry (Nygard, Western Glove Works, Mondetta);
- film industry (Buffalo Gal Pictures, Credo Productions);
- food and beverage (Maple Leaf, McCain, Schneider, Old Dutch);
- health-care products (Canadian Science Centre for Human and Animal Health, National Research Council Institute for Biodiagnostics);
- information and telecommunications (IBM Canada, CanWest Global Communications, Mind Computer Products);
- wood and building products (Isobord, Palliser, Loewen Windows); and
- transportation equipment manufacturing (Motor Coach, New Flyer, Lode King).

Winnipeg is also home to two major universities, the University of Manitoba and the University of Winnipeg, as well as a number of technical colleges, the largest being Red River College and Winnipeg Technical College.

According to Statistics Canada (February 2000), the unemployment rate in the Winnipeg metropolitan area was 5.8 percent in 1999, higher than either Dallas-Fort Worth or Huntsville. Average income in 1995 for Winnipeg was $24,184, while the average household income was $45,707 (Statistics Canada, February 2000). It is very difficult to compare these results with the US cities, because they measure different statistics (median income vs. average income), they are measured in different currencies (US$ vs. C$), and because the relative costs of living in the cities are unknown (including taxation levels).

4.4.1 – Winnipeg International Airport (YWG)

Winnipeg International Airport originally was named Stevenson Aerodrome in 1928, and was designated as Canada's first international airport (Thompson 1999). YWG operates as a regional passenger hub, a transborder airport, a gateway to Northern communities, an integrator cargo hub, a training facility for the Canadian military, and as a centre for aerospace maintenance and overhaul. The airport is open 24-hours per day and it is available in 97 percent of all weather conditions. Transport Canada owns YWG, but has leased the management and operation functions to the Winnipeg Airports Authority for a 60-year period beginning in 1997. YWG has three runways of 3,353 m (11,000 feet), 2,652 m (8,700 feet), and 1,524 m (7,000 feet) (WAA Master Plan 1999).

It currently operates as Canada's sixth busiest airport in terms of passenger volumes (Transport Canada, October 1999). Table 4.5 shows the annual passenger figures for YWG. Airlines currently offering scheduled service are: Air Canada, Air BC, Canadian Airlines, Canadian Regional, WestJet, Canada 3000, Royal Airlines, Northwest Airlines, Calm Air, First Air, Athabaska Airways, Bearskin Airlines, Perimeter Airlines, and Ministic Air.

Table 4.5 – YWG Air Passenger Traffic, 1982-2012

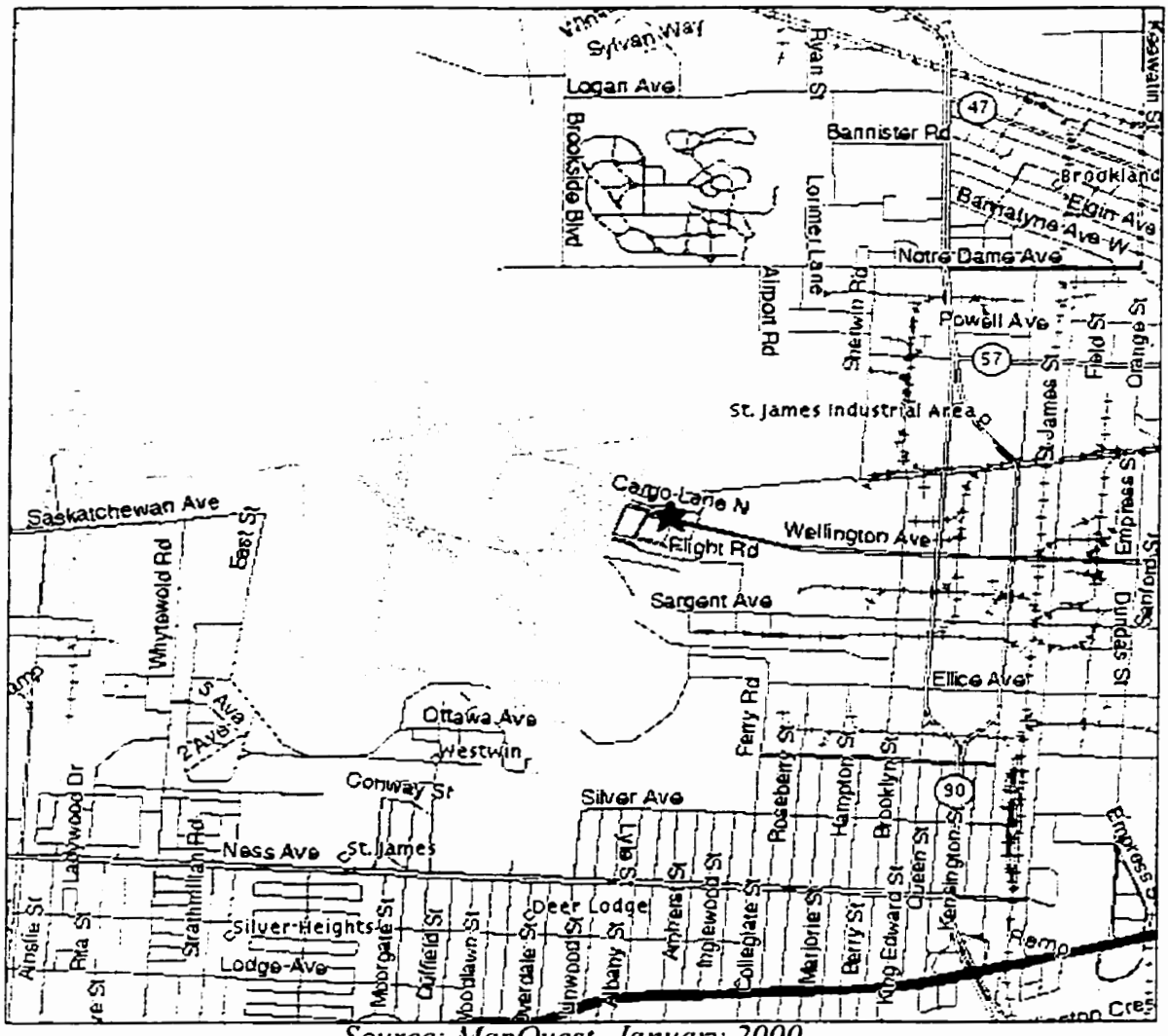
Year	Air Passenger Traffic
1982	2,085,200
1986	2,267,635
1990	2,254,497
1991	2,072,674
1992	2,142,124
1993	2,081,464
1994	2,148,890
1995	2,299,005
1996	2,782,494
1997	2,938,880
1998	2,879,843
1999 (unofficial)	2,920,000
2000 (projection)	3,190,500
2012 (projection)	4,395,900

Source: Winnipeg Airports Authority (1999) and web site (February 2000)

It is currently impossible to determine accurately where Winnipeg truly ranks in terms of cargo throughput because of the incomplete method of data collection effected by Statistics Canada and Transport Canada. The official cargo data, which ignore courier and integrator cargo volumes, rank YWG seventh in Canada. That ranking is based on the approximately 13,425 tonnes that moved through the airport in 1997, the most recent full year for which data are available (Transport Canada, October 1999). However, by collecting cargo volumes directly from carriers on a monthly basis, the Winnipeg Airports Authority has arrived at a more realistic picture of YWG's true cargo activity. Unofficial estimates for 1999, the first year for the new reporting system, indicate that YWG's cargo activity is most likely to total between 90,000 and 100,000 tonnes, possibly as high as 110,000 tonnes.[87] This likely moves Winnipeg into the top five or six cargo airports in the country. In terms of integrator cargo volumes, Winnipeg and Hamilton are the most important. Airports such as Toronto and Vancouver handle much more belly freight than Winnipeg, but are not as important in terms of express air cargo.

[87] There are still a number of issues that cloud the reporting system. For instance, the system is not harmonized. Some carriers report only inbound and outbound totals, while others report inbound, outbound and in-transit volumes. Not all carriers moving cargo at YWG are currently reporting volumes, but all of the major carriers are participating, including the largest belly-cargo carriers and the major integrators and couriers. The reporting process is still being refined in order to make it as effective and simple as possible. Similar processes are underway at other Canadian airports as local airport authorities realize the increasing importance of cargo activity to their revenue streams.

Figure 4.12 – Map of YWG Airport Area



Source: MapQuest, January 2000

Figure 4.13 – YWG Aerial View

Source: Winnipeg Airports Authority

YWG has a distinct location for its hinterlands, and that lies south and east of the airport, with some commercial and industrial activity to the west. Not surprisingly, the location of the current hinterland coincides with the main ground transportation routes leading to and from the airport. The primary access road to the passenger terminal is Wellington Avenue, while Sargent Avenue connects more directly to the cargo areas to the southeast of the terminal. Development in this area is dense, with relatively little room for existing companies to expand. Slightly further north there are a number of parcels of land on the east side of the airport that are still available for development, totalling approximately 21.5 hectares (53 acres). It is on the east side that YWG reveals minimal growth pole characteristics, but it is the underdeveloped west side of the airfield that has the greatest potential to act as a growth pole for future economic development.

The west side of the airport has about 1,200 hectares (3,000 acres) of land available for development. Some major airport-related tenants are already located to the west: Boeing, Air Canada Maintenance, and NavCanada. The Winnipeg Airport Lands Corporation, a joint effort of WAA and adjacent landowners in Winnipeg and the Rural Municipality of

Rosser, controls approximately 1200 hectares (3000 acres) available for business park development on the west side of the airport. This land closely fits the profile of the land surrounding the successful growth poles at the US airports included in this study. It is adjacent to the airport infrastructure; it has adequate highway infrastructure, connecting it directly with the Trans-Canada Highway and the major highway leading to the United States from Winnipeg; and it has rail infrastructure nearby. However, there is currently no intermodal container facility in the area to the west of YWG, despite the best efforts of some groups to establish a third-party operated (non-railway) multi-user container terminal. From the experiences at AFW and HSV, such a facility could be a vital part of YWG's conversion to a successful growth pole. Such plans were a part of Winnport's initial strategy.

Winnport, touched on earlier in this thesis, made an investment on the west side of the airport, took a large gamble on a specific air cargo routing, and lost. The company built a $5 million warehouse facility, a taxiway and an apron to connect with the existing infrastructure. The company proceeded to sign a 55-year lease for the site on airport land. Winnport received the Canadian bilateral rights to the Chinese airports in Shenzhen and Nanjing in February 1998 (Cash 1998a). Even at this early stage, officials were acknowledging the risk being taken by the company, risks that were repeated throughout the company's short time flying between Canada and China (Cash 1998b; Cash 1999a). When Winnport was flying, it had relatively full loads coming from China to North America, including 70 percent of capacity on the inaugural flight (Cash 1998b). However, North America-to-China cargo never increased enough in volume. That fact, along with difficult Chinese regulations, the Asian economic collapse, new freighter capacity elsewhere, and the under-capitalization of the company (Cash 1999a) forced Winnport to suspend operations in January 1999. Most recently, the company has abandoned its 747 in favour of a smaller 727, and has found a strategic partner in Royal Air Cargo (Cash 2000). Winnport is expected to be flying again in the first half of 2000, with its "assets" – the Chinese bilateral agreement and its air cargo licence in Canada – intact (Cash 1999b). Despite its troubles thus far, Winnport may still be viable. The Huntsville experience should show that the size of the city is not the only variable that

leads to a successful cargo-based growth pole airport. YWG can be successful by finding its niche in the air cargo market – a process that may or may not be assisted by Winnport.

4.5 – The Cargo-Passenger Activity Ratio (CPAR)

This study considers cargo to be the key determining factor in airport growth pole success. To that end, an indicator has been employed to determine an airport's dependence on passengers in relation to cargo. The Cargo-Passenger Activity Ratio (CPAR) is calculated by dividing an airport's total cargo tonnage for a given year by its total passenger tonnage in the same year. The passenger tonnage is equal to the total number of enplaned and deplaned passengers in that year divided by the number of passengers (including their baggage) that equals the weight of one tonne of cargo. For the purposes of this thesis, each passenger represents 90 kilograms, meaning that 11.111 passengers are the equivalent of 1 tonne of cargo. A value of 1.000, or unity, indicates that an airport moves exactly the same weight of passengers as freight. However, only the nine most cargo-intensive airports in the world have CPAR values in excess of 1.000.

It is fundamentally easier to arrive at an accurate figure for US airports, simply because the reporting of cargo and passenger data is mandatory there. In Canada, official statistics collected by Statistics Canada ignore the cargo carried by couriers and integrators, incorporating only the major scheduled passenger and charter airlines. For the US airports, data concerning the number of passengers and cargo tonnage are obtained from the Airports Council International (ACI) and their web site, www.airports.org. For YWG, the data are provided directly from the Winnipeg Airports Authority.

Interpretation of the CPAR for various airports abides by the following convention: the higher the CPAR value, the greater the relative role of cargo at a particular airport. Lower CPAR values indicate a greater role for passenger traffic. The CPAR formula is as follows:

Equation 4.1 – Cargo-Passenger Activity Ratio

$$CPAR = \frac{Freight(inTonnes)_j}{Passengers(inTonnes)_j}$$

Where j = the year being analyzed. For example, 1998.

For the four key airports in this study, the CPAR values are shown in Table 4.5.

Table 4.6 – Cargo-Passenger Activity Ratio, Case Study Airports, 1998

Airport	Passengers	Passengers (tonnes)	Cargo (tonnes)	CPAR
AFW	0	0	N/A	undefined
DFW	60,482,700	5,443,497	801,968	0.1473
HSV	1,037,676	93,392	44,825	0.4800
YWG	3,050,000	274,503	95,000[88]	0.3461

The CPAR values are difficult to analyze with such a small sample. For a better comparison, Table 4.6 shows the total passengers, cargo tonnage and CPARs for the world's top twenty-five passenger airports and the top twenty-five cargo airports. (Note, owing to some overlap, there are thirty-six airports in the analysis.) The waved lines in Table 4.6 indicate where this thesis' case-study airports rank. The first two lines represent HSV and YWG, respectively, while the third underscores DFW's position. AFW is not included since its CPAR value is undefined.

[88] This figure is within the range of the estimated cargo totals for 1999 for YWG as calculated by the Winnipeg Airports Authority.

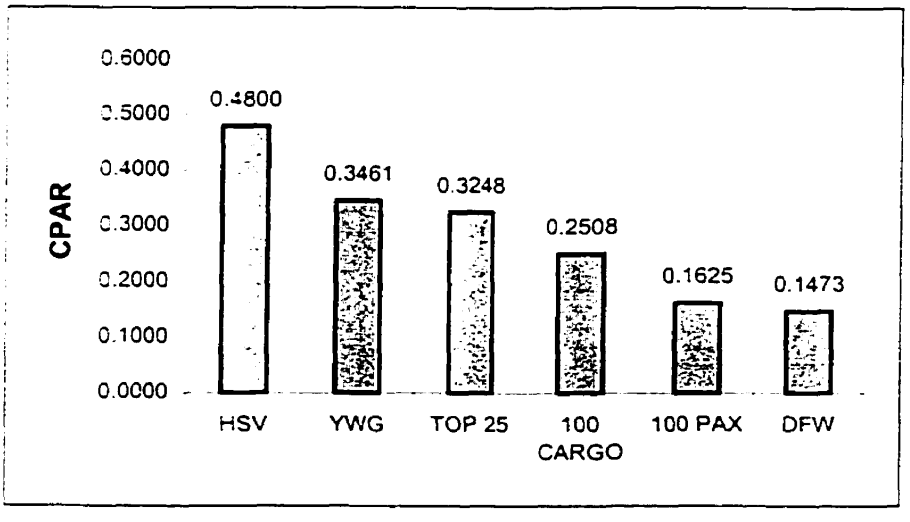
Table 4.7 – CPAR Values, Top 25 Passenger and Cargo Airports, 1998

Pax Rank	Airport	Passengers	Passengers (Tonnes)	Cargo (Tonnes)	CPAR
240	DAYTON (DAY)	2,192,948	197,367	893,239	4.5258
171	LOUISVILLE (SDF)	3,674,629	330,720	1,394,999	4.2181
144	ANCHORAGE (ANC)	5,016,489	451,489	1,289,266	2.8556
87	MEMPHIS (MEM)	10,063,883	905,759	2,368,975	2.6155
115	INDIANAPOLIS (IND)	7,292,132	656,298	812,664	1.2383
90	OAKLAND (OAK)	9,616,241	865,470	698,771	0.8074
32	TOKYO (NRT)	24,441,365	2,199,745	1,637,521	0.7444
23	HONG KONG (HKG)	27,919,935	2,512,819	1,654,356	0.6584
58	TAIPEI (TPE)	15,725,448	1,415,304	916,881	0.6478
34	SINGAPORE (SIN)	23,803,180	2,142,308	1,305,592	0.6094
12	MIAMI (MIA)	33,935,491	3,054,225	1,793,009	0.5871
16	NEW YORK (JFK)	31,436,478	2,829,311	1,604,422	0.5671
20	SEOUL (SEL)	29,429,044	2,648,640	1,425,009	0.5380
44	OSAKA (KIX)	19,161,035	1,724,510	766,607	0.4445
11	AMSTERDAM (AMS)	34,420,143	3,097,844	1,218,746	0.3934
7	FRANKFURT/MAIN (FRA)	42,716,270	3,844,503	1,464,955	0.3811
13	NEWARK (EWR)	32,512,106	2,926,119	1,094,383	0.3740
3	LOS ANGELES (LAX)	61,215,712	5,509,469	1,861,050	0.3378
28	BANGKOK (BKK)	25,623,901	2,306,174	719,255	0.3119
9	PARIS (CDG)	38,628,926	3,476,638	1,067,255	0.3070
4	LONDON (LHR)	60,659,593	5,459,418	1,301,251	0.2383
2	CHICAGO (ORD)	72,485,228	6,523,736	1,441,829	0.2210
8	SAN FRANCISCO (SFO)	40,060,326	3,605,465	771,931	0.2141
6	TOKYO (HND)	51,240,704	4,611,709	693,191	0.1503
5	DALLAS-FT WTH (DFW)	60,482,700	5,443,497	801,968	0.1473
25	TORONTO (YYZ)	26,744,530	2,407,032	350,000	0.1454
1	ATLANTA (ATL)	73,474,298	6,612,753	907,208	0.1372
10	DENVER (DEN)	36,831,400	3,314,859	447,266	0.1349
18	MNPLS/ST PAUL (MSP)	30,347,920	2,731,340	365,417	0.1338
17	HOUSTON (IAH)	31,026,369	2,792,401	354,961	0.1271
14	PHOENIX (PHX)	31,769,113	2,859,249	332,688	0.1164
21	LONDON (LGW)	29,173,196	2,625,614	294,009	0.1120
15	DETROIT (DTW)	31,544,426	2,839,027	284,336	0.1002
24	ORLANDO (MCO)	27,748,571	2,497,396	238,009	0.0953
22	ST LOUIS (STL)	28,700,622	2,583,082	134,545	0.0521
19	LAS VEGAS (LAS)	30,227,287	2,720,483	73,846	0.0271

Source: Airports Council International, November 1999, and author's research

Some further calculations from Table 4.7 show that the average CPAR is 0.7032, while the median CPAR is 0.3248. If the one hundred airports with the greatest number of passengers are considered, the mean CPAR is 0.2327 and the median CPAR is 0.1625. If the top one hundred cargo airports are considered, the mean CPAR is 0.6710 and the median CPAR is 0.2508. Evidently, of the four airports of prime concern to this study, one cannot be compared with these comparative indices but three can: HSV and YWG would be considered "cargo-oriented" in any of the three sets of airports, exceeding the median in each case, while DFW falls short of each median. However, DFW is fairly typical of major passenger airports, approaching the median for that category. Figure 4.14 shows how the case-study airports compare with the median CPAR values for the top 25 cargo and passenger airports (TOP 25), the 100 largest cargo (100 CARGO), and 100 largest passenger (100 PAX) airports worldwide.

Figure 4.14 – CPAR Value Comparison



All in all, the comparisons highlight the cargo content of HSV and YWG, while leaving it slightly understated at DFW. One implication of these findings is the prominence of HSV and YWG in the cargo-airport stakes; a situation that might auger well for their future development as growth pole airports.

4.6 – Growth Pole Characteristics of the Case Study Airports

It is necessary to revisit a point that was made in Chapter 2. Parr (1999) outlined four characteristics that are common to all growth pole settings. To reiterate, they were:

- encouraging the growth of employment and population at planned poles over a specified period;
- a definite limit on the number of planned poles, depending upon the nature of the setting;
- growth poles are selected based on their potential for supporting economic activity and growth; and
- the spatial structure of employment and population in the region will be modified.

It is now time to assess these characteristics with respect to their presence (or lack thereof) within the setting of airport growth poles.

First, an airport growth pole clearly influences regional employment, as is evidenced by the number of firms locating nearby. For example, AFW has intentionally drawn a multitude of new companies to the pole, firms that have not only increased employment levels, but have caused labour shortages in some fields. As the pole develops, it is also apparent that the nearby residential population increases. This was only becoming evident at AFW in the late 1990s, exposed as housing developments begin to be established. The fact remains, however, that the fastest-growing community in Northern Alabama is Madison, located adjacent to HSV and the JetPlex Industrial Park. The changes in employment and income generation were also noted in the HSV economic impact studies of 1988 and 1996, introduced earlier in this chapter. Meanwhile, DFW has acted as a magnet for employment and population as a natural growth pole.

Second, the limit on the number of planned poles is not as obvious, especially considering that two of the airport growth poles in this study are in the same metropolitan area. The premise behind this limitation is that there is a decreasing trend in terms of the marginal benefit of each additional growth pole. In other words, as growth poles are established in close geographic proximity to each other, the newer poles will have far less impact than the first poles had upon introduction. Furthermore, there is a possibility that

additional growth poles within a particular region may lessen the positive impacts of the existing growth poles. To be sure, this has not been the case at Dallas-Fort Worth. The introduction of AFW has not lessened the impact of DFW, although it has taken some business away (FedEx). DFW has been able to grow in tandem with AFW. However, if another development were to be planned within the metropolitan area, it would be unlikely to have as significant an impact as either of the established airport growth poles, and could lessen the impact of AFW and DFW. To illustrate this point even more clearly, if ten additional airports were planned to be converted into growth poles in the Metroplex, it would be virtually impossible for each to have significant economic impacts relative to the existing poles. This topic is addressed in Chapter 5, where part of the statistical analysis tests whether significant differences exist between the experiences of firms at AFW and DFW on the one hand, and firms at HSV and YWG on the other.

Third, growth poles are said to be selected on the basis of their potential for supporting economic activity and growth. In the case of DFW, this was not the case. The airport was constructed to replace outdated facilities and became a natural growth pole. For AFW and HSV, they were selected in part because of their potential for continued economic growth. For AFW, Ross Perot Jr. saw the future possibilities and invested to bring that vision to reality. In Huntsville, Ed Mitchell is credited with being the visionary leader. Mitchell, however, did not use his own investment, rather he secured federal economic development funds. In that regard, however, the agencies overseeing those funds must also have agreed – rightly – that HSV had the potential to support the economic activity and growth that would follow.

Finally, the spatial structure of employment and population in each case-study region has, in fact, been modified. At AFW, the growth pole's geographic area was farmland in 1988 and is now one of the major foci of economic development, employment and population growth in North Texas. DFW has undergone the same process since 1975, altering the spatial distribution of jobs and population in the region for a quarter of a century. Although downtown Dallas and Fort Worth are healthy, other centres of employment and population have developed in neighbouring cities since the airport's

construction. To make the point more clearly, it is the area of North Texas between AFW and DFW that is experiencing the most rapid growth in population in the region. HSV, as mentioned, has altered the population pattern in the region as the town of Madison continues to grow. In addition, the airport and the industrial park have shifted the employment focus of the region further west, straying from the traditional centres in downtown Huntsville and the Cummings Research Park (although both are still vital parts of Huntsville's economic development and employment profiles).

Winnipeg's spatial structure is partly defined by the airport's presence. Planners have had the foresight to prohibit residential development to the west and north of the airport, something that cannot be said for DFW or HSV. Since no new housing has been permissible in the St. James-Assiniboia area – other than infill developments – the city has expanded to the north, east and south rather than to the west. On the micro-level, the majority of airport-related developments are still crowded into the area along Sargent and Wellington Avenues near Berry, King Edward and Century Streets, the main routes surrounding YWG. There are two other areas with notable airport-related development. Immediately south of the airport, adjacent to CFB Winnipeg, are YWG's general aviation facilities, operated by Esso Avitat, Shell Kelly-Western, and a new executive aviation hangar built by Fast Air. To the southwest of the airport is Murray Industrial Park, home to Boeing and NavCanada. Also nearby are the Air Canada maintenance hangar and Winnport's facility. However, the southeast portion of the airport's hinterland is the most significant employment centre of the three.

A cargo-based airport growth pole, partially represented by an airport business park, could give Winnipeg the opportunity to change the spatial structure of the city discernibly, by creating a new focus of employment near the airport. This would be one of the implicit goals of any such development. If the west side of YWG is to be converted into a cargo-based airport growth pole, it will require, at the very least, targeted government and private industry programs to stimulate development. If programs are focused on growing the airport business park – and identifying the west side of the airport as the single growth pole in the region – then employment and population could grow at

the pole for the duration of the programs. Eventually, the business park could reach the critical mass of agglomeration, as discussed in Chapters 1 and 2, so that government programs would no longer be required. Firms would locate at the Winnipeg airport business park because it would be the best location for their business.

It is also important to reduce local competition for the same investment dollars. To be successful, the business park must be a full, collaborative effort with the support of the entire community. In other words, it makes little sense to invest in multiple growth poles in the same city simultaneously. This notion is consistent with classical growth pole theory.

The Winnipeg growth pole must be shown to have the potential to support future economic activity and growth. Winnipeg has an excellent strategic location, in the centre of North America. It has already been shown that Winnipeg has the lowest distribution costs in Canada for a single warehouse/North American distribution system. YWG is one of the continent's most reliable airports, with just a few hours of average shutdown time each year. The airport offers 24-hour operations and the city has excellent flying weather. Winnipeg currently lacks the visionary leader, likely resembling Ed Mitchell more than Ross Perot, Jr. When that leader emerges and takes on the role of establishing the airport business park, Winnipeg can move towards fulfilling the last of Parr's growth pole setting characteristics.[89]

A successful business park on the west side of YWG would change the region's spatial structure of employment and population. In a similar transformation to AFW, farmland could become the new home of air cargo companies or technology-intensive firms. An intermodal facility could function from where a barn once stood. Employment could grow and would likely be followed by an increase in population.

[89] The notion of the necessary leadership is discussed further in Chapter 6. While not a traditional component of growth pole theory, a case can be made for the visionary or entrepreneurial "superman" or "champion" for airport growth poles.

The positive picture just painted is still far from reality. Leadership of the Winnipeg Airport Lands Corporation has been ineffectual thus far, Economic Development Winnipeg has had no real impact on an airport business park, and neither the city nor the provincial government has stepped forward with any discernible positive action. The first step for the cases of AFW, DFW and HSV was the provision of infrastructure. At AFW, one policy is to have buildings and infrastructure ready so that when a firm indicates a desire to locate there, they can move in within 90 days.[90] If any firms wanted to locate on the west side of YWG, the lead time would be much longer. A 90-day "window" – or even building on speculation ("on spec") at all – is unrealistic for the current situation at YWG,[91] but to show that the Winnipeg airport business park is in earnest, the provision of *infrastructure* is a necessity. Firms must be assured that there are excellent roadways, high-quality municipal services (including water, sewer, electrical, telephone, high-speed telecommunications network), and an attractive environment – both aesthetically and financially – in which to do business.

A number of these issues are revisited in Chapter 6, which brings all the information together, arriving at a set of policy recommendations for Winnipeg. Before arriving at that point, however, the results of the survey process need to be disseminated, and that is the object of Chapter 5.

[90] Building "on spec" is not a new concept, however. From the 1930s, British regional policy encouraged the construction of speculative factories to encourage regional development. The idea is not foreign to North America either. Industrial Estates Limited laid out roads and modular factory units in Nova Scotia in the late 1950s (Todd 1995a).

[91] However, building "on spec" does occur in Winnipeg on a limited scale. Morguard Investments recently invested $3.1 million in a new mid-sized warehouse in North Winnipeg without a tenant in place (Santin 1999).

CHAPTER 5 – ANALYSIS

5.1 – Introduction

This chapter is composed of two main components. The first encompasses the responses gathered from local planning authorities at various levels and from airport management respondents. These two categories of respondents are grouped together because their surveys were very similar, and because the responses are all qualitative. The first part is split into subsections dealing with each airport separately, followed by a brief comparison of some characteristics of the three US airports and the Canadian case in Winnipeg. The second part of this chapter presents the results of the survey of airport-related firms. It groups together the survey results from all three US airports to find some common threads. The responses from the US firms are compared qualitatively and statistically with responses garnered from firms in Winnipeg.

5.2 – Qualitative Survey Results

This section for the most part consists of information given by planners and airport officials. However, it also includes some qualitative responses given by airport-related firms. The first airport examined is AFW.

5.2.1 – Fort Worth Alliance Airport

Job creation and taxation revenue were the prime benefits cited by planners associated with AFW. Specifically, respondents mentioned that numerous jobs were high-paying and that the tax base had increased every year since Alliance was created. One respondent regarded the birth of AFW as a turning point for the community, while another agreed that it was one of the best things ever to happen in the region. The uniqueness of the airport development was noted, and in particular the Texas Motor Speedway, which surely would not have located where it is (a few km north of the airport) were it not for the success of Alliance. Furthermore, the joint attraction of the

airport with the intermodal rail facility was highlighted. One respondent called the BNSF facility "as important" as the airport in terms of attracting firms. Between 1994 and 1995, the intermodal facility increased its annual number of lifts from 8,000 to 35,000 (Yevdokimov 1999). There was consensus that AFW had exceeded its expectations within the community.

For the future, AFW is expected to be a major part of the regional development plan. The emphasis for the future is definitely on employment; to be more precise, in ensuring that there are enough trained workers in the region to fill the jobs that continue to locate at AFW. For instance, a local junior college certified Lockheed Martin (ex-General Dynamics) employees to work at Alliance's American Airlines maintenance facility.

The City of Fort Worth has limited duties with respect to Alliance because the latter is mostly a private development. The City is responsible for services (for example, there is a Fort Worth Fire Station on the airport site), and zoning and planning laws. In addition, the City owns the actual airport, while Hillwood Development owns the surrounding land. Alliance Air Services, a Hillwood subsidiary, is contracted to operate the airport by the City of Fort Worth. The City is also heavily involved in the recruitment of firms (providing business incentives) and the provision of infrastructure. Overall, the City has a "give-and-take" relationship with Hillwood Development and both have the same goal of economic development in mind.

At Alliance, the American Airlines maintenance facility was the original anchor tenant, locating at the brand-new airport in 1989. American gave Alliance credibility, especially given the airport's remoteness from the city. According to one respondent, many firms have indicated that they would have located elsewhere if American were not there, or if it had failed. A lucrative tax exemption was one of the key factors that led American to choose Alliance over Tulsa, OK, according to respondents. BNSF was the next key company in establishing the critical mass. Together, American and BNSF convinced numerous companies that Alliance was "for real"; that is, a facility of some permanence. This is confirmed by Hillwood Development Corporation (February 2000): "after the

airport was built. American Airlines became the first corporate 'customer' at Alliance, soon to be followed by" BNSF. Other key early tenants included FedEx, the United States Drug Enforcement Agency (DEA), and Nokia.

The time path of development is fairly clear at Alliance. The early years of the project were marked by aviation-related development; up until 1992, the airport itself was the prime focus of development. The high quality of Alliance's infrastructure attracted distribution firms that relied on highways and railways. American Airlines established its maintenance base in 1992, followed by BNSF, the DEA, Nokia, Michaels, Marriott, and Nestlé. Nokia added a manufacturing facility after the success of its distribution centre, and, today 10 percent of the world's cellular telephones are made at Alliance. One respondent listed six key development steps for Alliance:

1. the initial airport development;
2. BNSF connecting the airport to Houston and the West Coast by rail;
3. American Airlines giving the area credibility;
4. FedEx becoming the airport's first major cargo user;
5. Nokia becoming the area's first major manufacturing tenant; and
6. Intel, solidifying the high-tech development and bringing numerous support firms.

Aviation, distribution and manufacturing will still be the main types of development at Alliance, but will be complemented by residential development and more commercial development at the nearby Circle T Ranch. The airport will play no real role in this development, for it is all managed by Hillwood. Development will continue until, as one respondent termed it, "total absorption" takes place, probably in 25-30 years.

One of the current measures in progress is the construction of housing for employees of Alliance firms with varied price ranges to accommodate the different salary levels found at AFW. As mentioned in Chapter 4, the runway at AFW is planned to be expanded by the year 2004 to 3962.4 m (13,000 feet) from 2926 m (9,600 feet) and this will boost the

attractiveness of the airport to users of large aircraft.[92] Intel is expected to build a microprocessor-manufacturing plant at Alliance, and FedEx and BNSF both have expansion plans. One of the successful aspects of AFW has been the construction of warehouses and office space on speculation (or "on spec"). In other words, Hillwood builds buildings without having a tenant. Then, when a firm approaches and wants to move into Alliance as quickly as possible, it can be accommodated, usually within ninety days.

The airport respondents (technically not an airport authority) cite the mass of new industrial development as the key element of the airport that has aided regional development. The airport's development strategy initially focused on aviation-related firms (like American Airlines), but has since expanded to include technology-intensive firms, manufacturing, air cargo, and warehousing and distribution. Now, the chief targets of the airport's marketing efforts are *Fortune 500* firms, or firms of similar quality, according to one respondent.

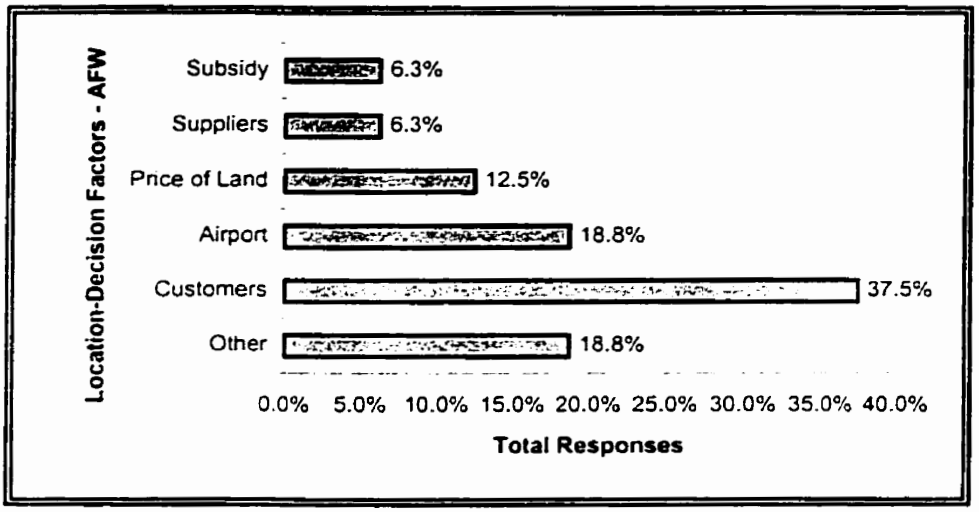
Constraints to development at AFW are few and comparatively slight. The most significant is the lack of quality infrastructure, since it is quite removed from what is available in the rest of Fort Worth. One respondent noted that the City's ability to deliver water and sewer services is being challenged as Alliance grows. Airport respondents claimed that no barriers to proper development existed, but that ordinances were in place to ensure that certain types of incompatible development – churches, schools, or high structures – may not be built near the airport.

Firm respondents added some valuable qualitative information as well. At AFW, the responding firms indicated that without their current proximity to the airport, approximately 20.8 percent of their business would be affected. As the following

[92] Lengthening the runway at AFW is an example of an investment in infrastructure, with the goal of attracting more economic development. Longer runways allow for more cargo to be carried on aircraft, which means increased revenues for an airport, and more economic spin-offs in the region. Anchorage International Airport lengthened its main runway in 1995 and experienced a 57.9 percent increase in cargo activity between 1995 and 1998 because aircraft could increase their payloads significantly (Government of Alaska, January 2000; Airports Council International January 2000).

sections show, this is a comparatively low dependence for the US airports, indicating that there are other benefits to locating at AFW apart from the airport. This notion is supported by the location-decision factors cited by firms near AFW. Proximity to customers was the most frequently mentioned factor (37.5 percent), followed by proximity to the airport (18.8 percent). The total distribution of location-decision factors is shown in Figure 5.1.

Figure 5.1 – Location-Decision Factors – AFW Firms



5.2.2 – Dallas Fort Worth International Airport

In the view of city and county planners, the main benefits to the Dallas-Fort Worth community stemming from DFW were what one would safely predict. Convenience for business travellers and access to international cargo service stand out as two of the most important responses outside of those dealing with the airport's economic impacts. Those responses included references to stimulation of retail, hotel and tourist industries, warehouse and distribution business, and the enormous employment engendered by airport operations. One respondent pointed out that taxes generated on the airport site are particularly important, as a large proportion goes back into the airport's budget, thus enabling the airport to lower its fees, making it more attractive for airlines. Interestingly, although the airport's primary focus is on passenger transportation, more respondents

indicated the importance of cargo service as a benefit to the region. One suggestion was made that the airport could raise its service level to the community.[93]

One respondent defined DFW's role in the community as: "to work regionally with communities to provide efficient transport of people and freight". There was full agreement that DFW has fulfilled its role in the community, with one respondent stating it has exceeded what was expected when the airport was built. The airport is also expected to play a "pivotal" role in the region's development plan, moulding the types of businesses attracted to the region. A master plan has recently been completed encompassing airport development, as well as commercial and residential development and ground transportation for at least one nearby city (Euless).

Respondents were reluctant to give any firm the title of "anchor tenant" at DFW. In fact, there was little knowledge among respondents about any aspect of the development pattern at DFW. No one could identify firms that were among the first to locate near DFW. Respondents suggested two development patterns. The first was that local retail and hotel developments were followed by warehousing and distribution companies. This pattern, however, does not seem to have much to do with airports specifically. The second pattern began with the initial presence of importers, exporters, sub-contractor manufacturers and light-industry manufacturers drawn to an airport location by the FTZ (which, paradoxically, was judged to be unnecessary but, yet, acted as a strong positive influence in terms of attracting firms to DFW). These firms were followed by freight forwarders and cargo handlers and, finally, corporate headquarters. Freight forwarders are still located predominantly around DFW, despite the loss of some cargo business to Alliance (primarily FedEx, an airline less frequently used by freight forwarders). Most Metroplex air cargo moves through DFW simply because there are so many domestic and international passenger flights – and the corresponding aircraft belly space – and a large number of all-cargo flights serving numerous markets.

[93] The belief that the airport offers a poor level of service may stem from the dominance of American Airlines at DFW. Many feel that the high proportion of flights operated by American at DFW

The airport representatives agreed with the planners that the FTZ, in combination with the international cargo facility at DFW, was an economic stimulus for international activity. The development pattern focused less on manufacturing firms and more on international JIT businesses. Again, the respondents did not give any single firm the title of anchor tenant. One called the air service the anchor for development, while another listed American Airlines, Delta Airlines and UPS as the first firms to locate near the airport.

Each of the organizations that responded indicated involvement in either the recruitment and attraction of businesses to DFW or the expansion of services at DFW. In particular, their involvement concerned:

- attracting air service;
- "cherry-picking" domestic airlines to fill particular markets;
- assisting businesses with location decisions; and
- the common provision of tax exemptions to attract firms.

One respondent pointed out the necessity for the individual cities around the airport to develop their own infrastructure should they hope to attract any firms. One of the responding organizations, rather than concentrating on attracting new firms, was more focused on issues that affect businesses already located in the region. Section 5.2.5 details the incentive policies of the cities relevant to this study.

Each respondent indicated numerous development plans for the airport area, ranging from "big-box" retail stores to car-rental facilities to new cargo terminals and speculative building construction. In terms of a time frame for the development, the consensus among respondents was that they were "ongoing" and about to occur "as soon as possible".

The airport representatives, for the most part, concurred with the planners. One respondent called aiding regional development the airport's "fundamental purpose",

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(approximately 70 percent of the flights) leads to higher costs, fewer options, and poorer service.

stating that ports have always stimulated economic development.[94] Another respondent mentioned part of the airport's mission statement, which aspires to exceed customers' expectations. All respondents noted the economic impact study already discussed in Chapter 2, citing the US$11 billion impact.

Respondents described the types of firms the airport tries to attract as being aviation-related (passenger and cargo), but maintained that new agreements would focus more upon non-aviation development. Master plans were being developed for two of the neighbouring cities. Development at the airport is expected to be complementary to the core businesses of passenger and cargo transportation, allowing them to feed off one another.

The airport organization (again, not called an airport authority, but serving the same purpose) controls all development within the 7000 hectares (17,000 acres) of DFW Airport. Leases – there are only leases for land on the airport, no purchasing is permitted – are controlled by the airport, as are any design or code changes. The airport assesses development possibilities on a case-by-case basis with the notion of providing services to the region as the grounds for its decisions.

Constraints to development at DFW, as cited by respondents, are as follows:

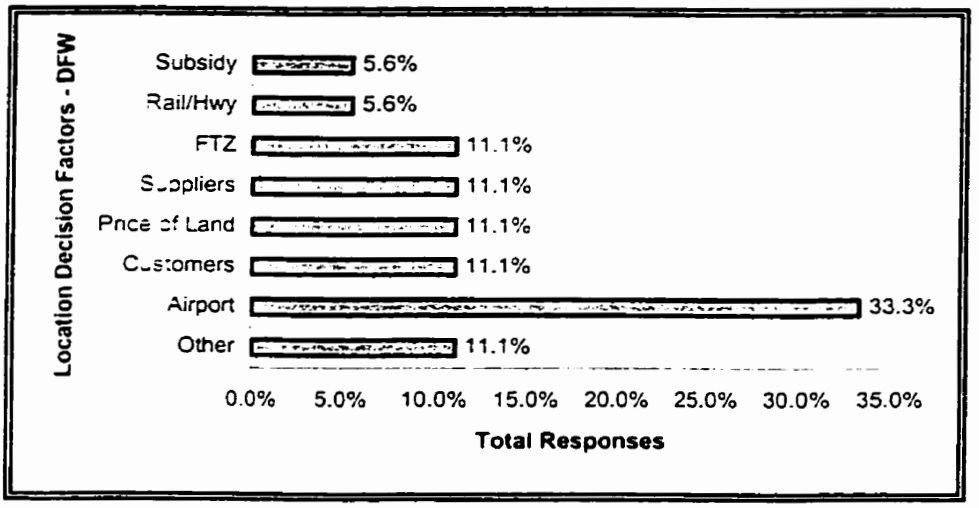
- Because the airport only leases land rather than selling it, there is a disadvantage for developers who would normally purchase a large section of land for development into a business park.
- Development must be consistent with the airport's core businesses.
- The surrounding cities can hamper development in their own cities through not agreeing to share taxation revenue with the airport's owner-cities.

Despite these constraints, DFW has ample land on which it can expand and is indeed at the centre of one of the fastest growing parts of the Metroplex.

[94] Again, this is similar to the hinterland concept (Amoyaw 1999).

For the airport-related firms at DFW, an average of 54.2 percent of respondents' business would be affected without their current proximity to the airport, a much higher proportion than that occurring at either AFW or HSV. This reinforces the claim that the airport is responsible for an immense impact in the region. In other words, on average, over half of each company's business would be impaired without the airport. This observation is supported by the responses given as reasons for the companies' location decisions. Proximity to the airport was the most frequently-mentioned response, garnering a full one-third of all responses, three times the total for any other individual response, as shown in Figure 5.2.

Figure 5.2 – Location-Decision Factors – DFW Firms



5.2.3 – Huntsville International Airport

Planners in Huntsville put less emphasis on traditional economic impacts than did their Texas counterparts. The benefits listed for Huntsville include the movement of people (more notable when the city in question is smaller); effective shipping of "high-tech" cargo between Huntsville and all parts of the world, with direct air connections with Europe and Latin America especially valued; and filling the need for effective ground transportation, with the International Intermodal Center playing a critical role. Again, the belief was unanimous that HSV fulfilled its function in the community.

In terms of development actually on the airport site, it is the City of Huntsville that has planning authority, not Madison County. However, this creates some interjurisdictional issues examined later in this section. The Huntsville-Madison County Airport Authority is responsible for securing land for development and creating a land-use plan.

The development pattern can be pieced together from the answers given by respondents. The first firms to locate near the airport were Onan (now a power-generation division of Cummins Engine Company) and the pharmaceutical company, Cheeseborough Ponds (both of which have since closed in Huntsville), and LG Electronics in 1981. Chrysler and Boeing both located at Huntsville in the mid-1980s. Boeing's facility in Huntsville is closely associated with the city's military presence and space industry and does not manufacture any aircraft or aircraft parts. Intergraph, Hitachi and Dunlop Tires soon located in nearby Lowe Industrial Park.[95] In 1989, Raytheon located in JetPlex Industrial Park, followed soon after by electronics firms such as TDK, Motorola, Futaba and JIT, and a perfume company, Parfum de Coeur.

The development path described by airport officials closely resembled that noted above. The first firm to locate near the airport was Onan. Today, the types of firms the airport attracts are often involved in the technologically intensive space and defence industries.

The military and space programs long associated with Huntsville have drawn many firms to the area, but this drawing power is a "double-edged sword".[96] Many of the firms that

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[95] Unfortunately, it was not possible to include the firms located in other nearby industrial parks in the survey of firms at Huntsville, despite the fact that some of them are airport-related (such as distribution companies). However, the majority of firms in the other nearby parks are not airport-related, but are members of heavier industries. Therefore, their omission from this study should not bias the results. (This belief was confirmed in a personal communication with Ed Mitchell, February 2000.) Apart from the Jetplex Industrial Park, park-specific contact lists could not be acquired during the author's short stay in Huntsville.

[96] Other airports are also influenced by a military presence in the city. For example, San Antonio's recent efforts to establish an International Trade Processing Center at the former Kelly Air Force Base, have been strongly supported by local companies that originally located in the city to support the military, and Boeing recently prevailed as an anchor tenant (Bronstone et al. 1999; Greater Kansas City Development Corporation, February 2000). Austin's new Bergstrom International Airport is on the site of a former air force base ("Austin", About.com, January 2000). Airports in Nashville and New Orleans were once

set up in Huntsville are on short-term contracts with NASA or the US Army and are frequently gone from the city within three to five years. Although this quick turnaround leads to a lack of stability for the work-force, invariably another company quickly moves in to fill any void left by emigrating companies. According to Ron Hamby of the Huntsville-Madison County Airport Authority, there has historically been a net gain in such companies.

The Huntsville-Madsion County Chamber of Commerce works closely with all of the area's industrial parks to promote development, holding, amongst others, a contract with the airport authority. Planning respondents did not indicate specific projects that might be in the offing for HSV, but mentioned that the marketing of the area to firms is an ongoing process. One respondent pointed out that marketing efforts often try to separate Huntsville from the rest of Alabama, because firms located elsewhere in the country have generally negative images of the state. The FTZ at HSV was called crucial to the development of the airport area, particularly for the easy movement of international goods. One additional factor highlighted by two respondents is the construction of Interstate-565 in 1991, making the project a truly regional one, including all of Northern Alabama and Southern Tennessee.

Another respondent cited the uncongested nature of Huntsville as the prime reason it has been able to attract an international cargo company like Cargolux. Cargolux wants to be able to land whenever it arrives over its destination (from Luxembourg), a circumstance it enjoys at HSV, but could likely not achieve at Atlanta, for instance. Because Atlanta's airport is quite congested, most flights are assigned a particular slot that must be met, something Cargolux cannot guarantee if it is forced to wait for any late-arriving cargo in Europe. Also underscored by the same respondent was the importance of cooperation with customs officials. The airport and the planners stressed that no delays occasioned by customs procedures had taken place. Carriers came to Huntsville because of a

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military fields as well (Nashville International Airport, January 2000; New Orleans International Airport, January 2000). St. Petersburg-Clearwater International Airport is a commercial facility, but is also home to the busiest Coast Guard air station in the world (St. Petersburg-Clearwater International Airport, January

combination of quick turnaround times and the necessary equipment in an uncongested environment.

Respondents from the Huntsville-Madison County Airport Authority viewed themselves as being integral parts of the regional development plan and process for an 18-county region surrounding Huntsville. The development strategy has always been to develop more than just an airport; on the contrary, it has ambitions to transform the area into a full transportation centre. For this reason, the International Intermodal Center became the dream of the authority in the late 1970s. However, the focus of HSV – right from the beginning in the 1960s – was to be an economic catalyst for international commerce in the region. There is also consensus that the driving force – or the visionary leader – behind all of the development at HSV was Ed Mitchell, a man who arranged financing for both the original airport and the International Intermodal Center at a time when container terminals were unheard of at airports.

One respondent indicated that projects like Huntsville are not usually a quick success and generally require "deep pockets". An airport authority respondent stated that earnings now exceed outlays for Huntsville International Airport, in conjunction with the industrial park and intermodal facility.

The airport authority has done everything it can to ensure continued growth around the airport, having purchased several thousand hectares reserved for future development to the west and south. Directly east is the JetPlex Industrial Park and slightly further east is Redstone Arsenal and the Marshall Space Flight Center, ensuring no incompatible development in that direction. The only major constraint lies immediately north of the airport in the city of Madison, AL. Much smaller than Huntsville, Madison is located just to the north of the airport and just outside the city limit of Huntsville. As can be observed in Figure 4.7, Madison is actually closer to the airport than the main urban part of Huntsville. Compounding this proximity, Madison is the fastest growing urban centre

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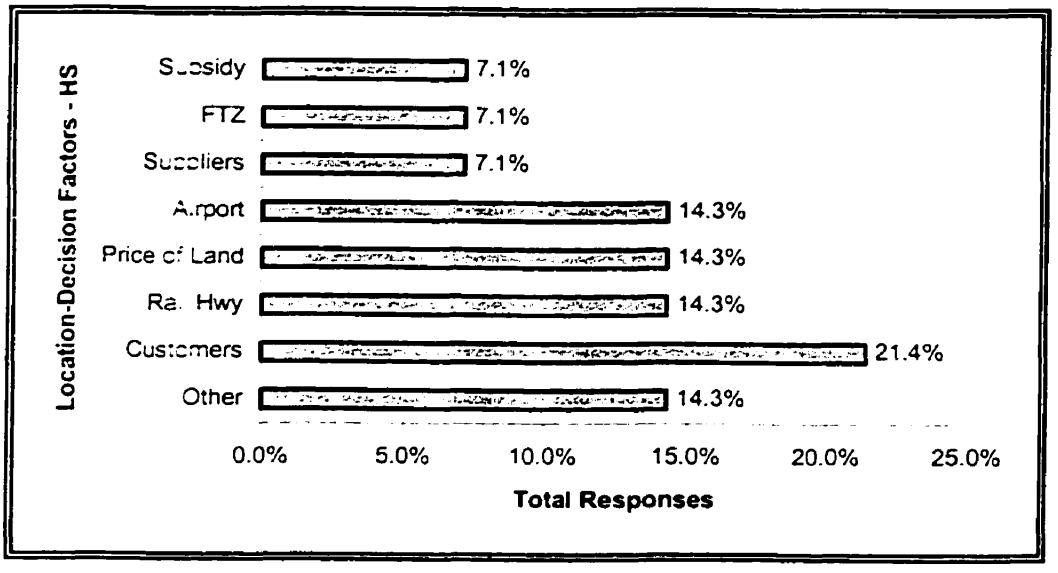
2000). YWG is also an important site for the Canadian military at 17 Wing, CFB Winnipeg. The military aspect of the airport makes Winnipeg unique among major Canadian airports, however.

in the region, and its population is composed mostly of high-income families. For these people, the noise generated by HSV is an issue despite the decision to locate the airport well outside the city of Huntsville in order to avoid any such conflicts. When the airport was built, Madison's population was little more than 5,000 and development was not expected to affect the airport. Its population had swelled to more than 20,000 by 1999 and population growth represents an issue that was certainly unanticipated in the 1960s, and one that probably could have been avoided. Madison's population grew by 228.2 percent between 1980 and 1997 (Huntsville-Madison County Chamber of Commerce 1998).

Airport-related firms indicated that, on average, 29.2 percent of their business would be affected without their current proximity to the airport. This was higher than AFW, but considerably lower than DFW. Responses regarding location-decision factors were in line with those given by firms at AFW. A total of 21.4 percent of the responses indicated that proximity to customers entered into the decision. Responses of proximity to the airport, price of land/lease, and proximity to railway/highway each represented approximately 14 percent of the total responses, as shown in Figure 5.3.

Figure 5.3 – Location-Decision Factors – HSV Firms



5.2.4 – Winnipeg International Airport

The respondents for Winnipeg reflected the minimal development to date. In general, the responses indicated frustration with the current state of airport development and some pessimism that development will continue to be hindered under the current set of circumstances. By the same token, there was a significant degree of optimism that Winnipeg – as both a city and an airport – could be a successful airport growth pole, given proper leadership and co-operation.

The responses pertaining to the community benefits arising from the airport represented a wider array than at the US airports. One respondent stressed the marketability aspect with which the airport provides the city. The 24-hour nature of the airport is an integral marketing tool for attracting firms. Two respondents identified ease of travel as another benefit. Major companies are concerned about access to their branches, something that is provided at YWG, although not to the same extent as an airport like DFW. One specific example cited was Winnipeg's burgeoning film industry, which places a high value on access to Southern California.[97] Apart from the passenger-side benefits, one respondent mentioned that air transportation for cargo is increasing in importance as concepts such as Just-In-Time (JIT) manufacturing and electronic commerce grow in popularity and usage. Having a major, congestion-free airport, capable of handling all types of aircraft puts Winnipeg in the position to try to capitalize on these trends. All respondents agreed that YWG is a strong piece of the city's infrastructure and an important tool for economic and commercial development.

No consensus was reached regarding YWG's role in Winnipeg's regional development plan. One respondent called the airport a catalyst, helping to ensure consistent zoning and transportation planning, including stimulating land development. Another respondent indicated that the airport was just one part – albeit an important part – of a large overall plan. One of the airport authority respondents emphasized WAA's

[97] YWG's access to Southern California was upgraded in 1999 with the commencement of daily service to Denver (with Air Canada partner, Air BC), with connections to Los Angeles (via United Airlines).

developing relationships with all three levels of government, particularly with the city in terms of the development of an airport business park.

There was agreement that the airport fulfils its current role in the community. However, there was also general agreement that that role should be altered, as discussed later in this section. According to more than one respondent, with "decent" passenger service, YWG is well respected and has the community's confidence. One respondent indicated that businesspeople in Winnipeg particularly like the location of the airport close to downtown and are impressed with the visible evidence that WAA is reinvesting in the airport's infrastructure.

Constraints to development at YWG range from noise (the Silver Heights and West End/East St. James residential areas are immediately below the flight path for the airport's most frequently-used runways) to accessibility (particularly ground access on the west side of the airport) to environmental issues (specifically dealing with nearby Truro Creek and Omand's Creek). However, one respondent called YWG's community consultative committee (a group that addresses airport development issues with the community's best interests in mind) one of the most active in Canada. Some other constraints noted were quite specific. For example, Winnipeg's cold climate makes rapid construction difficult, limiting the possibilities for firms that desire a short lead-time for start-up. In addition, one respondent indicated that Winnipeg suffers from an image problem, specifically in the eyes of people who have never visited the city. The negative perception of outsiders is predominantly inaccurate, according to this respondent, but it is a difficult problem to overcome. It was also pointed out that Winnipeg's labour-force is generally unskilled, although one individual firm respondent disagreed, stating that Winnipeg's labour-force is skilled in particular industries.

While not truly a constraint, one respondent identified an issue that could potentially have a negative impact on development. The respondent called WAA reactive in its planning endeavours. The respondent expressed the opinion that WAA should be more involved, and be aware of potential opportunities. Furthermore, it was recommended that the

airport and the land be assembled and presented in an attractive package that can be quickly dispensed and marketed to specific users.

Land development near YWG sparked several varying points of view, especially in terms of respondents indicating their own opinion as to how development could best be encouraged. The land near YWG was referred to as "good" but in need of infrastructure investment. The lack of commitment and lack of infrastructure (on land bordering the airport) makes the west side of YWG not as attractive as other locations that do have infrastructure, according to one respondent. Another respondent posed the question: Who will invest in the infrastructure?

Multiple respondents agreed that one of the most effective ways for Winnipeg to compete in terms of attracting firms is through the provision of incentives. Such a strategy would have the effect of putting Winnipeg on more equal terms with other airport business parks, particularly those based in the USA, which routinely provide such advantages. One respondent specifically recommended that the city provide long-term tax abatements, rather than merely giving land to some developments.

None of the respondents firmly identified an anchor tenant, but more than one grouped together the aerospace firms of Standard Aero, Bristol Aerospace, Boeing and Air Canada as being very important for airport area development. Two other respondents identified UPS as a potential anchor tenant for new development on the west side of the airport. Another explained one perspective of the benefit of an anchor tenant. A strategic anchor (the example given in this case was Standard Aero) sends positive signals that the airport is competitive and potentially attracts suppliers. In any event, developers need to be aware of international changes in order to ensure competitiveness.

That same respondent identified a three-step process for the development of an airport business park in Winnipeg:

1. The local air cargo market needs to grow, and part of that growth entails moving more products by air and expanding

the local export economies. This also includes building new or expanded facilities for integrators.

2. In order to take advantage of any immediate developmental opportunities, on-site infrastructure development needs to be addressed on the airport lands.
3. In the airport vicinity, new infrastructure is also required. An economic case must be made as to why those lands are needed and what decisions and policies could spark development, including the development of a Canadian version of an FTZ.

Airport-related firms indicated that, on average, 42.7 percent of their business would be affected without their current proximity to the airport. In terms of their location-decision factors, the most frequently mentioned response was proximity to the airport, the importance of which is reinforced in the statistical analysis of YWG. Proximity to the airport accounted for 31.4 percent of all responses, followed by proximity to customers with 20.0 percent, price of land with 17.1 percent, and proximity to suppliers with 14.3 percent of responses. Figure 5.4 shows the total distribution of responses at YWG. Figure 5.5 shows the YWG responses in comparison with the responses from the US airports as a group.

Figure 5.4 – Location-Decision Factors – YWG Firms

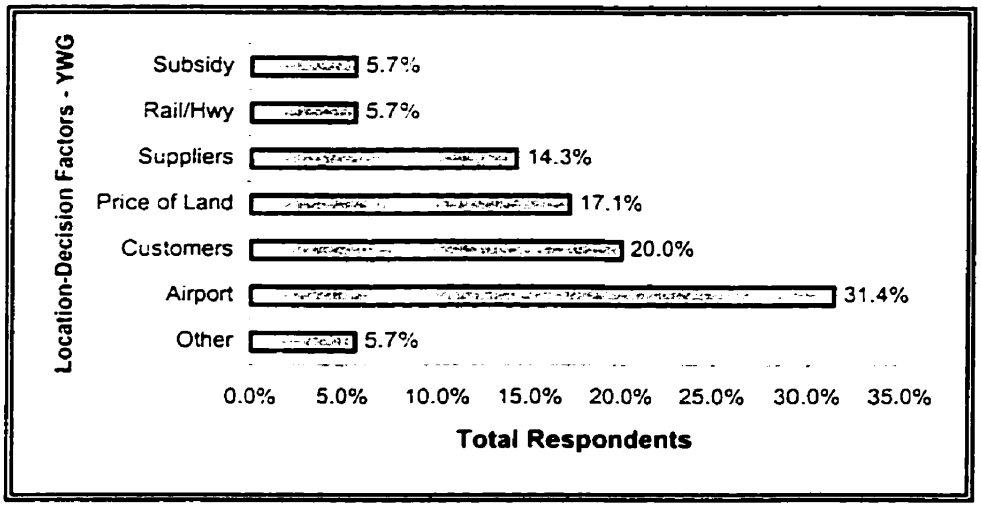
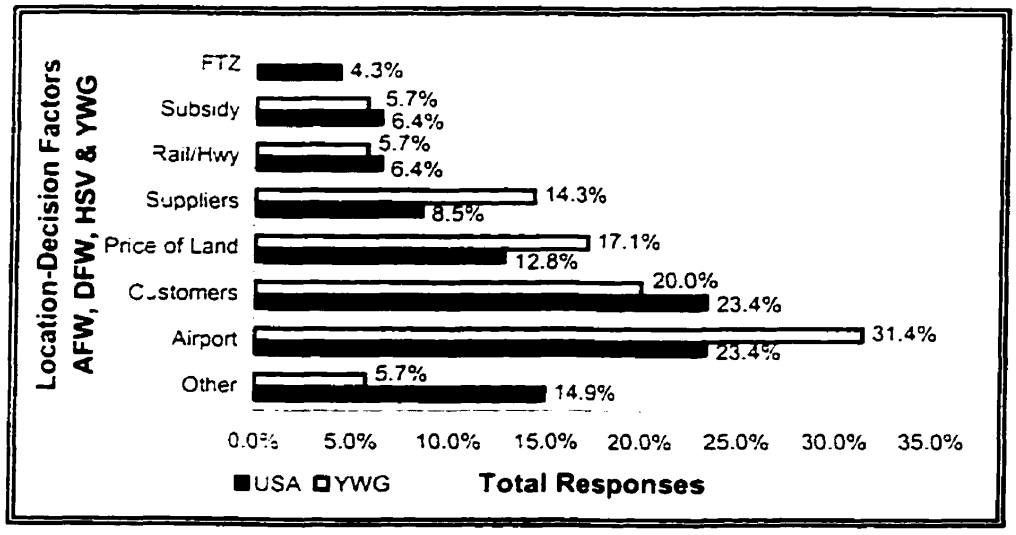


Figure 5.5 – Location-Decision Factors – All Firms



Firms at YWG also identified a number of constraints to development, an issue that was not prevalent at the US case studies. As discussed later in this chapter, eight of fourteen respondents at YWG indicated at least one instance of a constraint to development. Five respondents mentioned land development and space on the airport site as major impediments, a fact substantiated by developmental difficulties at YWG. Two respondents indicated that WAA and government organizations represented obstacles in the path of development. Surprisingly, only one respondent indicated that a lack of quality infrastructure was a constraint. However, the lack of infrastructure is clearly a greater impediment for firms that are considering relocation to YWG than for the firms that are already there. These constraints are real and they are partly responsible for the lack of development at YWG. Recommendations in Chapter 6 address many of these impediments.

One final note that was raised by two respondents was the entrepreneurial spirit that seems to be more evident in the USA than in Canada. One respondent suggested that the difference in population densities between the two nations contributes to this difference. Another respondent stated that there will never be a "white knight" for YWG as there was for AFW and HSV. Chapter 6 addresses the issue of a leader in the development of

cargo-based airport growth poles. At this point, however, some of the other characteristics attendant on the case-study airports are discussed.

5.2.5 – Comparing Some Factors

There are some other factors that play a role in the relationship between the airports in this study and regional economic development. The most salient of them are discussed here, in particular the make-up of each airport's Board of Directors, the occurrence of interjurisdictional issues, the existence of tax abatements and incentives, and the issue of foreign trade zone status near cargo-based airports.

The board of directors of each airport is selected in a way peculiar to itself. For example, the Board of Directors of Hillwood Development Corporation – all members privately appointed – governs development surrounding Alliance Airport, but the City of Fort Worth owns the airport itself. Eleven members comprise the DFW Board of Directors. Four members are appointed by the city of Fort Worth, while the city of Dallas appoints seven (in accordance with the proportion of the cities' populations at the time of the airport's construction, and with the proportion of each city's ownership of the airport). One of the membership positions for each city is given to its mayor. The non-mayoral positions (nine in total) are made up of local business leaders, providing a mix of civic government and business concerns on the board. The Board of Directors at HSV is made up of five members. Two are appointed by the Huntsville city council and two are appointed by the Madison County Commission.[98] The fifth member is jointly appointed by both organizations. As of December 31, 1998, the YWG Board of Directors was sixteen strong. The federal government, the City of Winnipeg, and the board itself each appoints three members. The Winnipeg Chamber of Commerce appoints two, and Economic Development Winnipeg, the Assiniboia Chamber of Commerce, the Rural Municipalities of St. Andrews and Rosser, and the provincial government each appoints one, thus making the YWG Board the most diverse and balanced group of the case-study airports.

[98] The Madison County Commission is essentially the county-level equivalent of a city council.

Each of the airports in this study deals with interjurisdictional factors. For instance, AFW is well outside the City of Forth Worth, but is technically located within the city limits. It actually has as much of an impact on the smaller towns nearby as it does on Forth Worth. Furthermore, AFW is situated directly on the boundary between two counties. DFW is physically spread over several cities between Dallas and Fort Worth, and two counties. In Huntsville, there are issues surrounding the airport concerning the rapid development of the City of Madison. HSV also straddles two counties, geographically speaking. The land adjacent to YWG lies both within the City of Winnipeg and the Rural Municipality (RM) of Rosser, presenting a number of challenges that must be addressed prior to any large-scale development to the west of the airport. Owing to the interjurisdictional issues at YWG – that is, because it involves the city and a RM – the provincial government is also necessarily involved, making the situation even less clear. In any event, cooperation among jurisdictions appears to be the best remedy in terms of economic development, as witness the selection of project sites by DFW Airport.

Many firms are naturally attracted to airport locations by the benefits accruing to passenger and/or cargo air transportation proximity. Others are slightly more "footloose" and are drawn to whichever site is most attractive economically. This often results in communities offering tax exemptions and business incentives in an effort to attract additional major firms. The idea is not only to attract the major firms, but also their suppliers, who, upon locating near their major customers, pay their full share of taxes. Therefore, the region's tax base expands through new industrial firms locating in the region, while employment and income are generated by all firms, further enhancing regional development. Such exemptions and incentives figure prominently in each of the three American airports in this study.

Fort Worth has a clear program for offering incentives, aimed at regional economic development. Companies pay a nonrefundable fee of US$15,000 to apply for a tax abatement (McCain 1998). The city does not accept applications from companies located

in other parts of the Metroplex, demonstrating its commitment to a regional approach. After a firm is approved for an incentive, Fort Worth closely monitors its compliance with the terms of the abatement, including an annual audit. The city has, on occasion, withdrawn or reduced abatements for companies that do not comply with the agreed-upon terms (McCain 1998). Some examples of the abatements offered at AFW are shown in Table 5.1.

Table 5.1 – Alliance Tax Abatements

First Year	Company	Value	Jobs	Terms	Final Year
1989	American Airlines	$200 M	2,200	100% on personal property	2005
1994	Nokia	$57.2 M	1,800	100% on real and personal property	2005
1994	Hillwood Development	$10 M	N/A	Lower of $2.5 million or city costs for interchange	2004
1996	JC Penney	$142 M	400	30-90% on real and personal property	2009
1996	Tech Data	$15 M	1,500	25% on real and personal property (extra abatements for new construction)	2007
1996	Best Power	$8.4 M	450	40-80% on real and personal property	2007

Source: City of Fort Worth, December 1999.

DFW Airport does not directly offer any incentives, but the surrounding cities do so extensively. For example, the cities of Grapevine, Euless, Coppell and Dallas each offers a Freeport Tax Exemption, whereby goods are exempt from business and property taxes provided they leave Texas within 175 days. Euless, Coppell and Dallas also consider tax abatements on a case-by-case basis for firms that invest or expand in their jurisdictions. Euless considers sharing the cost of infrastructure with companies as well. Coppell's economic incentives can also include rebates on sales taxes and development fees. The City of Irving's economic development plan recommends that civic leaders ensure Irving remains competitive in terms of business incentives with neighbouring cities. In essence, this means that Irving would have similar programs to Grapevine, Euless, Coppell and

Dallas (City of Grapevine, January 2000; City of Euless, January 2000; City of Coppell, January 2000; City of Dallas, January 2000; City of Irving, January 2000).

Huntsville offers firms exemptions from state and local taxes, but firms must pay school taxes. The City of Huntsville offers some further assistance in the form of preparing land for development. The Tennessee Valley Authority also aids firms locating in the region by providing low interest loans up to US$2 million for equipment and construction costs.[99] The International Intermodal Center was built predominantly with federal regional development funds from the EDA and ARC, two programs discussed elsewhere in this thesis. At the time of the construction of HSV, Ed Mitchell was a member of the ARC and ensured assistance for his hometown.

The Economic Development Partnership of Alabama (EDPA) is a privately-funded, non-profit organization, composed of business leaders across the state (EDPA, November 1999). The EDPA offers a corporate income tax credit of 5 percent for 20 years, totalling 100 percent of the capital cost of a project. The organization also offers industrial revenue bonds for land, buildings, machinery and equipment, industrial site preparation grants, economic development loan programs, and economic development infrastructure grants for new and expanding industries (EDPA, November 1999).

In Winnipeg, limited incentives are offered, but no comprehensive plan exists to attract firms to an airport business park. For example, the City of Winnipeg offers a program whereby firms can defer their property taxes, but no abatements are offered. For its part, the provincial government has programs in place offering certain cargo air carriers a rebate on the provincial fuel tax. The airport is also limited in its ability to offer incentives, primarily being confined to offering land on the airport site for discounted lease or rental rates. In other industries in Manitoba, the incentives are much more significant. For example, the provincial government has teamed with the City of

[99] The Tennessee Valley Authority (TVA) is the largest producer of electricity in the USA and manages the environmentally-sensitive Tennessee River system. More important to this context is its role as a regional economic development agency. The specific information about the TVA's role in Huntsville was provided directly by Ed Mitchell, but more information can be found on the TVA web site at www.tva.gov.

Brandon and the City of Winnipeg to provide incentives associated with the hog-processing industry, encouraging the construction of a new facility for Maple Leaf in Brandon and expansion of the J.M. Schneider facility in Winnipeg. The Schneider deal, which was forged in reaction to the deal given to Maple Leaf, contains the components outlined in Table 5.2.

Table 5.2 – Government Incentives for J.M. Schneider Expansion in Winnipeg

Government	Incentive Amount	Provisions
City of Winnipeg	$2.2 Million	Traffic Lights
		Infrastructure
		Lower Sewer Rate
Province of Manitoba	$300,000	Trunk Sewer Rate Charges
	$650,000	6 ha of Land
	$3 Million	Sewage Pre-Treatment Plant
	$3 Million	Job Training

Source: O'Brien 2000

In comparing the four airports, particularly the three US airports compared with the lone Canadian airport, there are a few similarities and also a number of differences. Some differences are rooted in the sovereignty of countries with different laws, regulations and attitudes towards airports. However, nationalistic excuses cannot account for a lack of leadership and a lack of cooperation in Winnipeg.

Another element lacking in Winnipeg, but present in the three US airports, is a foreign trade zone, or FTZ. In other countries, FTZs are also known as Export Processing Zones (EPZs), Special Economic Zones (SEZs) and Free Trade Zones (also abbreviated as FTZs). FTZs are particularly attractive to companies that ship internationally, many of which are found at each of AFW, DFW and HSV. FTZs, in their American incarnation, are specially designated areas adjacent to ports of entry (seaports and airports usually, but increasingly at inland intermodal centres), that are considered to be outside of US Customs jurisdiction. However, domestic activities – primarily manufacturing – are permitted within the zone. FTZs are designed to offset some of the advantages of overseas producers that import goods into the USA, allowing their tenants to compete

with them using domestically-manufactured goods. Table 5.3 shows the benefits to companies locating in FTZs and to the public.

Table 5.3 - Foreign Trade Zone Benefits

User Benefits	Public Benefits
▪ No duties or quota charges on re-exports	▪ Facilitates & expedites international trade
▪ Duties and taxes deferred on imports	▪ Helps local firms compete with foreign firms
▪ Payable duty is lower of end product or components	▪ Attracts offshore activity & retains domestic activity
▪ Goods held for export are exempt from inventory taxes	▪ Assists local economic development efforts
▪ Goods can be altered/manipulated	▪ Creates employment opportunities

Source: International Trade Administration, February 2000; Foreign Trade Zone Corporation, February 2000

Winnport planned to develop a FTZ at its cargo centre, but Canadian regulations did not permit the establishment of geographically-defined zones. The federal government is currently addressing this issue, and is expected to redefine the Customs and GST laws, allowing Canadian FTZs to be effective. When new legislation is passed in Canada, it is likely that most major airports will establish a FTZ on-site. In the case of YWG, WAA will likely need to take a leadership role due to the decreased presence of Winnport in terms of land development.

Chapter 6 assesses the key differences in the conclusions and discusses methods to narrow the "growth pole gap" between the US airports on the one hand, and YWG on the other. First, however, the analysis continues with an examination of the quantitative survey results.

5.3 – Quantitative Analysis

5.3.1 – Introduction

Obtaining usable responses from airport-related firms proved to be onerous. For US firms overall, the response rate was low. In total, 226 questionnaires were sent to firms near the US case-study airports based upon the lists discussed in Chapter 3. In the event, only 21 usable surveys were received. Using these numbers, the return rate is just 9.29 percent, extremely low for this type of research.[100] However, there are some other factors that must be taken into account. A disappointing 76 surveys were returned by the US Postal Service, after being deemed undeliverable. Many of the returned envelopes indicated that the address – which was copied directly from the lists provided by each airport – did not exist. With those 76 surveys removed from consideration, the response rate improves to 21 surveys out of 150, or 14.0 percent, which is still quite low. One additional factor should be noted. There were some returned surveys, particularly during the phase of follow-up e-mails to companies (mostly to firms surrounding DFW), that were not usable (4 firms). By the same token, some companies that received the questionnaire replied that it was not relevant to their business (8 firms). For some of these companies, this was true, as they were part of the aviation or aerospace industry in Dallas-Fort Worth, but were not related, or near, either AFW or DFW. The updated response rate is 21 out of 138, or 15.2 percent. For official purposes, this figure is considered to be the response rate, but it is possible that it is much higher. If the actual responses (21) are added to the non-usable responses (4), they total 25. There are also 8 firms for which the survey was not applicable. In other words, 25 out of 33 firms felt the survey was applicable to them. If these ratios hold true for the entire sample that received surveys (assuming that all non-deliverable surveys were returned to sender, and none was lost), then the true maximum number of respondents for which the survey would be applicable could be calculated by using Equation 5.1.

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[100] Such a response rate is not unheard of, even for well-designed surveys. Economic impact studies frequently have response rates ranging from less than 10 percent to 25 percent. Again, other factors – such as population definition and the nature of the industry – partially explained this response rate (Shurvell, personal communication, February 2000; Shurvell and Prentice 1999).

Equation 5.1 – Modified Response Rate

$$\frac{r}{t} = \frac{x}{T} \quad \text{or} \quad x = \frac{rT}{t}$$

where r = the actual number of usable plus unusable responses;
t = the total of usable plus unusable responses plus non-applicable responses;
T = the grand total number of surveys sent out (not including returns to sender); and
x = the maximum applicable returnable responses, taking into account the non-applicable firms that did not respond.

In this case, $r = 25$, $t = 33$, and $T = 138$. Therefore, $x = 104.55$, or 105. If the actual maximum number of respondents that could be expected is 105, then the response rate is 21 out of 105, which equals exactly 20 percent. That approaches respectability, but remains disappointingly low.

It was difficult to determine any reasons for the low response rate for the US questionnaire process because the survey was mainly distributed by mail. Some firms simply could not provide the requested information, while others indicated that they would not be appropriate for the survey, since they were not truly airport-related in any way. It is also possible that more questionnaires were undeliverable, but were not returned to the sender. The remaining firms that did not respond likely considered the survey to be unimportant to them, especially since they had no real vested interest in the study's results, nor were they offered an incentive to respond.

For Canadian firms, the response rate was much higher, primarily because the survey was undertaken by telephone and in person. In total, 21 firms were contacted and 14 were surveyed. However, the process was still made difficult due to unreturned phone calls and e-mails. The high response rate was only achieved through persistent efforts to contact companies. Again, the survey, although very brief, was not important to most respondents.

Having prefaced this section with a discussion on the response rate, one more cautionary note is required. This study does rely on both qualitative and quantitative results to analyze the four case-study airports. However, owing to the low number of responses from airport-related firms, the statistical analysis is not as reliable as the qualitative analysis. Therefore, the statistical analysis should be considered as a support mechanism for the qualitative analysis, rather than independent evidence of significant differences – or non-significant differences for some questions – between the US and Canadian case-study airports. In terms of the ultimate conclusions and recommendations in Chapter 6, the qualitative analysis is given much more weight than the quantitative analysis.[101] With this in mind, the remainder of this section outlines the statistical findings.[102]

5.3.2 – Phase 1: AFW vs. DFW vs. HSV

To create a usable data set, the survey responses from all three airports were combined to form one group representing cargo-based growth pole airports in the United States. The intent was to compare the results of this unified group with firms located in Winnipeg, the latter representing a potential cargo-based growth pole airport in Canada. In total, 21 usable responses were received from the US cities.

In order to ensure that the US airports accurately represent a single population, it is necessary to compare the responses given by the firms in each city. This is done by using a chi-square test. However, the chi-square test should only be considered as a very rough measure in this case, since at least one of the key requirements of chi-square analysis is not satisfied. Because the small sample size is split into three groups, there are numerous instances of expected values of less than five; constituting infringements of the limit of one-fifth of the cells, as discussed in Chapter 3. However, the chi-square test confirms what can be fairly accurately judged upon close visual inspection of the observed

[101] Although the statistical analysis is frequently referred to as "quantitative analysis", it can be considered qualitative data as well. Everitt (1992, p. 2) states that "counts or frequencies are ... qualitative data" and that quantitative data are "obtained from measurable variables such as height, temperature, and so on".
[102] Also, note that one respondent from DFW did not respond to questions 9 and 10. Therefore, the number of respondents varies slightly between the first questions and the last questions.

frequencies: for the most part, firms located near the US cargo-based growth pole airports gave consistent answers regardless of geographic location within the USA.

A number of firm-classification questions were asked, but analysis of these responses is reserved for the comparison of the US airports with the Canadian case, YWG, later in this chapter.

To begin with, it is expected that the null hypothesis will prevail in each case. This portion of the analysis is anticipated to demonstrate that there is no significant difference between the three US airports. If the null hypothesis prevails, then the three US airports can be considered to represent one group. The alternative hypothesis is that there is a statistically significant difference between the three airports, indicating that they cannot represent the same group with any validity.

$\mathbf{H_0}$ = There is no significant difference between the airport-related firms near AFW, DFW and HSV.
$\mathbf{H_a}$ = There is a statistically significant difference between the airport-related firms near AFW, DFW and HSV.

For Phase 3 of the study to be valid, it is important that the three US airports truly represent one group, meaning that there should be no statistically significant difference between them. The statistical analysis, although flawed, should confirm that there is consistency among the US case studies. For each section of the statistical analysis, the detailed results are found in Appendix A.

The first question analyzed with chi-square is whether the company depends on airport operations. As is the case for all chi-square analyses in this study, the pre-selected significance level is 0.1 or 90 percent confidence, for which the critical *p*-value is 4.61 with two degrees of freedom. For this question, $\chi^2 = 3.597$, which is not statistically significant at the 0.1 level of confidence. In fact, even at the 0.15 level, the difference

between responses is likely attributable to chance. The null hypothesis is supported in this case, as expected.

The next question is in a similar vein, asking whether the firm could operate as it does today if it were not located near the airport, but still in its current city. There was very little variation in the responses between AFW, DFW and HSV for this question, yielding a χ^2 of 0.808, meaning that any difference between groups is almost certainly attributable to chance, and is not a true difference between the populations. Again, the result supports the null hypothesis, as expected.

There was similar agreement as to whether or not the respondent firms have expanded their operations. With $\chi^2 = 0.597$, again there is very little evidence supporting a real difference in the populations. For each airport, the average increase in area was over 100 percent.

Firms were also asked if their company could operate as it currently does if it were located in another city. The resulting χ^2 statistic for this question is 1.909, which is still insufficient to reject the null hypothesis at the 0.1 level. The next question was a follow-up, asking whether the company in question could operate as it does without a major airport in the city. The calculated χ^2 is 4.463, which is very close to the critical value for significance at the 0.1 level (4.61), but slightly below, rendering it non-statistically significant as well. Thus far, each question supports the null hypothesis.

Two further questions are used to demonstrate the commonalities of the US airports. In the first, which posed the question as to whether the airport has met the firm's expectations, there is complete unanimity for all airports that yes, the airport in question has met expectations. Therefore, no χ^2 value can be calculated, and is displayed as "#DIV/0!" in Appendix A. The final question has nearly the same unanimity with respect to the perception of any constraints to development at the relevant airport. Only one

respondent indicated any type of constraint at a US airport.[103] The χ^2 value is 2.456, not statistically significant at the 0.1 level.

None of the questions that could have shown differences between the three US airports did so, even with the relatively unrefined statistical analysis provided.[104] Despite the reservations incident to the method, it can be safely assumed that the three US airports do not differ significantly in their experiences and do, in fact, represent a single point of view, that of firms surrounding successful US cargo-based growth pole airports.

One additional test is performed prior to the main test comparing Canadian with US airports. It is possible that because two of the airports in this study are in the same metropolitan area (AFW and DFW), they may have a different set of experiences and responses as a group than the two airports which dominate their own hinterlands (HSV and YWG). This possibility should be explored, especially since AFW and DFW are located in a significantly larger metropolitan area than either HSV or YWG. The following test determines whether the Dallas-Fort Worth area, or a large urban centre in general, may lead to different responses than those associated with other, smaller locales.

5.3.3 – Phase 2: AFW + DFW vs. HSV + YWG

AFW and DFW are two components of the "multi-airport system" that serves the Dallas-Fort Worth market (de Neufville 1994). The null hypothesis again represents the outcome wherein there is no statistically significant difference between the responses of AFW and DFW compared with those provided by respondents near HSV and YWG. The alternative hypothesis is that AFW and DFW differ in their responses as a group from HSV and YWG. It is believed that the null hypothesis will be rejected in this scenario, indicating that either city size or the presence of two growth pole airports in the same city

[103] The specific constraint was that the required on-site retention ponds in the JetPlex Industrial Park in Huntsville cut back on available square footage for development and lessened available space for truck parking, not a major concern.

[104] Although none of the questions resulted in a finding of significance at the 0.1 level, two were, in fact, significant at the 0.25, 0.20 and 0.15 levels. However, this is the more likely source of error for a chi-square analysis with small expected frequencies. Mistakenly rejecting the null hypothesis is a Type I Error.

has a significant impact on cargo-based airport growth pole success. This relates to one of the key elements of growth poles, that there be a limit on the number of planned poles.

$\mathbf{H_0}$ = There is no significant difference between the airport-related firms near (AFW plus DFW) and those near (HSV plus YWG).
$\mathbf{H_a}$ = There is a statistically significant difference between the airport-related firms near (AFW plus DFW) and those near (HSV plus YWG).

The results are presented in Appendix A, and, for the most part, the null hypothesis is once again supported. Only two questions deserve in-depth examination here.[105]

First, the question regarding whether a firm could operate as it does today without a major airport in the city produced a moderately significant result, but not significant at the 0.1 level. The calculated χ^2 value is 1.591, with firms in the Dallas-Fort Worth Metroplex favouring the "no" response more than firms in Huntsville and Winnipeg. Although the difference is only significant at the 0.25 level, it may represent an underlying factor in terms of locational preference for firms. In particular, it likely applies mostly to firms that have established themselves in the area and would find it difficult to re-create their existing supply-chains and customer bases. Firms near HSV and YWG appear to feel slightly less dependent on localized characteristics. In Huntsville, this may be due to the relatively transient nature of some of the firms given their time-limited contracts with the federal government. In Winnipeg, the difference may simply be a reflection on the city's underdeveloped status as a growth pole airport. Firms have not attached themselves to any particular characteristics of the city. In any event, this difference should not be overstated, as it is not significant at the pre-selected level of significance.

Second, the question regarding any perceived constraints to development had a statistically significant difference, with a χ^2 value of 8.568, significant at the 0.1 level, the

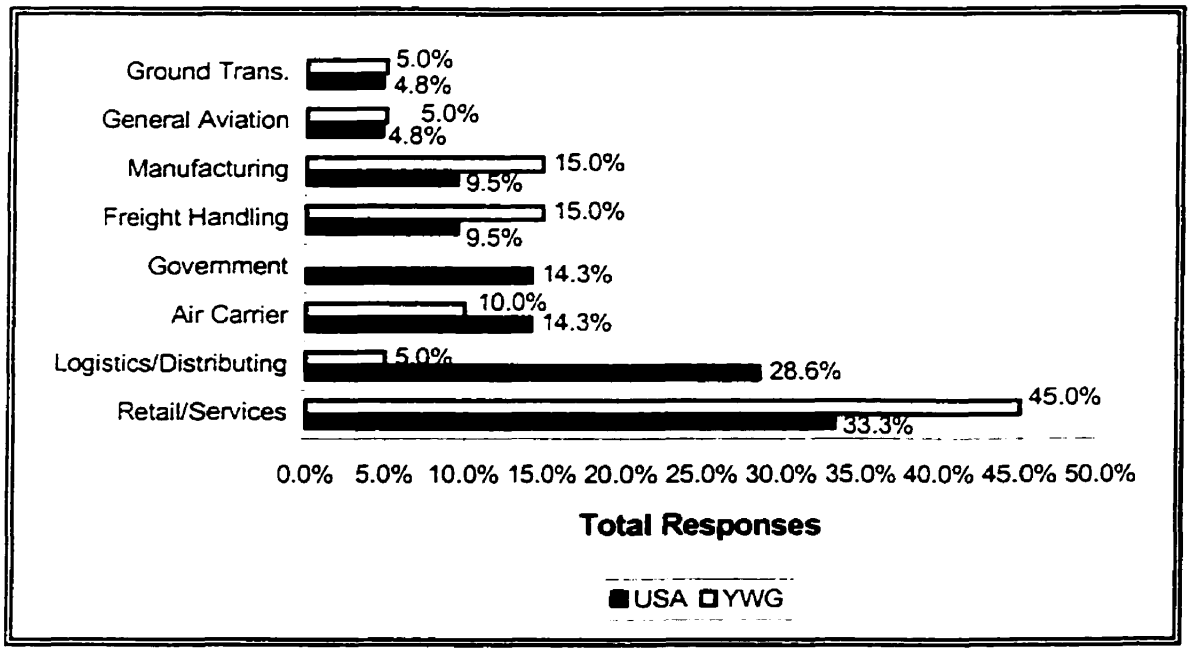
0.5 level and the 0.01 level. There can be no doubt that the result is statistically significant. However, this result is almost entirely due to the collective responses of the firms associated with YWG, rather than HSV. Therefore, analysis of this question is reserved for the next section. The next step is to analyze the US responses as a group compared with the responses received from Canadian firms.

5.3.4 – Phase 3: US Airports vs. Canadian Airport

This section goes into detail on the remaining questions of the questionnaire process, as it is the most important part of the statistical evidence supporting the hypotheses. First, some firm-classification questions can be assessed, comparing the three US cases with YWG. Responding firms represented a wide array of firm-types, ranging from air carriers to government agencies to a fire department. Over half of the US firms were categorized as either Retail Services or Logistics/Distribution. The Canadian firms represented a similar array of activities, displaying an even greater emphasis on Retail/Services firms, with a particular focus on aviation services within that subgroup. The overall distribution of firm types is displayed in Figure 5.1.

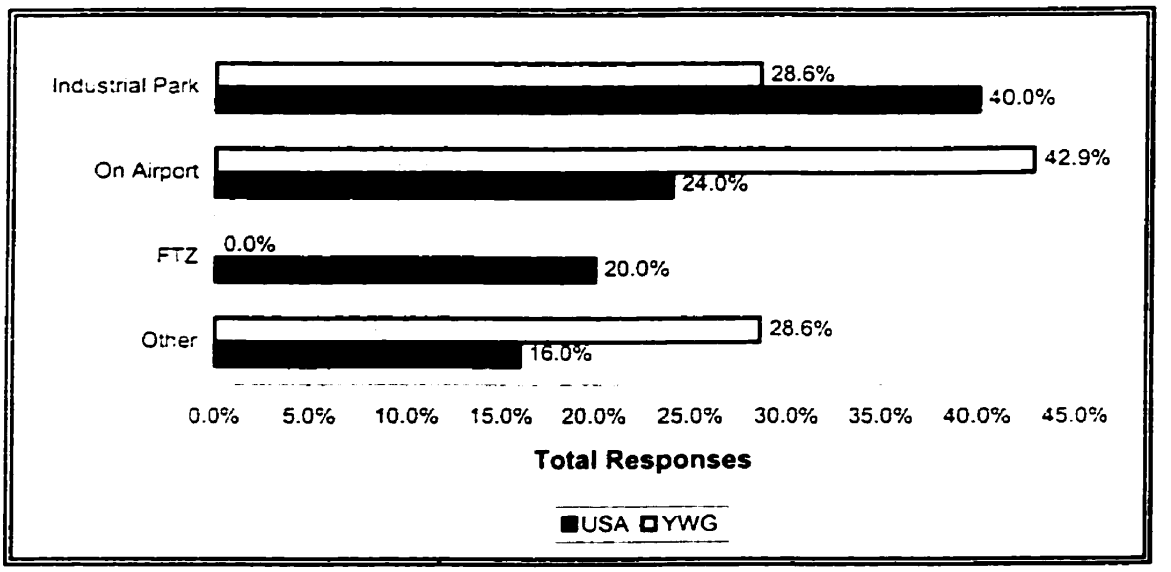
[105] However, it should also be noted that for each of the questions discussed below, there is one cell with an expected frequency of less than 5. But, especially for the second question, the difference can easily be noted by comparing the actual frequencies visually.

Figure 5.6 – US and Canadian Firms: Business Type



The setting of the firms did vary significantly between airports, but it is presumed that many respondents may have misinterpreted the question slightly. For example, at Alliance, it is known that all of the firms are located in one of the business/industrial parks on site, all of which is a FTZ, yet only one respondent confirmed that it was located in an industrial park and one more indicated that the firm was in a FTZ. In addition, for the Canadian firms, the response of "FTZ" was not applicable because such zones do not exist in Canada. The most frequent response for US firms was an industrial park location, with 40 percent of responses, followed by on-airport with 24 percent and FTZ with 20 percent. For Canadian firms, the most common setting was on-airport, with 42.9 percent of the responses. The next most common was an industrial park setting, with 28.6 percent of responses. The setting responses are displayed in Figure 5.7. It should be pointed out that firms could select more than one response and that the percentages reflect the total number of responses given, not the total number of respondents.[106]

Figure 5.7 – US and Canadian Firms: Physical Setting



There was a clear delineation between the US airports in terms of the year the firm was established, and the distance the firm is located from the airport. DFW, being the largest and most passenger-oriented, noticeably differs from AFW and HSV on both counts. Table 5.4 shows the average year of establishment for firms at the three US airports. At AFW, the average starting year is 1995, primarily because the airport itself did not exist until 1989. For DFW firms, on average, the first year of operations was in 1983, while for HSV, it was 1991. Overall, the average first year for US firms was approximately 1990 (1989.81). The average start-up year for Canadian firms was 1977, as shown in Table 5.4. In this regard, YWG resembles DFW more than either AFW or HSV, likely because it, too, is an older airport. The difference between years of the US airports makes comparing them with YWG less valuable. It can be concluded that the first year of operations sheds little light into the success of a growth pole, other than measuring how quickly it has attracted firms. However, this must be combined with a measurement of the total number of airport-related firms surrounding the airport in question. For example, AFW and HSV have been very successful over a short period of time (since the

[106] There are a total of twenty-five responses given by the twenty-one US firms, while each of the Canadian firms indicated only one response.

mid-1980s as a group), but neither has had as large an impact as DFW, although its growth pole nature has been spread over a period almost twice as long.

Table 5.4 – All Firms: Average First Year of Operations

Airport	Average First Year
AFW	*1995*
DFW	*1983*
HSV	*1991*
US TOTAL	1989.81
YWG	1977

Table 5.5 shows the average distance in miles and kilometres from the surveyed firms to the airport in question, and the average travelling time in minutes. Overall, there is very little difference is observed between the US airports as a group and Winnipeg. Again, DFW stands out with an average distance of 10.73 km (6.67 miles) and 11.33 minutes. The average distance for AFW firms is 0.40 km (0.25 miles) and 1.17 minutes. For HSV, the average distance is 1.61 km (1.00 miles) and 2.00 minutes. For the US firms as a group, the average distance is 5.02 km (3.12 miles) and 5.57 minutes. At YWG, the average distance is 3.7 km (2.3 miles) and 5.7 minutes. The differences across airports can be partially explained by the relative sizes of the four airports. Due to the immense land area taken up by DFW, it is logical that firms would have to be further away from the central areas of the airport. For example, a firm may be located 8 km from DFW's boundaries, but the respondent may indicate a distance of 15 km, considering only the distance between the firm and the passenger terminals or cargo areas. Again, the only conclusion that can be drawn from this information is that the more rapidly-developing growth poles tend to have firms closer to the airport. This characteristic does not appear to contribute to YWG's slower development, as its results are very comparable with those of the US airports as a group.

Table 5.5 – All Firms: Average Distance/Travelling Time from Airport

Airport	Kilometres	Miles	Minutes
AFW	*0.40*	*0.25*	*1.17*
DFW	*10.73*	*6.67*	*11.33*
HSV	*1.61*	*1.00*	*2.00*
US TOTAL	5.02	3.12	5.57
YWG	3.70	2.30	5.71

For the remainder of the statistical analysis, it is anticipated that the null hypothesis will be rejected, as in Phase 2, but unlike Phase 1. In other words, it is believed that there is a significant difference in the characteristics of the US airports by comparison with those of YWG, representing Canadian, non-growth pole airports. This is hypothesized to be the case for each question, although, in view of data limitations, it is very likely that some questions will result in the null hypothesis being supported.

For all questions, the hypotheses are as follows:

$\mathbf{H_0}$: There is no significant difference between the US airport-related firms and the Canadian airport-related firms.

$\mathbf{H_a}$: There is a statistically significant difference between the US airport-related firms and the Canadian airport-related firms.

Again, the full set of responses in tabular form is located in Appendix A, but the notable results are discussed here. The first question, asking if the company depends on airport operations, resulted in a statistically significant difference between the US and Canadian experiences. The Canadian firms were more likely to depend upon airport operations. The χ^2 value is calculated to be 2.763, which is marginally higher than the critical value for the 0.1 level of significance. The result is not significant at the 0.05 level. The resultant Cramer's V statistic is 0.281, which, when squared, indicates that only 7.89 percent of the difference between the populations can be attributed to this variable. Essentially, this result indicates that firms around YWG are more dependent upon airport operations than the firms at the US airports. This may seem confusing at first, given that the US airports are deemed to be more successful than YWG. However, upon closer

inspection, the result is logical. The US airports have, in fact, been more successful at attracting firms, indeed ones that do not need to be near an airport. Firms at YWG tend to be there because they have to be near an airport, at least to a greater degree than those around the US airports. If YWG becomes more of a growth pole airport, it is likely that this trend would be reversed, that more non-aviation-related firms would locate in the vicinity, as has occurred at AFW, DFW and HSV. Table 5.6 shows the observed and expected frequencies, the χ^2 statistic, the *p*-value, Cramer's V, and an interpretation of Cramer's V as an r^2 value, showing the measure of the relationship.

Table 5.6 – Statistical Analysis: Phase 3, Question 1

1	YES	NO	TOTAL
YWG	10	4	14
AFW+DFW+HSV	9	12	21
Total	19	16	35
Expected	**YES**	**NO**	**TOTAL**
YWG	7.60	6.40	14
AFW+DFW+HSV	11.40	9.60	21
Total	19	16	35
p-Value	0.0965		
Chi-Square	2.7632		
Cramer's V	0.2810		
r-squared	0.0789	7.89%	

The next question that warrants discussion is Question 9, which asks whether the airport in question has lived up to the firm's expectations. While the resultant χ^2 value is only 1.472, which is only significant at the 0.25 level of significance, this result cannot be deemed reliable due to extremely small expected frequencies. In two of the four contingency table cells, the expected value is not only less than 5, but less than 1. In fact, the results are skewed because of a single firm that indicated its dissatisfaction with its location. Therefore, this question should be ignored, despite the fact that the χ^2 value is moderately significant. It is safe to accept the null hypothesis.

The final question, which addresses perceived constraints to development at the various airports, is the most telling for this study. Firms at the US airports were nearly unanimous in indicating that there were no constraints to development. Only one US firm indicated any sort of constraint. For the Canadian firms, the case was very different,

as over half of the firms indicated some form of constraint to development. The resultant χ^2 value is 11.504, which is significant at the 0.1 level, the 0.05 level, the 0.01 level, and even the 0.001 level. With a Cramer's V statistic of 0.582, this variable has a strong correlation with the difference in the airports, explaining 33.83 percent of the difference. Although it was not expected that the other questions would support the null hypothesis, it is important that this particular question does not. It is this question that points out the key difference between the US airports and YWG. Despite the desires of local companies that may wish to expand, or companies from elsewhere that may wish to relocate to Winnipeg, impediments to doing so are beyond their control. Factors such as these influence the decision-making process for firms with respect to location, and, despite having some of the characteristics of a growth pole airport, most firms are choosing not to locate in Winnipeg. Table 5.7 shows the detailed statistical information for this question.

Table 5.7 – Statistical Analysis: Phase 3, Question 10

10	Y	N	T
YWG	8	6	14
AFW+DFW+HSV	1	19	20
Total	9	25	34
Expected	**Y**	**N**	**T**
YWG	3.71	10.29	14
AFW+DFW+HSV	5.29	14.71	20
Total	9	25	34
p-Value	0.0007		
Chi-Square	11.5035		
Cramer's V	0.5817		
r-squared	0.3383	33.83%	

The questions that did support the null hypothesis show that Winnipeg does have some characteristics in common with the growth pole airports in the USA, including company expansions, relative dependence on the city as a whole, and operations in relation to a major airport. However, until the constraints hampering development are addressed, the other factors will be fruitless in terms of attracting the critical mass of economic activity required for YWG to become a true growth pole airport.

5.4 – Lessons Learned for Winnipeg

The statistical analysis demonstrates what was already made evident from the qualitative responses given by the airport and planning respondents: Winnipeg presents a different situation from that obtaining at the US case studies. Although the responses for YWG did not differ significantly from those of AFW, DFW and HSV for several questions, two key questions did stand out as being significantly different, with one more being worthy of further investigation.

However, the most significant response related to constraints to development at YWG, an issue that was also alluded to by the airport and planning respondents. A number of constraints to development at YWG are not present at the US airports. Some of the anecdotal references to constraints are discussed earlier in this chapter.

However, Winnipeg – and YWG – has a number of advantages to its credit. Most of these are mentioned in Section 4.1.6, but Table 5.8 shows that Winnipeg has the lowest total annual operating cost for warehousing and distribution of any major city in Canada. Table 5.8 is based upon the same criteria as Table 4.1, which displayed the total operating costs for US cities.

Table 5.8 – Total Annual Operating Cost, Warehousing and Distribution, Selected Canadian Cities

Location	Total Annual Operating Costs (US$)
Winnipeg, MB	$17,316,000
Ottawa, ON	17,778,000
Mississauga, ON	18,074,000
Montreal, QC	18,165,000
Toronto, ON	18,432,000
Saskatoon, SK	18,929,000
Calgary, AB	19,852,000
Edmonton, AB	20,257,000
Halifax, NS	22,658,000
Vancouver, BC	23,114,000

Source: The Boyd Company 1999.

Savings of nearly US$6 million annually by relocating a distribution centre from Vancouver to Winnipeg, or US$2.5 million annually by relocating from Calgary, indicate that Winnipeg is the most efficient location for North American distribution from Canada. Such reductions in total costs would normally offset relocation costs within a few years, meaning that it should be possible to convince companies of the economic advantages associated with moving to Winnipeg. Some of the reasons for Winnipeg's low overall costs relate to lower than average labour costs, lower costs for land, and the abundance of major trucking firms headquartered in Manitoba.[107] Some of these factors were mentioned in passing by some survey respondents in Winnipeg.

The final chapter summarizes the findings of this study. It also assesses the results of the analysis with respect to growth pole theory and the relationship between transport infrastructure and regional economic development. Chapter 6 also revisits the quantitative, and especially the qualitative, analyses so as to make conclusions about the case-study airports and to make recommendations for YWG's bid to become a cargo-based growth pole airport.

[107] Manitoba is a net provider of transportation services, particularly trucking services. The relatively high number of trucking companies located in the province means that competition is healthy, which, in turn, leads to lower freight rates.

CHAPTER 6 – CONCLUSIONS AND RECOMMENDATIONS

6.1 – Meeting the Growth Pole Criteria

The cargo-based growth pole airports in this study fall into one of two categories. First, as is the case around DFW International Airport and around Winnipeg International Airport, there is the unplanned hinterland. Firms move into the area because they believe certain advantages exist for them near the airport. This process is more evident around DFW, by far the larger of the two. Second, there are planned hinterlands, such as those found at Alliance Airport and Huntsville International Airport. Especially in the case of Alliance, the entire process of firm immigration and location is carefully planned and managed.

Any planned airport hinterland should be one contiguous area (FAA 1965). This is important for several reasons, not the least of which is the applicability of foreign trade zone status in the United States.[108] While this is not an issue – at least geographically – in Canada, it is still advantageous to have one contiguous package of land developed as an airport business park. A single area eases zoning and transportation access, and limits the region's exposure to noise, truck traffic, road congestion and other side-effects of an airport business park. One contiguous area also eases the process of marketing the business park and provides shippers with the "one-stop-shopping" approach that is deemed to be valuable in Huntsville.

The three US case-study airports have been shown to have overall positive impacts on their respective regions. There may be dispute, however, as to whether AFW, DFW and HSV are growth poles. In Chapter 1, several factors were cited that are instrumental in engendering a successful airport growth pole. These factors were also said to measure the critical mass of a cargo-based growth pole airport. Each of them is now assessed with respect to the case-study airports. To recall, the factors were:

[108] However, subzones of existing FTZs can be set up at more remote manufacturing plants.

- expansion of airport-related companies;
- the value-added by airport-related manufacturing companies;
- employment generated by airport-related companies;
- cooperation between the airport, industry, and government (including incentives and abatements);
- the critical nature of a third transportation mode (rail or sea); and
- the take-off point for the airport growth pole.

The expansion of airport-related companies was equally prevalent in the USA as it was in Canada, according to the survey results. However, three firms – all in Winnipeg – indicated that they had undergone a decrease in size, rather than an increase. So, while the survey asked about expansion, it ignored the possibility of firms contracting. Other sources note that corporate expansions in Dallas-Fort Worth numbered almost 400 in 1995 (Smith 1996). The Huntsville area, as noted earlier in this thesis, regularly instances firms that experience changes in company size (and company turnover) as a result of the cyclical and short-term nature of government contracts that are so prevalent in the region. In Winnipeg, the strong aerospace industry has undergone relatively steady expansion compared with most other industries; a fact exemplified by Standard Aero's current patchwork of locations southeast of the airport. To conclude, the expansion of airport-related firms *is* a measure of the critical mass and *does* lead to a successful growth pole. However, the tendency of firms at YWG to contract rather than to expand indicates that YWG has not yet reached the critical mass.

Airport-related companies are frequently members of industries that focus on value-added activities. This is verified by considering the companies that surround each of the airports, as noted in Chapter 4. To mention just one at each of the US airports:

- Nokia manufactures mobile phones at AFW;
- Boeing manufactures rockets and air-defence systems at HSV; and
- NEC operates a production, engineering and marketing office at DFW.

YWG's aerospace industry only partially fulfils this measure. For example, Boeing and Bristol do some value-added manufacturing, but Standard Aero and Air Canada are more service-oriented, performing maintenance on engines and aircraft.

Each of the US airports in this study has generated employment for its respective region. For the most part, the development has not occurred at the expense of other parts of the metropolitan areas. Growth at Alliance has not hurt the economy of the rest of Dallas-Fort Worth. On the contrary, the growth at the airports only breeds more growth in the entire region, displaying the "trickle-down" effect discussed earlier in this thesis. In Huntsville, the airport development is one of several foci of employment in the region (along with downtown, Cummings Research Park and, increasingly, Madison), but it is one of the largest and one of the most important. In Winnipeg, the airport area is also a centre of employment, but certainly not as significant as it could be given the large tracts of land nearby. Development is slower at YWG than at AFW, DFW, and HSV. This was a point that was made clear by the airport and planning respondents. In addition, as pointed out by Loreth (1996), growth at YWG *has* taken place at the expense of other parts of the city. Most notably, growth has been somewhat retarded in St. Boniface and Transcona, despite the available land and infrastructure there. YWG lags behind the US airports in terms of this measure. To compare the three US airports, the generation of employment is the most clear (geographically speaking) at AFW and HSV. However, it is the largest, by far, at DFW.

To varying degrees, each of AFW, DFW and HSV has registered success in forging public-private partnerships. In each case, the initial investment in infrastructure was made, at least in part, by government organizations. At AFW, the public investment was considerably less than at either DFW or HSV in terms both of real dollars and the proportion of the total cost. AFW, therefore, has had a greater degree of public-private co-operation. DFW and HSV were funded in different manners. DFW was a process begun and funded by the federal government, while HSV was a local initiative that then secured regional development money from the federal government. In each of the US cases, governments and businesses work together to create an environment that is attractive for business, including the provision of incentives and abatements. In Winnipeg, the initial investment was also made by the government, as Transport Canada owned the airport until December 31, 1996. However, public-private co-operation has produced no significant, tangible business park development since Transport Canada

transferred responsibility to WAA. For instance, the Winnipeg Airport Lands Corporation was a partnership designed to market the land to the west of the airport, but, to date, has proved ineffectual. Although most of the organizations have the same ultimate goal of economic development, there is generally very little co-operation between private organizations – such as WAA, the aerospace industry or the air cargo carriers – and public organizations at the civic, rural municipality and provincial level. This shortcoming includes a complete lack of any co-ordinated plan for incentives and abatements for companies that may wish to locate near the airport. This issue is raised again later, since it is one of the most significant impediments to development in Winnipeg.

For AFW and HSV, the additional transportation mode offered by an intermodal container facility has had positive impacts on regional economic development, and has strengthened the attractive pull of each airport, confirming its standing as a growth pole. The previous chapter noted one response to the survey that indicated that the intermodal centre at AFW was as important as the airport in terms of attracting development. Because of its role as a major passenger hub, in addition to its role as a cargo centre, a third transport mode is not regarded as being of equal importance for DFW. YWG's size is more in line with AFW and HSV than DFW, and it follows that a new intermodal facility near any new intermodal business park would play a similar role as those currently existing at Alliance and Huntsville. Although it is mentioned in the YWG Master Plan, there is no specific plan for a new intermodal centre at YWG. Currently, CNR and CPR each operates its own intermodal facility in Winnipeg. The CNR facility is crowded and leads to traffic congestion where the rail line crosses Kenaston Boulevard and Waverley Street. Nevertheless, CNR has stated that relocating the facility would be too costly. At CP Rail's facility, there is some room for growth. However, a combined facility near YWG, operated by a third party, would offer Manitoba's international shipping community a number of advantages in addition to complementing the truck-air nature of an airport business park.[109]

[109] Although this section focuses on international container shipping, a combined intermodal facility would have positive impacts for domestic container shippers as well.

> Manitoba is a small and fragmented market. There are over two dozen freight forwarders and a handful of larger shippers that use a variety of marine carriers to access overseas markets. Because of market size, Manitoba shippers are discriminated against, in terms of "service commitment" and "rate incentives" by marine carriers. Ocean containers are essentially sold to the highest bidder (Crockatt 1998, p. 35).

The consortium operating the facility would have to be sizeable enough to be able to negotiate volume-discount rates from marine carriers (Crockatt 1998).

Besides its role at growth pole airports, intermodal traffic is the fastest growing segment of the rail industry (Pennington 1994; Master 1998). At AFW and HSV, the intermodal centres share the core of the development with the airports. At HSV, intermodal traffic is projected to triple between 1998 and 2008 (Infanger 1998), while at AFW, 30-40 percent of businesses make "significant use" of the BNSF intermodal facility (Master 1998). Synergy between transportation modes and carriers results in savings for manufacturers and distributors. Apart from the economic advantages it provides, intermodalism is also beneficial to the environment and has positive social impacts. For example, intermodalism reduces road congestion, fuel consumption, pollution and accidents, and can help serve as a solution to a shortage of long-haul truck drivers in North America (Master 1998). This issue is revisited again in the recommendations.

Each of the three US case-study airports has reached its critical mass. This is not to say that no effort is required to continue the growth and development of the airports and business parks; rather, it indicates that the facility does not have significant risk, and does not require investment without a greater degree of certainty in the results. In other words, until an airport development reaches its critical mass, the process is an uphill battle with risk. There must be a firm belief by the private and public sectors that the hard work will ultimately pay off and the risks will prove to be worthwhile. Furthermore, it requires a firm commitment in the form of financing and policy. Without long-term commitment, a government that initiates a growth pole policy is inviting wasted investment, for only a

development over a reasonable amount of time will enable the pole to reach the critical mass. This gestation could be a very long process, possibly ten years or more, often longer than a particular government's term of office. The investment could also be wasteful if a new government cancels the previous administration's programs. Although AFW has achieved success in a relatively short time frame, others have not. North Carolina Global TransPark has been developing since 1990, but has only experienced minimal growth (FAA 1991; North Carolina Global TransPark Authority, November 1999).

It is now opportune to pose the original question that was asked at the beginning of this study; namely,

How does a location reach the critical mass for a cargo-based growth pole airport?

The first key to reaching the critical mass for a cargo-based growth pole airport, and likely the most important, is appropriate airport infrastructure, including ground access and cargo facilities. Without adequate airside and groundside infrastructure, no airport can realistically expect to be a successful growth pole. One official at AFW considered the initial provision of infrastructure, in conjunction with the first few tenants, to be the critical mass (Garrison 1997). Regardless of the nature of the remaining critical-mass characteristics, none can be effective without the presence of infrastructure. The cargo infrastructure is important, as mentioned, but is useless without a healthy local air cargo market, something that is determined by other parts of the critical mass.

The local air cargo market is determined by the firms in a particular region – specifically, an airport's catchment area – that are users of air cargo. As discussed in Chapter 1, such firms typically produce or require goods that are high in value relative to weight, or deal with goods that are time-sensitive. An example of the former is Nokia at AFW, which manufactures valuable – but small – mobile telephones. The classic example of the latter is FedEx, with a sorting hub at AFW, but also having operations at DFW, HSV and YWG. FedEx moves packages with time-definite deadlines. Part of the critical mass is a

local air cargo market that is diverse enough to withstand fluctuations in any particular industry, and large enough to have a significant and constant demand for a variety of air cargo services, spawning competition by air cargo providers in the local market. This includes both the integrator market and heavier air cargo associated with wide-body passenger and freighter aircraft, a service clearly lacking at YWG, and a primary reason firms divert air cargo away from YWG (Thompson et al 1999).

It is possible that there is an actual number of firms, or a volume of air cargo that constitutes the minimum point beyond which an airport has reached the critical mass. However, it is likely that this value varies by airport. For instance, HSV has lower annual air cargo volumes than YWG, but in this study, HSV, unlike YWG, is considered to have the critical mass for a cargo-based airport growth pole. Having said that, HSV has higher *relative* cargo volumes than YWG; that is, the air cargo share of Huntsville's total regional economy is proportionally larger than Winnipeg's.[110] Therefore, it can be concluded that the air cargo market must be strong, steady, diverse and large relative to the market as a whole. The Winnipeg air cargo market is growing steadily, but owes much of that growth to integrator traffic, meaning that the diversity aspect – represented by heavy and outsized cargo – is not as well developed as it is in Dallas-Fort Worth (where some thirty cargo carriers fill every niche market) or Huntsville (where Airborne Express, CargoLux, FedEx, Emery and UPS can satisfy nearly every shipper's needs).

Other components of the critical mass include the environment in which the airport and business park operate. In this case, the term *environment* means the business environment, including locational advantages, tax implications, co-operation between relevant organizations, and ease of establishing a new location. This is the one area in which YWG most seriously lags behind its US counterparts. The interviews and surveys revealed a number of constraints at YWG, many of which are bureaucratic in nature rather than physical impediments to development. As the recommendations of this

[110] HSV's total cargo volume for 1998 was 44,825 tonnes, which, when compared with the city's population, equates to roughly one-third. YWG's most positive estimate for air cargo volumes in 1998 would be approximately 100,000 tonnes, which is less than one-sixth of the city's population. A better

chapter show, this is one area YWG needs to address in order for it to reach the critical mass preparatory to assuming the status of a growth pole airport.

What can be said with certainty is that the critical mass for a cargo-based airport growth pole is not easily quantifiable.

6.2 – Other Cities' Perspectives

A number of other cities, particularly in the mid-continent region of North America, are also contemplating airports and intermodal facilities in various combinations that are designed to spur economic development. A quick review of experiences in Kansas City, San Antonio, Monterrey, Kinston (North Carolina) and Newburgh/New Windsor (New York) show that Winnipeg is not alone in considering a multimodal transportation centre. The fact that other cities have moved forward should also encourage Winnipeg's decision-makers either to commit to the notion of funding infrastructure for an airport growth pole, or to abandon the idea altogether.

In Kansas City, MO, a former military base – Richards Gebaur Airport (RG) – is in the process of being converted into a major intermodal facility and International Trade Processing Center (ITPC)[111] to be served by Kansas City Southern Railroad (KCS). The airport has been used only for general aviation in recent years. However, Kansas City has another excellent GA and corporate airport in the heart of its downtown. The KCS facility will utilize the current RG runway as a truck driveway, the primary base for the railbed, and for stacking containers (personal communication with David Malecki; Bronstone et al 1999). There is a possibility that the Kansas City Aviation Department could construct a new runway to keep the aviation aspect of RG intact. However, it would remain a GA airport rather than trying to follow the examples of Alliance and

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estimate would be to compare the cargo volumes with the regional GDP. However, it was not possible to obtain GDP information on a city-by-city basis.

[111] A large share of the cost of establishing the International Trade Processing Center comes from the US federal government, an example of the US government's commitment to developing multimodal facilities.

Huntsville, by trying to attract air cargo services to complement the intermodal (rail and truck) freight movements.

San Antonio is also converting a military base – Kelly Air Force Base – into a multimodal transportation centre. The air infrastructure is already in place at Kelly, with plans to construct an intermodal facility. The effort in San Antonio is a fully-co-ordinated one, with co-operation from all government levels and local businesses. Local planners are lobbying for ITPC status for their city, just as they are in Kansas City. Given its proximity to Mexico, a new multimodal transportation centre in San Antonio could become the major US gateway fuelling multimodal trade between the US and Mexico. San Antonio is trying to capture some of the traffic currently switching modes at Laredo. As an ITPC, cargo could clear customs in San Antonio (or Kansas City or Alliance as the case may be), and avoid long delays at the US/Mexico border. San Antonio, Kansas City, Alliance, Oklahoma City and Des Moines are in competition to be awarded ITPC status by the US federal government (Bronstone et al. 1999).

In Monterrey, Mexico, a state-of-the-art, privately-operated intermodal facility is to be located adjacent to the city's all-cargo airport. Again, there are few synergies between air and rail operations, but having the one-stop-shopping approach is attractive to shippers and companies alike. The extent of economic development surrounding Monterrey's new facility is yet to be determined, but it has been noted as one potential model for a new intermodal facility in Winnipeg (St. Arnaud 1999).[112] The Monterrey facility is adjacent to the NAFTA "Mexico-Laredo" highway (No. 57) and two major railways, further exemplifying the importance of infrastructure, and the consolidation of transport modes.

The North Carolina Global TransPark has been mentioned already in this thesis, but it is appropriate to reintroduce it here. The location, Kinston, NC, was chosen because of its access to two rail carriers, two Interstate highways, two deepwater ports, existing industrial utilities, FTZ status, US Customs and the airport (Pennington 1994).

[112] For more on the situations in Kansas City, San Antonio and recent efforts for a new intermodal facility in Minneapolis-St. Paul, see Bronstone et al. (1999).

Another airport that has undergone efforts in the 1990s to garner cargo activity and regional development is Stewart International Airport in Newburgh/New Windsor, New York. Like RG in Kansas City and Kelly in San Antonio, the airport is a converted military base that has received well over US$100 million in government investment in the late 1980s and early 1990s (FAA 1991). Some economic development has occurred, with the nearby location of firms like Anheuser-Busch, American Express, Cessna and cargo carriers including FedEx, Airborne, Emery, the United States Postal Service, and also the United States Department of Agriculture (FAA 1991).

While this study shows that it is important to invest in infrastructure in order to effect regional economic development, the cases of Kansas City, San Antonio, Kinston and Stewart demonstrate that it is also important to take advantage of existing infrastructure before investing in new infrastructure. This is another lesson that Winnipeg should consider in any planning efforts. However, other locations have reiterated the overall importance of infrastructure to attracting economic development in their respective regions. In each case above, the one common goal was to attract more transportation activity and economic development to the community, and the one common instrument for doing so was the provision of infrastructure. Another note on this section is that the above multimodal facilities are relatively new and still warrant further study to determine their impacts – or potential impacts – on regional economic development.

6.3 – Hypotheses Revisited

A set of hypotheses was laid out in Chapter 1. In this final chapter, it is appropriate to assess the accuracy of the hypotheses. To analyze them, each hypothesis is restated below, followed immediately by a discussion coloured by the results of this study.

6.3.1 – Hypothesis 1

> *Firms will only locate adjacent to a particular airport if the necessary infrastructure is provided and if that location does not put the firm at a competitive disadvantage compared with other firms in the region in the same industry. Infrastructure includes road access, municipal services, and airside taxiways and aprons immediately adjacent to the cargo-based businesses.*

A proportion of the firms surveyed (78.6 percent in Winnipeg and 57.1 percent in the USA) indicated that their airport location was selected at least partly because of the provision of air, rail or highway infrastructure. For the particular case of AFW, the initial public outlay of US$138 million has easily been justified. Not only has the private sector contributed nearly US$4 billion to develop Alliance, but the public coffers have been replenished many times over by tax revenues deriving from companies near AFW. As noted in Chapters 4 and 5, the same can be said for HSV. Since the initial outlay of capital by the various levels and institutions of government, the income to the miscellaneous government agencies through user fees and taxes has easily justified the cost. In terms of locational decision-making, most firms would select a site with infrastructure in place ahead of one without infrastructure.

Hypothesis 1 is **accepted** on the grounds that public (and private) investment in infrastructure has played an important role in attracting development at the case-study airports.

6.3.2 – Hypothesis 2

> *An airport authority must offer more than just available land and infrastructure in order to attract firms. Incentives and abatements are part of doing business in a competitive environment.*

While only a few firms (14.3 percent in total) indicated that their locational decision was based on incentives or tax abatements, it is apparent that the latter do play an important role. The literature reviewed in previous chapters supports this and airport officials also acknowledge the important role abatements and incentives play in attracting firms to airport business parks: "We have the momentum... and a long list of other incentives" (Mike Berry of Hillwood Development Corporation, quoted in Garrison 1997, p. 4). Rodda (1998, p. 43) noted that Intel was lured to Alliance, rather than locating at other, more traditional "high-tech centres", because of "huge tax abatements". Similarly, Galaxy Aerospace chose the AFW location over other locations in the Dallas-Fort Worth area partly because of tax abatements, including job training, financing, relocation costs and construction of facilities (Garrison and Allen 1997).[113]

The best example of how abatements aid development is to consider supply-chains that develop near airports. Nokia, which operates the world's most productive mobile phone manufacturing facility at Alliance, was given a significant tax abatement to locate there (Hillwood Development Corporation, February 2000). Nokia was exempted from paying some property taxes, but still paid a payroll tax, to say nothing of the state taxes on the goods and services that it purchased (besides which, its employees all paid income tax). Although it was likely a good investment just considering the costs and benefits associated with Nokia, the positive impact does not end there. Perlos and Nolato, both plastics companies that act as suppliers to Nokia, have located at Alliance as well, in

[113] Galaxy Aerospace is a subsidiary of Israel Aircraft Industries Ltd. Galaxy manufactures build-to-suit business jets.

order to be as geographically close to their main customer as possible. The Finnish company Perlos and Swedish Nolato did not receive any incentives or abatements to influence their decisions; therefore they both pay full taxes and employ hundreds, creating even more value out of the original incentive plan offered to Nokia (Hillwood Development Corporation, February 2000). In September 1999, Savcor Coatings, another Finnish supplier to Perlos and Nolato, leased space at Alliance, showing that the supply-chain development can continue beyond the first level.[114] A similar situation exists at HSV, where the government's role includes not only incentive and abatement packages, but also a major presence in the forms of NASA and the Army. The supply-chains are well established for both governmental and business linkages. At DFW, the linkages are so interconnected that it is nearly impossible to trace them effectively.

Hypothesis 2 is **accepted** because this study has found that incentives and abatements do play an important role in attracting firms and, subsequently, attracting suppliers to those firms. However, incentive programs must be only one component of a larger strategy.

6.3.3 – Hypothesis 3

> *Having a major anchor tenant is crucial. It is vital to identify that first major firm that is willing to move away from the rest and choose a new location. Part of the importance of the anchor tenant is brand-name recognition. A well-known company moving to a particular airport location will help convince other firms that it is a good strategic location.*

The anchor tenant does not appear to be as important for DFW or HSV as it is, or was, for AFW. American Airlines is the unanimous choice as the anchor tenant at AFW, and is credited with playing a very important role in attracting other firms. At DFW, no

[114] Alliance also is the site of a significant aerospace supply-chain. Recaro, which manufactures seats for American Airlines, and Questron, which is a parts supplier for Galaxy Aerospace and Recaro, have both

major anchor tenant was singled out by any respondent. Perhaps because its focus is primarily on passengers, economic development around DFW has not received the same scrutiny and consideration as its counterparts in this study. At HSV, several respondents identified Onan as the original anchor tenant. However, this organization was probably not as important to HSV as American Airlines is to AFW, considering the fact that Onan no longer has operations in Huntsville. The true anchors to economic development in Huntsville – at the airport, in Cummings Research Park, and every other technological area in the region – are the Marshall Space Flight Center and Redstone Arsenal. In Winnipeg, the notion of an anchor tenant was noted by some respondents as an important instrument for attracting other companies, indicating a belief that one major industrial firm in the area west of the airport could spur significant development. Three respondents in the airport authority or local planner surveys for Winnipeg identified Standard Aero as a potential anchor tenant for a Winnipeg airport business park. Standard Aero is considered in more detail in the Recommendations section of this chapter, under the heading Recommendation 4.

However, the importance of the anchor tenant may have been overstated. Rather than an individual firm, it is an anchor *industry* that is the key to success. The anchor industry is representative of the "propulsive industry" as noted throughout growth pole literature. If the case studies are considered, the propulsive, or anchor, industries become evident. At AFW, it is distribution companies that make up the largest proportion of the tenants. Despite the fact that American Airlines is not a distribution company at AFW, the majority of firms there – the ones driving the growth – are warehousing and distribution companies. At DFW, it is aviation-related industries that are the most important, although they are spread throughout the Metroplex. At HSV, it is electronics and technology-intensive companies that represent the propulsive industry. In Winnipeg, as alluded to previously, it is the aerospace industry that appears to be the best candidate for propulsive industry or anchor industry status. This notion leads directly into the next hypothesis.

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located at AFW because of the supply-chain agglomeration advantages they perceive.

Hypothesis 3 is **partially accepted** but amended to address the notion of a propulsive industry, rather than being limited to an anchor tenant.

6.3.4 – Hypothesis 4

> *Any airport authority may model itself after other communities, but the type of firm attracted should complement the existing strengths of the region.*

Winnipeg's strengths are diverse, as noted in Chapter 3, but some of its key growth industries are aerospace, trucking and, more recently, air cargo. Therefore, if this hypothesis is found to hold true, Winnipeg is best served by trying to expand its aerospace industry, its distribution industry and its air cargo industry. DFW has traditionally enjoyed strong and healthy aviation and distribution communities, characteristics that are exploited by DFW and AFW. Huntsville has been a strong technology centre since the end of World War II, and its airport business park reflects that tradition as well.

Hypothesis 4 is **accepted** based on the experiences of the case-study airports. Each has used its community's traditional strength industries to help develop its airport business park.

6.3.5 – Hypothesis 5

> *The more transport modes located at an airport, the better its chances of being a successful growth pole. Specifically, high-quality highway connections and a rail container terminal are important components of an airport growth pole. Marine infrastructure could also provide an airport with an advantage. It is not included in this study because none of the airports considered is on a coast.*

This issue has already been addressed in this chapter. Rail infrastructure brings an added dimension that attracts more companies and enables local shippers to access one-stop-shopping for their transportation needs and can directly lead to lower rates. Although the focus has been on air-road-rail infrastructure, some North American airports – namely Seattle, San Francisco and Los Angeles – have been handling sea-air cargo in the Asia-Pacific market for years (Taneja 1994). For the case of Winnipeg, a seaport is an impossibility, so an intermodal rail facility is the best fit.

Hypothesis 5 is **accepted**, based on the multimodal success of AFW and HSV, particularly in terms of being able to attract companies that use air, rail and highway transportation in any combination.

The hypotheses can be considered to be conclusions for this study, especially because they have all been accepted, at least partially. However, during the course of this study, other conclusions have been drawn, leading to a set of recommendations. These recommendations constitute the next section.

6.4 – Recommendations

The following six recommendations are based on the findings of this study. They do not pretend to be all-encompassing, but they do present a coherent package for effecting regional development. The fact remains that if these recommendations were to be implemented in the short-term, YWG would stand a better chance of becoming a cargo-based growth pole airport than it currently does.

I. Creation of a Planning Authority

Planning for an airport business park is difficult in Winnipeg. There are many organizations – both public and private – that claim stakes in the process of development. The land in question lies on the airport grounds, in the City of Winnipeg and in the RM

of Rosser. Which of these organizations, if any, should be responsible for the planning and funding of infrastructure for an airport business park? The answer is that all of them, in co-operation with the provincial and federal governments, should be sharing the planning responsibilities and splitting the cost of infrastructure. Unfortunately, this arrangement has not worked adequately to date. No significant development has occurred. Part of the reason is the lack of a single, effective planning organization for lands that are both on and off the airport site.

> *WAA should take the lead in creating an airport planning authority (referred to in the remainder of this chapter as the Winnipeg Airport Planning Authority), which would have control of the land (including reserve lands). The authority should be given the power to offer incentive programs (therefore it should have city and provincial representation) to qualified firms, with the ultimate goal of promoting regional economic development through the development of airport land. The authority must have a sizeable budget funded by the federal, provincial, city and municipal governments and by WAA. In return, tax revenues generated on the land should be split between those organizations and the planning authority, and should be earmarked for reinvestment.*[115]

[115] In 1995, the San Antonio Initial Base Adjustment Strategy Committee recommended that an airport development authority must be able to purchase, own, manage, lease and sell property; have access to capital; attract businesses that are planning to relocate to San Antonio, either with its own incentives or in coordination with other governmental agencies; and own and operate businesses so that it could, in the long-term, be able to enter into joint ventures. The development authority was eventually embodied in the Greater Kelly Development Corporation.

II. Airside Infrastructure

Winnipeg International Airport has adequate runway capacity for its projected traffic growth well beyond the 2020 planning horizon of its current Master Plan. WAA has also planned for the addition of a parallel 13-31 runway when traffic volumes dictate that it is necessary. The network of taxiways is satisfactory for current levels of activity as well. However, the current cargo area to the southeast of the terminal is becoming overcrowded, with tenants clamouring for apron space during the busy overnight hours. Unfortunately, expansion space is at a premium in this area as the adjacent land is occupied by regional passenger airlines (e.g. Perimeter Airlines, Ministic Air) and non-airport users (e.g. Western Canada Aviation Museum). This land is the location of choice for the Integrators for it is the closest airport land to downtown. Being on the west side of the airfield puts integrators at a disadvantage. However, the west side would be ideal for heavier cargo operations, which are not as time-sensitive as the integrators' operations. Before investing in new airside infrastructure, including the possible relocation of cargo companies, the Winnipeg Airport Planning Authority should make the best use of existing infrastructure by converting land from marginal uses (like the Aviation Museum) to the optimal land use for that location.

> *The Winnipeg Airport Planning Authority must ensure that there is sufficient airport land available for cargo and courier operations. The southeast area of the airport should be reserved for the current integrator tenants. The smaller regional passenger airlines should be consolidated in a regional passenger terminal so that more space can be devoted to integrator airlines. Heavy cargo operations should be developed on the west side of the airport, near the Winnport facility and the Air Canada Maintenance Facility. Any initial investment in infrastructure should come from the planning authority's start-up budget.*

III. Groundside Infrastructure

HSV is lobbying to have the Memphis-Atlanta highway routed through Huntsville. In all likelihood, this will be the case. The three-digit-interstate (I-565) is inimical to the attraction of firms and the city has no real east-west access. AFW and DFW are both flanked by major Interstate Highways, and are working towards improving the quality of the highway that connects the two airports (State Highway 114). On a micro-level, all the US airports offer high-speed, limited-access freeways that link with the downtown and other business centres in each city. Winnipeg, on the other hand, has no direct route to downtown, and many of the airport routes are two-lane or three-lane arterials, hindered by a multitude of traffic lights and even stop signs (like on Berry Street and Ferry Road). The current groundside infrastructure does not lend itself well to passengers, in terms of access to the terminal, or to cargo, in terms of direct access to downtown for couriers and to major highways for distribution on a larger scale. On the west side of the airport there is currently very little serviced land. Therefore, municipal infrastructure must also be incorporated into any groundside investment strategy.

> *The Winnipeg Airport Planning Authority should lobby for freeway status for Highway 75 and Highway 1 to improve the city's image to foreign investors. Having those routes displayed as freeways on a map will enhance the image of Winnipeg's distribution opportunities. The Winnipeg Airport Planning Authority should also lobby for funding for a more direct route linking YWG with downtown Winnipeg, replacing the scattered routing options that currently exist. Finally, the planning authority should ensure that the expansion of municipal services is always well in advance of the expansion of the airport business park land.*

IV. Creating the Right Environment

Planners must ensure that the necessary tools are available to make any project work. Incentives are necessary to attract major firms and major firms are necessary to attract other firms. In addition, it is important to attract major firms as opposed to just any firm that wishes to locate near the airport. Well-known firms offer brand-name recognition that can influence the locational decisions made by other firms.[116]

Incentives alone are not enough to drive decision-making by firms, but they are an essential part of the process, particularly for the US case studies. Loreth (1996, p. 14) argues that "property tax reductions designed to influence the location of industrial development inside Winnipeg would be an ineffective economic development policy". His statement may be true in that property tax reductions may not be enough. They may have to be offered in conjunction with such incentives as free or very inexpensive land, reduced municipal service rates, job-training programs, and other types of reduced or deferred taxes. The right environment is not limited to offering incentives; it also includes other attractive features, such as the creation of a foreign trade zone. This is also why a planning authority is necessary. If the city were giving away land and receiving no tax revenue from it, the city would not be able to justify the investment, since the only governments receiving tax revenues from activities on that land would be at the provincial and federal level. Therefore, a tax-sharing scheme is a necessity.

Creating the suitable environment also requires a consistent effort at public and private co-operation to ensure competitiveness in industrial site selection.[117] Other components of this step to development include establishing a high standard of living for workers,

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[116] An example of the advantages of brand-name recognition is the airport terminal hotel in Huntsville. When it was called the Skycenter Hotel, it barely broke even during its years of operation. In the mid-1990s, it became a Sheraton Four Points Hotel, and ever since has enjoyed high occupancy rates in large part because it is attractive to business travellers who are loyal to that particular chain, or prefer to stay at a hotel with a recognizable name. Sheraton Four Points can be associated with an expected level of service and amenities. For these very reasons, WAA also chose Sheraton Four Points to operate the terminal hotel at YWG.

[117] This co-operation is not always fully regional (for example, Love Field vs. DFW vs. Alliance). It may be necessary to compete within one city for public and private support.

having affordable housing with appropriate amenities, and, above all, creating a "win-win" situation that meets the needs of the airport, businesses and the community.

> *The City of Winnipeg, the Province of Manitoba, the RM of Rosser and WAA, under the umbrella of the Winnipeg Airport Planning Authority, should devise a comprehensive plan of tax exemptions, tax abatements, and other financial incentives to attract major, brand-name firms, but should not offer the same incentives to smaller support firms. The program should include an initial assessment phase, during which the ultimate costs and benefits to the community are weighed, with only those projects that are most beneficial being approved. The plan should also incorporate an annual or semi-annual review to ensure that the benefiting companies are meeting all conditions of the incentives.*

V. Identify and Focus on the Propulsive Industry/Anchor Tenant

American Airlines gave AFW the credibility it needed to attract other firms. Without American Airlines, respondents to the survey indicated that AFW would likely be years behind its current success. As mentioned in the previous section, the aerospace industry may be the best nominee as the propulsive industry for a Winnipeg airport business park. Specifically, Standard Aero would be an appropriate candidate in that the company values its current airport location, uses some air freight, and some company employees travel frequently. In addition, Standard Aero is a Winnipeg-based company that conducts business worldwide and is a major employer in the region, meaning that it is clearly in the best interests of the city and province to ensure that the company is satisfied with its situation in Winnipeg.[118] Currently, the company operates out of several small buildings southeast of the airport. However, Standard Aero has also indicated that it is not willing to consolidate its operations and relocate to the west side of the airport owing to the large

[118] However, Standard Aero is ultimately owned by UK interests (Dunlop Standard Aerospace Group).

investments that have been made in the current facilities. Therefore, if Standard Aero is to be the anchor tenant that some respondents have suggested it could be, Recommendation 2 will have to be in effect as well: Standard Aero would need to be compensated for consolidating and relocating to a new business park.

However, there are other paths that could be followed by planners. A solid base of warehousing and distribution businesses should be established, as has been the case at AFW and DFW. As these businesses expand, more tend to be attracted to the area. Part of the effort devoted to attracting these firms should be an aggressive and focused marketing plan, which addresses the issue of Winnipeg's strategic advantages for distribution. Another option is to stress the continued development of Winnipeg as an air cargo hub. Purolator and FedEx already have substantial investments at YWG, UPS is increasing its level of activity, and Winnport is resuming operations. Given these facts, it would not be surprising if more air cargo companies soon find Winnipeg to be an excellent location for the expansion of their own business.

There is every reason to maintain that the promotion of a Winnipeg Airport Business Park should focus on the aerospace industry, the warehousing and distribution industry, and the air cargo industry.

> *The Winnipeg Airport Planning Authority should identify one or more propulsive industries around which development of an airport business park can grow. It is important that the propulsive industry has the strong potential to attract more firms and positively influence regional economic development. The three best candidates for status as propulsive industries in Winnipeg are:*
>
> - *the aerospace industry (led by Standard Aero, Bristol Aerospace, Boeing Canada, and Air Canada),*
> - *the warehousing and distribution industry (led by some of Canada's largest trucking and distribution*

companies, like Kleysen, Paul's Hauling, Bison Transport, Arnold Brothers, TransX, and Direct Integrated Transportation), and

- *the air cargo industry, led by companies that have made significant investments in their facilities in Winnipeg, like Purolator, FedEx and Winnport.*

VI. Promotion of Full Multimodalism

An earlier section of this chapter provided a comprehensive examination of the benefits of adding a third transportation mode to a cargo-based growth pole airport. It is clear that economic development could be enhanced with such a facility near YWG. If the Winnipeg Airport Planning Authority, assuming it were endowed with a large enough budget, were to build and operate the facility, with contracts with the railways, revenues from the facility could be returned to WAA for reinvestment in the airport and the business park. Private investment from WAA could potentially leverage some government funding (as with the ARC and EDA at HSV and the many levels of government that helped construct facilities at AFW and DFW). The Winnipeg Airport Planning Authority could provide land within its jurisdiction for an intermodal facility.

It is important to foster the development of YWG not just as an airport, but as a full transportation centre. Attracting firms requires the planning authority to market the truck and rail connections as much as the air cargo services, or as one survey respondent from Fort Worth called it, an "air-rail-road Gateway". Many firms will be attracted by other modes of transport to stress the facility's role as more than air cargo. Chapter 5 noted that at AFW, the BNSF intermodal facility to be as important as the airport for attracting business.

The Winnipeg Airport Planning Authority and/or WAA should be the leaders in creating a consortium of private

and public investors to build an intermodal facility on airport land to the west of the airfield.

At YWG, the critical mass can be reached. The few major firms may not seem like a critical mass at first, but suppliers for the major firms tend to locate very close to their main customers. The concentration of firms continues to build upon itself, as the growth pole airport becomes a success. Therefore, efforts must be focused on the long term in addition to the immediate need to enhance infrastructure and attract development. A long-range planning horizon is vital for continued development and success.

The recommendations laid down in this chapter come with no guarantees, but they are inspired by the experiences at successful centres, and have been essential ingredients to their success. However, implementing the recommendations also requires sufficient will and energy, and large amounts of stamina. The success of the case studies in this thesis cannot be replicated everywhere, but Winnipeg has been found to have many similar traits and could, given the right leadership and environment, be a successful cargo-based growth pole airport.

6.5 – Summary and Conclusion

No major company has been willing to be the first to initiate an airport business park on the west side of YWG. Some survey respondents indicated the belief that no significant development will ever occur there. A WAA respondent indicated that at least one courier firm did not wish to locate on the west side of the airport because it believed it would be at a competitive disadvantage. Its competitors were all on the east side of the airport, closer to the central business district. Other survey respondents were more optimistic, indicating that before a major company will invest in their own facility, some investment must be made to improve the quality of infrastructure in the area. Adequate roads, railways and municipal infrastructure could then aid in attracting the first key tenants, including a member of YWG's propulsive industry, possibly playing the role of anchor tenant. However, it is important that the infrastructure be incorporated into a

comprehensive plan. "Transport infrastructure must be an integrated system, not isolated components" (Department of Transport, Western Australia 1999, p. 4).

Which is the more accurate view? What are the chances of a significant cargo-based airport growth pole at YWG? Currently little evidence supports the belief that there will be a growth pole development there. While Winnport's initial demise was not the result of its location, it certainly did not act as the catalyst it was expected to be upon its inception. On the other hand, integrators are expanding their traffic at YWG, suggesting that, in terms of air cargo, Winnipeg clearly has an important role to play.

Infrastructure is the first and most important cornerstone for developing a cargo-based growth pole airport. Not only do air cargo carriers require adequate airside infrastructure, but firms require transportation and municipal infrastructure as well. Development will not occur unless the supply of land – including infrastructure provision – meets the requirements of industry; a point stressed by Loreth (1996). He goes on to state that, since the City of Winnipeg,

> as a municipal government, specializes in land-use management and the construction of transportation, sewer and water infrastructure, the most effective use of municipal tax dollars for the purpose of economic development relates to the construction of public infrastructure in strategic locations (Loreth 1996, p. 12).

As an addendum to Loreth's comments, this study finds that a critical aspect of the factor encapsulated in the expression, "supply of land – including infrastructure provision", consists in creating an environment in which firms know they are wanted in the community. Moreover, these firms must be convinced that the community will assemble an attractive package of land, infrastructure and financial incentives. In short, this thesis reaffirms Loreth's policy implication opinion, but the fact remains that little has been accomplished four years after Loreth's recommendations. It is hoped that the same fate does not await the recommendations in this thesis.

One of Winnipeg's local planning respondents summarized the problem facing development at YWG by asking the question: "Who will invest in the infrastructure?". He further elaborated by comparing the dilemma to the Chicken-and-Egg syndrome. In other words, how can development occur without infrastructure; but why should one invest in infrastructure if there is no development?

It also must be allowed that neither the City of Winnipeg nor the Province of Manitoba is willing to make large investments in infrastructure for a project with a questionable future. Furthermore, it is worth recalling that the growth-pole investments in Dallas-Fort Worth and Huntsville were not made solely by the city and state governments. These two statements bear on each other; they also point to an important consideration.

Putting DFW aside for the moment because its origins stem from the pressing need for a new major passenger airport, the other two American cases, AFW and HSV, shared a common trait; namely, a champion for the cause. The development at AFW would surely be on a much smaller scale today were it not for the involvement of the Perot family, particularly Ross Perot, Jr. and his Hillwood Development Corporation. In all likelihood, AFW would have been similar to the dozens of other small, underutilized general aviation airports in North Texas. Similarly, HSV received some funding from the city and state governments, but major investments were also made via federal regional development programs, as discussed earlier in this thesis. The grants were secured through the lobbying efforts of Ed Mitchell, who is unanimously credited with much of the economic development surrounding HSV.

While an entrepreneurial champion is not a traditional component of growth pole theory, perhaps such a leader is indispensable for cargo-based airport growth poles. Explicit provision needs to be made for a leader who can guide the development and planning process through the financial hurdles associated with the startup phase of development. This is the case for North Carolina's Global TransPark. That project has the unequivocal support of the state's Governor, Jim Hunt, who is also the Chairman of the North Carolina Global TransPark Authority (North Carolina Global TransPark Authority,

December 1999). Governor Hunt played an important role in providing state funding for the project, but also helped to secure funding from the FAA for the lengthening of the airport's runway. It is possible that Winnipeg's future could be aided by the presence of a leader with either "deep pockets" or the ability to secure government funding for infrastructure projects. Some of the names mentioned for this role include philanthropists such as Izzy Asper or the Richardson family, or visionaries such as Sam Katz.

In any event, success in Winnipeg is dependent on investment. Part of that investment will likely have to be privately based, either philanthropically or through WAA. It *must* be complemented by investment from all three levels of government (as was the case in the US instances). The federal government has made a commitment to improve Canada's infrastructure in a matching-funds program. Therefore, the province would have to invest in order to ensure federal funding. Furthermore, part of the land designated for an airport business park lies outside the City of Winnipeg, necessitating the province's involvement. The Province can either help the City of Winnipeg and the RM of Rosser reach a land-use and taxation agreement, or create a special planning and taxation jurisdiction (as recommended in the formation of the Winnipeg Airport Planning Authority), or annex a portion of the RM of Rosser into the City of Winnipeg. Finally, the civic government's responsibility should lie with providing the municipal infrastructure (i.e. sewer, water and drainage). Regardless of the exact funding breakdown (for example, 25 percent from each of the private sector, federal government, provincial government and civic government), the initial investment will be measured in the hundreds of millions of dollars. A small "test investment" or pilot project will not be adequate to put YWG in a position to become a successful cargo-based airport growth pole. A major investment is required for municipal, ground transportation, rail and airfield infrastructure in order to give such a project a realistic chance of succeeding. If success is achieved, the spatial structure of employment and population within the region would be expected to change, as predicted by growth pole theory in Chapters 1 and 2.

In the United States – at least in the case studies examined in this thesis – public and/or private investment in transport infrastructure has preceded economic development. At

each of AFW, DFW and HSV, a commitment was made to fund infrastructure on the belief that the benefits – the expected economic development – would outweigh the costs associated with providing that infrastructure. In each case, that belief held true, for all three airports contribute significantly to their respective regional economies.[119] In terms of a simple cost-benefit analysis, the benefits have, as predicted, surpassed the costs.

In Winnipeg – which may or may not accurately represent all of Canada – decision-makers seem more prone to waiting for economic development to occur before committing to invest in infrastructure. If anything can be learned from the US case studies, it is that the investment, whether public or private, needs to be made in infrastructure before the economic development will occur. Chapter 2 outlined the permissive role that infrastructure has in terms of development. It may not directly cause economic development, but it is certainly a prerequisite. The case studies show that this is true in practice as well as in theory.

Providing infrastructure for an airport business park at Winnipeg International Airport will not ensure large-scale regional economic development. There is no guarantee that Winnipeg will be the next Alliance or Huntsville if roads are built, an intermodal facility is constructed and high-quality municipal services are provided. However, one certainty has made itself evident during the 1990s as politicians and businesspeople have pondered the possibilities of an airport business park. To put it plainly: if no infrastructure is provided, regional economic development will continue to be seriously impeded.

It may not be too late for development to begin at YWG, despite the lack of action since previous studies and plans were tabled (Loreth 1996; City of Winnipeg 1996; Airport Vicinity Landowners Association 1995). However, as alluded to in the opening pages of this thesis, other Canadian airports are putting plans into action. Hamilton is continuing to enlarge its cargo business. Calgary is beginning to market its adjacent land; an unprecedented action that is succeeding in attracting development. Mirabel is already an

[119] This is not to say that YWG does not contribute to the regional economy. However, much more investment is needed for YWG to be considered an equal to AFW, DFW or HSV.

important cargo centre, has the most underutilized infrastructure in Canada (of major airports), and has an abundance of available nearby land.[120] Earlier, this chapter outlined the efforts undertaken by other Mid-Continent cities to create multimodal centres and attract economic development. Not only does Winnipeg have to compete with cities and airports across Canada, but it has to compete with the likes of Kansas City, Des Moines, San Antonio, Monterrey and even cities as large as Minneapolis-St. Paul and Dallas-Fort Worth. Winnipeg cannot afford to bask in complacency with competition of this calibre.

[120] However, Mirabel is also the most effective counter-argument to this thesis. Investment in infrastructure does not always result in economic development. As de Neufville (1994, p. 43) notes, development at Mirabel "fails to justify the investment". However, it could be argued that Mirabel has managed to garner a legitimate anchor tenant drawn from the aerospace industry; namely, the Bell Helicopter Textron plant.

Appendix A – Statistical Data

A1 – AFW vs. DFW vs. HSV

1	Y	N	T
AFW	2	6	8
DFW	5	2	7
HSV	2	4	6
Total	9	12	21
Expected	**Y**	**N**	**T**
AFW	3.43	4.57	8
DFW	3.00	4.00	7
HSV	2.57	3.43	6
Total	9	12	21
p-Value	0.1655		
Chi-Square	3.5972		
Cramer's V	0.4139		
r-squared	0.1713	17.13%	

2	Y	N	T
AFW	4	4	8
DFW	5	2	7
HSV	4	2	6
Total	13	8	21
Expected	**Y**	**N**	**T**
AFW	4.95	3.05	8
DFW	4.33	2.67	7
HSV	3.71	2.29	6
Total	13	8	21
p-Value	0.6677		
Chi-Square	0.8077		
Cramer's V	0.1961		
r-squared	0.0385	3.85%	

3	Y	N	T
AFW	3	5	8
DFW	4	3	7
HSV	3	3	6
Total	10	11	21
Expected	**Y**	**N**	**T**
AFW	3.81	4.19	8
DFW	3.33	3.67	7
HSV	2.857143	3.142857	6
Total	10	11	21
p-Value	0.7421		
Chi-Square	0.5966		
Cramer's V	0.1685		
r-squared	0.0284	2.84%	

4	Y	N	T
AFW	4	4	8
DFW	2	5	7
HSV	4	2	6
Total	10	11	21
Expected	**Y**	**N**	**T**
AFW	3.81	4.19	8
DFW	3.33	3.67	7
HSV	2.86	3.14	6
Total	10	11	21
p-Value	0.3850		
Chi-Square	1.9091		
Cramer's V	0.3015		
r-squared	0.0909	9.09%	

5	Y	N	T
AFW	3	5	8
DFW	0	7	7
HSV	3	3	6
Total	6	15	21
Expected	**Y**	**N**	**T**
AFW	2.29	5.71	8
DFW	2.00	5.00	7
HSV	1.71	4.29	6
Total	6	15	21
p-Value	0.1074		
Chi-Square	4.4625		
Cramer's V	0.4610		
r-squared	0.2125	21.25%	

9	Y	N	T
AFW	8	0	8
DFW	6	0	6
HSV	6	0	6
Total	20	0	20
Expected	**Y**	**N**	**T**
AFW	8.00	0.00	8
DFW	6.00	0.00	6
HSV	6.00	0.00	6
Total	20	0	20
p-Value	#DIV/0!		
Chi-Square	#DIV/0!		
Cramer's V	#DIV/0!		
r-squared	#DIV/0!	#DIV/0!	

10	Y	N	T
AFW	0	8	8
DFW	0	6	6
HSV	1	5	6
Total	1	19	20
Expected	**Y**	**N**	**T**
AFW	0.40	7.60	8
DFW	0.30	5.70	6
HSV	0.30	5.70	6
Total	1	19	20

p-Value	0.2929	
Chi-Square	2.4561	
Cramer's V	0.3504	
r-squared	0.1228	12.28%

A2 – (AFW + DFW) vs. (HSV + YWG)

1	Y	N	T
YWG+HSV	12	8	20
AFW+DFW	7	8	15
Total	19	16	35
Expected	**Y**	**N**	**T**
YWG+HSV	10.86	9.14	20
AFW+DFW	8.14	6.86	15
Total	19	16	35

p-Value	0.4333	
Chi-Square	0.6140	
Cramer's V	0.1325	
r-squared	0.0175	1.75%

2	Y	N	T
YWG+HSV	12	8	20
AFW+DFW	9	6	15
Total	21	14	35
Expected	**Y**	**N**	**T**
YWG+HSV	12.00	8.00	20
AFW+DFW	9.00	6.00	15
Total	21	14	35

p-Value	1.0000	
Chi-Square	0.0000	
Cramer's V	0.0000	
r-squared	0.0000	0.00%

3	Y	N	T
YWG+HSV	11	9	20
AFW+DFW	7	8	15
Total	18	17	35
Expected	**Y**	**N**	**T**
YWG+HSV	10.29	9.71	20
AFW+DFW	7.71	7.29	15
Total	18	17	35

p-Value	0.6254	
Chi-Square	0.2383	
Cramer's V	0.0825	
r-squared	0.0068	0.68%

4	Y	N	T
YWG+HSV	11	9	20
AFW+DFW	6	9	15
Total	17	18	35
Expected	**Y**	**N**	**T**
YWG+HSV	9.71	10.29	20
AFW+DFW	7.29	7.71	15
Total	17	18	35

p-Value	0.3796	
Chi-Square	0.7721	
Cramer's V	0.1485	
r-squared	0.0221	2.21%

5	Y	N	T
YWG+HSV	8	12	20
AFW+DFW	3	12	15
Total	11	24	35
Expected	**Y**	**N**	**T**
YWG+HSV	6.29	13.71	20
AFW+DFW	4.71	10.29	15
Total	11	24	35

p-Value	0.2072	
Chi-Square	1.5909	
Cramer's V	0.2132	
r-squared	0.0455	4.55%

9	Y	N	T
YWG+HSV	19	1	20
AFW+DFW	14	0	14
Total	33	1	34
Expected	**Y**	**N**	**T**
YWG+HSV	19.41	0.59	20
AFW+DFW	13.59	0.41	14
Total	33	1	34

p-Value	0.3957	
Chi-Square	0.7212	
Cramer's V	0.1456	
r-squared	0.0212	2.12%

10	Y	N	T
YWG+HSV	9	11	19
AFW+DFW	0	14	14
Total	9	24	33
Expected	**Y**	**N**	**T**
YWG+HSV	5.29	14.71	20
AFW+DFW	3.71	10.29	14
Total	9	25	34

p-Value	0.0034	
Chi-Square	8.5679	
Cramer's V	0.5020	
r-squared	0.2520	25.20%

A3 – (AFW + DFW + HSV) vs. YWG

1	Y	N	T
YWG	10	4	14
AFW+DFW+HSV	9	12	21
Total	19	16	35
Expected	**Y**	**N**	**T**
YWG	7.60	6.40	14
AFW+DFW+HSV	11.40	9.60	21
Total	19	16	35

p-Value	0.0965	
Chi-Square	2.7632	
Cramer's V	0.2810	
r-squared	0.0789	7.89%

2	Y	N	T
YWG	8	6	14
AFW+DFW+HSV	13	8	21
Total	21	14	35
Expected	**Y**	**N**	**T**
YWG	8.40	5.60	14
AFW+DFW+HSV	12.60	8.40	21
Total	21	14	35

p-Value	0.7782	
Chi-Square	0.0794	
Cramer's V	0.0476	
r-squared	0.0023	0.23%

3	Y	N	T
YWG	8	6	14
AFW+DFW+HSV	10	11	21
Total	18	17	35
Expected	**Y**	**N**	**T**
YWG	7.20	6.80	14
AFW+DFW+HSV	10.80	10.20	21
Total	18	17	35
p-Value	0.5808		
Chi-Square	0.3050		
Cramer's V	0.0934		
r-squared	0.0087	0.87%	

4	Y	N	T
YWG	7	7	14
AFW+DFW+HSV	10	11	21
Total	17	18	35
Expected	**Y**	**N**	**T**
YWG	6.80	7.20	14
AFW+DFW+HSV	10.20	10.80	21
Total	17	18	35
p-Value	0.8902		
Chi-Square	0.0191		
Cramer's V	0.0233		
r-squared	0.0005	0.05%	

5	Y	N	T
YWG	5	9	14
AFW+DFW+HSV	6	15	21
Total	11	24	35
Expected	**Y**	**N**	**T**
YWG	4.40	9.60	14
AFW+DFW+HSV	6.60	14.40	21
Total	11	24	35
p-Value	0.6556		
Chi-Square	0.1989		
Cramer's V	0.0754		
r-squared	0.0057	0.57%	

9	Y	N	T
YWG	13	1	14
AFW+DFW+HSV	20	0	20
Total	33	1	34
Expected	**Y**	**N**	**T**
YWG	13.59	0.41	14
AFW+DFW+HSV	19.41	0.59	20
Total	33	1	34
p-Value	0.2251		
Chi-Square	1.4719		
Cramer's V	0.2081		
r-squared	0.0433	4.33%	

10	Y	N	T
YWG	8	6	14
AFW+DFW+HSV	1	19	20
Total	9	25	34
Expected	**Y**	**N**	**T**
YWG	3.71	10.29	14
AFW+DFW+HSV	5.29	14.71	20
Total	9	25	34
p-Value	0.0007		
Chi-Square	11.5035		
Cramer's V	0.5817		
r-squared	0.3383	33.83%	

Appendix B – Questionnaires

LOCAL PLANNERS' QUESTIONNAIRE

Name: _____
Organization: _____
Email: _____

1. What are the chief benefits to this community arising from the airport and airport-related activities?

2. Does the airport fulfil its expected role in the community?

3. What role does the airport play in the regional development plan for this community?

4. Has your organization noted any constraints to development near this airport? If yes, please specify.

5. a) What has been the development pattern near this airport?

b) What has been the time path of firm location near this airport?

c) Was there an original anchor tenant? Who?

d) To the best of your knowledge, which firms moved in first?

6. a) What role does your organization play in development near this airport?

b) What plans are there for development near this airport?

c) What is the estimated time frame for this development?

AIRPORT AUTHORITIES' QUESTIONNAIRE

Name: _____
Organization: _____
Email: _____

1. a) How does this Airport Authority see itself in terms of aiding regional development?

2. a) Who sits on the board of directors? How are they selected?

   b) Are there representatives from both government and private industry?

3. a) What has been the development strategy for the Airport Authority?

   b) In other words, what kind of firms did the airport try to attract to this area?

4. a) What has been the development pattern near this airport?

b) What has been the time path of firm location in this area?

c) Was there an original major anchor tenant?

d) To the best of your knowledge, which firms moved in first?

5. a) What are the plans for development near the airport in the future?

b) What role will the Airport Authority play in this development?

c) What is the estimated time frame for this development?

6. Are there any constraints to development at this airport? If yes, please specify.

FIRM QUESTIONNAIRE

SECTION A – COMPANY INFORMATION

1. Please provide the following information:

Name of Firm: _____

Address of Firm: _____

Distance from Airport (in miles): _____

Distance from Airport (in time): _____

2. Please provide the following contact information:

Your Name: _____

Your Title/Position: _____

Phone Number: _____

Fax Number: _____

E-mail Address: _____

3. Please indicate the type of business:

a) Air Carrier ..... ❍
b) Ground Transportation ..... ❍
c) General Aviation ..... ❍
d) Freight Handling ..... ❍
e) Aircraft Services ..... ❍
f) Retail ..... ❍
g) Logistics ..... ❍
h) Manufacturing ..... ❍
i) Other ..... ❍

Please specify -_____

4. When was your company founded at this location?

_____

5. What is the status of your company to the corporation as a whole?

Head office, branch, etc. _____

6. Please indicate the physical setting of your company.

a) Industrial Park..... ❍

Please specify the name of the park. _____

b) Government-owned building..... ❍

c) Foreign Trade Zone ..... ❍

d) Other ..... ❍

Please specify _____

SECTION B – LOCATION ISSUES

1. Does your company depend on airport operations?

Yes ❍ No ❍

2. Could your company operate as it does today if it were not located near the airport, but still in this city?

Yes ❍ No ❍

3. Has your company expanded since locating here?

Yes ❍ No ❍

If yes. square footage before expansion: _____

square footage after expansion: _____

4. Could your company operate as it does today if it were located in another city?

Yes ❍ No ❍

If "No", what attributes does this city possess that other cities do not?

_____

5. Could your company operate as it does today if there were no major airport in this city?

Yes ❍ No ❍

6. Approximately what percentage of your business would be affected without your current proximity to the airport?

_____%

7. What percentage of nearby firms was already located here when your company was established at this location?

_____%

8. What were the main reasons for your company choosing this location? (Please indicate all applicable responses.)

a) Proximity to Suppliers
b) Proximity to Railway or Highway
c) Price of Land Lease
d) Foreign Trade Zone
e) Proximity to Customers
f) Proximity to Airport
g) Subsidy/Incentive
h) Other (Please Specify)

_____

9. Has this location met your expectations?

Yes ❍ No ❍

10. Has your company experienced any constraints to development at this airport?

Yes ❍ No ❍

If yes, please specify: _____

11. What other airports in the region are used by your company?

_____

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