

The Importance of Transport in Business' Location Decisions

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Executive Summary

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Introduction

Understanding the role of transport in decisions made by businesses on where to locate or relocate is a crucial element in our ability to assess the impact of our transport system on people's lives. The DfT have commissioned the Transport Research Institute and Employment Research Institute at Napier University, Edinburgh to review the current level evidence of the issues considered by businesses in choosing where they locate / relocate and in particular, the significance and importance to which transport is a factor within that decision-making process.

This is a complex subject area. There are many types of businesses - each with their individual transport needs and considerations - and the task of unpacking and isolating the influence of transport is a complicated and difficult process. As such, there is very little significant consensus concerning the overall effects of transport on business location and wider economic development and it is recognised that considerations need to be made almost entirely on a case-by-case basis.

Naturally, this reflects the differing needs and demands relating to different firms the various characteristics different locations provide. The review itself breaks these issues down into a number of areas - the impact of technology; by business type; firm characteristics, labour supply; spatial scale, and; growth / displacement. This summary, highlights a number of generic considerations the review has identified, inherent when thinking about the role of transport on businesses.

Changes in the Business Environment

Firstly, the environment within which different businesses operate is complex and ever changing. Advances in ICT provision has altered this context in a number of significant ways which have an impact on the way the world - and transport - is viewed and utilised. ICT has allowed us to develop new ways of working and communicating instantaneously with a large number of people, spread across a range of physical locations and distances, and provided us with the potential flexibility to work wherever and whenever we want.

This is a complex interrelationship with better communication potentially reducing the need for travel, but on the other hand reinforcing or possibly expanding travel demand as new markets and localities are opened.

This is still a relatively nascent area of study and not surprisingly, there is little hard evidence - nor consensus - over the potential impacts that ICT has on travel demand. This study therefore, attempts to synthesise research into the influence of transport provision in this complex and dynamic process.

A Necessary, but not a Sufficient Condition

Compiled from business surveys, important factors commonly cited as important in considering a location include:

- the quality and scope of physical and business infrastructures;

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- factor cost and supply, especially labour;
- market demand and links to international markets;
- institutional infrastructure and networks;
- a 'culture' supporting 'civicness' and entrepreneurship;
- indigenous company growth;
- agglomeration economies;
- technological development;
- as well as more social factors such as climate, lifestyle, image and crime rates.

Although some of these have an element of transport within these, none *directly* relate to transport *per se*. As a general rule, studies suggest that transport is only an important factor, once the decision to set up in an area has been taken. This is thought to be attributable to a number of factors:

- The review notes that - within certain parameters, such as, access to airports or major motorway interchanges where absolutely necessary - levels of transport provision are generally seen as ubiquitous within developed countries and as such transport is seen as a necessary, but not a sufficient condition for influencing business location.
- Transportation costs are typically found to be only a very small proportion of firms' total costs - usually less than 5%. As such, any improvements to the transport infrastructure is likely to yield small cost savings and gains to firms.
- The decision to move may be prompted by transport difficulties and inaccessibility. However, it is argued that the transactions cost to any change in transport may be too high to enable the firm to respond fully to a change in transport costs. Therefore the review notes that businesses are likely to change operations in discrete steps, and it is only when certain cost thresholds are reached that it becomes efficient to the firm to revise its number or location of depots.

It should be noted therefore that although influential, transport costs are not the primary business location driver on an international and national scale. An interesting conclusion to be drawn from the review is that on the one hand, transport being such a small proportion of a firm's costs implies that minor changes in provision and function of the infrastructure is likely to have little impact on businesses. Improvements in *transport provision* therefore are only likely to have a limited impact since firms are only making savings on a small proportion of cost. However, this assumes firms have perfect information on their costs.

The review identified that current and expected levels of services provided by transport infrastructure (e.g. the quality, reliability, time, the width of the supplier/customer market and financial costs of journeys using it etc.) are a crucial component in the actual location decisions themselves. To this end, *perceptions* of improved travel time were considered an important factor in considering business investment.

It is important to note however that research has historically tended to focus on the provision of new transport - opening up new markets and opportunities for businesses - rather than improving existing provision and this latter issue requires further investigation.

Transport as Part of a Package

Where transport is of obvious importance, is where improvements in the transport system opens up new, previously untapped areas and markets. However, as noted above, improvements in the transport system in itself would not usually be thought sufficient to stimulate (re)location. It is important therefore that investment is considered as part of a wider package in support of other factors or initiatives supporting other economic or social regeneration factors and spatial policies.

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The review notes that large-scale transport infrastructure policies are likely to be successful in supporting *latent* growth in under-developed regions, but is likely to be ineffective in *stimulating new* growth.

Related to this issue is that transport is important in business relocation only when the decision to move has already been taken.

New transport infrastructure may influence business location, but this can often involve displacing business from one area to another. This can be beneficial if redistribution from congested to stagnant areas; however, evidence suggests that transport investment will tend to displace business activity towards congested areas.

The Logistics Sector

A further factor which may explain a firm's degree of responsiveness to transport is the recent expansion in the logistics market. The increased speed and complexity of distribution networks has meant a significant increase in the number of firms outsourcing many of their transport functions to specialist firms in recent years. As such, direct transport considerations have become less important and become more secondary as specialist logistics companies take on the role.

As logistics firms develop their distribution networks to incorporate practices such as *Just In Time* delivery, an issue of increasing importance is the reliability of the transport network. A number of studies noted that it was not the amount of time taken that was important to logistics firms, but being able to deliver when scheduled. For example, it was suggested that whether a delivery takes 8 hours or 5 hours is relatively unimportant. The key consideration, is that the delivery firm can rely on the journey taking 8 hours, so that it can be factored into the timing of the logistics chain.

It is argued that this is an area of increasing significance and importance although the impact and demands of the changing logistics industry is an area not currently well understood.

Differences in Needs by Spatial Scale

It is noted that ICT and the expansion of firms allows them to have a wider geographical focus and become more dispersed as different elements of firms' business can be outsourced or relocated.

The review notes that the globalisation of the business environment, means that it is increasingly important to consider the national transport system as a whole, and its connectivity with the rest of the world. It is recognised however that the importance of transport on an area or country's *international* competitiveness is an area where little is understood.

Within this context, transport networks are becoming broader and the importance of being near transport hubs - be they air, sea, road or rail - is crucial. A key conclusion to be drawn therefore is that the reliability and connectivity of the transport system is of concern.

Studies note that good air connectivity is vital to businesses operating on an international scale, and for the development of 'world cities' as business locations. It is suggested that air transport *per se* is not a necessary condition, but what is important are: the extent to which that area is plugged directly in to other major international hubs - availability and efficiency of routes (direct, hubbed); costs and the level of competition in global transport market, and; perceived and actual interchange efficiencies. This is a key consideration in the level of foreign investment into an area and is most important for firms with international trading or contacts such as, high-tech firms, financial services and pharmaceutical firms.

It is perhaps unsurprising that air transport has a greater influence on the location of *foreign* investors and business services, whereas it is the road transport has a larger influence on *domestic* investment. The evidence suggests however that transport becomes an increasingly important factor for businesses as the geographical scale is reduced from supranational down to local.

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Recent trends indicate a general movement of businesses locating away from large cities to urban fringes. This is in part at least facilitated by the development of technology, allowing the decentralisation and spread of firms, or their component parts over a wider geographical area, opening up choice of location.

It is noted that heavy industries are likely to incur the highest transport costs and are likely to be the most location dependent. However, there is growing evidence on the location dependency of light manufacture and service firms - particularly with regard to road and air access. It is recognised that high-technology *manufacturing* and service businesses often 'cluster' together. In this context however, transport is a secondary consideration to face-to-face networking, and that this - coupled with the preference for a type of location - that is a key locational factor. This 'clustering' effect is compounded by allowing firms to take advantage of location specific factors which drew the firm there in the first place - such as labour source, the cost of premises. The review notes however, that the exact effect and importance of transport to these firms is inconclusive.

At a local level, again there is limited consensus, with research highlighting that schemes can increase the attractiveness of city centre locations, whereas others show that the development potential is limited. In particular, it is noted that - for example - the impact of traffic reduction measures such as bus priority measures, charging, limiting parking and the effects of by-passes on location decisions, is not yet widely understood.

Regardless, transport policies aimed at moving business into cities are most effective if combined with other policies. Ideally, it is argued, transport planning should be *integrated within* land-use planning and regeneration policies, if it is to be effective in meeting objectives.

Accessibility

Labour supply is often cited as the most important single factor in business location and that the ability of employee / customer access is perhaps the key transport consideration. Transport investment has an obvious role to play in reducing travel time and increasing the labour pool from which firms can draw. Transport can be used as a tool to boost labour supply, through increasing workplace accessibility and therefore labour market size.

However, it is noted that there is little literature considering evidence of the reverse effect: means of encouraging businesses to locate in accessible areas to allow wider labour market participation and reduce travel demand. Studies note however, that higher-skilled workforces are prepared - or are more able - to be more mobile and tend to 'follow' firms to areas where they are established.

This paper represents a brief summary of the key issues emerging from the review of literature on the importance of transport in business location decisions.

1. Introduction

The Department for Transport (DfT) has highlighted a need to better understand the role of transport in business' location decisions in order to inform future research, decision-making and policy formation. While there exists a wealth of material on this subject, there is a clear need to organise and contextualise this material in a way that can provide clearer guidance to policy makers regarding the key issues, the importance of these relative to other determinants of business location, and the influence of DfT policy instruments. As a result the DfT commissioned the Transport Research Institute and Employment Research Institute at Napier University, Edinburgh to undertake this study.

Remit

The purpose of this study is to review and organise the relevant literature on business location decisions and provide an explanation of the role and significance of transport-related factors in influencing these decisions. This will help provide a strong base from which the DfT can develop further research in this area while avoiding wasteful duplication. Hence the study:

- reviews literature on business location decisions, including the role of transport, drawing from a number of disciplines including transport policy, economics, planning and management, primarily in the UK, but also in elsewhere;
- reviews literature that focuses specifically on identifying the extent to which transport acts as a determinant of business location;
- reviews literature on the ways and the extent to which business location decisions affect transport behaviour and policy;
- identifies the knowledge gaps in relation to the issues identified above;

Overview

There is no consensus concerning the effects of transport on business location and wider economic development. Changes in transport costs (including money, reliability and time costs) are influenced by new infrastructure, changes in infrastructure management or congestion/deterioration of existing infrastructure, as well as by the efficiency of transport operations. These will influence business productivity, innovation, access to knowledge and markets, regional patterns of commerce and the commuting and migration decisions of households etc. Hence they may affect the location decisions of businesses already located in an area (and their long term viability) as well as those thinking of setting up or locating there.

A key question is what is the relative importance of transport compared to non-transport factors? It has been long recognised that transport costs make up a relatively small proportion (usually 5-7%) of total costs, although this varies by industry (CBI, 1985; Diamond and Spence, 1989). The evidence generally suggests that transport is a necessary but not sufficient condition for influencing business location, especially in developed countries where transport infrastructure is generally ubiquitous. Other factors such as access to skilled labour, market changes, tax structures etc., are generally more significant. However congestion imposes great costs upon businesses and increased use of 'just-in-time' and other logistic approaches give increasing prominence to factors such as reliability of transport systems. In addition transport is often seen as an area where government can exert significant direct influence.

There are important qualifications to this general conclusion concerning the relative low importance of transport in influencing business location. The role and importance of transport will be affected, amongst other things, as:

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- The business environment is changing, especially in terms of business organisation and globalisation, which is likely to lead to a greater importance of logistics and global transport links (e.g. good access to hubs of delivery company networks may become an increasingly important location factor for some businesses).
- Different types of businesses or business functions have different transport requirements and priorities (e.g. internationally mobile firms rate air links more highly than domestic firms), and different sets of comparator locations from which to make a choice (e.g. they may compare transport services across different countries).
- Labour is usually a key location factor for businesses and transport changes may influence its accessibility through commuting (e.g. better local transport may increase the labour pool for a business, while congestion may reduce it). Although it should be recognised that locations that improve car accessibility can adversely affect lower paid and part-time workers and some social groups.
- The spatial scale of analysis is crucial. The relative importance of transport may differ when considering local, intra-regional, inter-regional or international location choices. Transport is likely to be more important in influencing a businesses' choice of location within a local area, rather than its choice between regions (e.g. transport changes may influence a business' choice as to which part of town to location, but may be irrelevant as to which region of the UK it goes to). Evidence often confuses the effects of differing scales.
- Local redistribution of businesses may have little or no effect on the growth of the regional or national economy as a whole, so it is important to distinguish transport investment that simply helps move businesses around a region rather than leads to regional or national growth.
- While most forms of transport are available across most of the UK, not all are ubiquitous (e.g. the availability of airports, and more importantly the number and destinations of flights from them, varies considerably, and while roads may be ubiquitous, their quality and levels of congestion vary greatly).

The framework used in the report seeks to unpack the differences in the impacts of and upon transport according to:

- Changing business organisation, including the effects of globalisation, technology and increased complexity, the role of transport within corporate strategies and the changing role of logistics on business location.
- Business characteristics (e.g. size, sector, ownership, function).
- Types of labour supply and also the implications for social inclusion.
- The spatial scale of analysis (international, national, inter-regional, intra-regional and local) including the characteristics of different regions.
- Economic growth versus redistribution, and the role of transport investments in generating new activity or causing the relocation of existing activity.
- The characteristics of the transport infrastructure, services using it and its management (in particular air transport, strategic networks and localised networks).

Meanings of transport and business location in this report

It is useful to set out some understanding of the main terms used in this report. First, *transport* covers both investment in new and existing infrastructure and equipment and its management (e.g. service levels, congestion charging or regulation of air travel, including taxes). Crucial to business location decisions are the current and expected levels of services provided by it (e.g. the quality, reliability, time and financial costs of journeys using it etc.) rather than simply the existence of infrastructure.

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Hence maintenance or improvements to existing infrastructure may be as, or more, important than providing new infrastructure.

In this report, *business location* has been taken to involve each of the various components of location change, including businesses that move all or part of their activities into or away from an area (relocation), and businesses that start up or stay in an area (location). From the perspective of a given location, on the positive side these are:

- business birth (why did the founder choose this location to start-up);
- complete business relocation (relocating the whole business to this location);
- partial relocation by moving part of the business elsewhere or setting up a new branch plant;
- *in-situ* business growth (which includes the implicit choice not to move that activity to another location).

The mirror image or negative side of these concern the components of employment decline, which again involve implicit or explicit choices affecting the location of businesses:

- business death/closure (would the business have survived if it had been in or moved to another location?);
- complete business relocation involving moving the whole business elsewhere;
- closing and/or moving part of the business elsewhere;
- and *in-situ* contraction of the business.

The definition of business can cover not just commercial businesses (which is the main focus of this report) but also other organisations (e.g. third-sector or government). Change is usually measured in terms of numbers of firms or employment (and type of employment; e.g. full- or part-time; quality of jobs etc.) but could be measured in other terms (e.g. turnover). The choice of location is only part of a much wider decision making process, involving choices of strategic direction, how opportunities can be taken through alternative production means, outsourcing etc., and whether relocation of all or part of the organisation is needed. The attraction of a new location may be due to 'push factors' (e.g. lack of space) or 'pull' factors (e.g. access to a new market), and these may influence the range of alternatives considered.

Outline

Of course, it is not possible to consider all potentially relevant literature in a relatively short study and so attention has been focussed upon these most relevant to current policy priorities. The structure of the report is as follows:

Chapter 2 identifies some current and recent historical trends in business location, within the UK and internationally.

Chapter 3 provides an overview of some of the main theories that seek to explain the drivers of business location and the relative importance of transport in location decisions. It then presents some empirical evidence from studies that have sought to determine the degree to which transport factors influence business location.

Chapter 4 provides a review of evidence concerning the role of transport in business location decisions. As discussed above, the importance of transport depends on a number of factors including the changing business environment, the characteristics of businesses, the effects on labour markets, the spatial scale of the impacts, whether the change mainly influences growth of the economy or redistribution within an area, and the specific type of transport change. This chapter therefore examines each of these.

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Chapter 5 focuses on the link between land use planning and transport. It examines evidence on the effects of planning decisions and regulation on business competitiveness and location decisions. It then examines evidence on the influence of business location decisions upon travel, traffic volume and distribution, and the implications of this for labour accessibility.

Chapter 6 takes a closer look at some of the methodological issues emerging from the review. Some evidence is presented on the adequacy of existing modelling techniques, particularly Land Use Transport Interaction models. The need for greater *ex-post* evaluation and the accuracy of existing *ex-post* appraisals is then discussed. Finally we look at the robustness of existing evidence on the link between transport and business location - particularly in terms of data quality, scale, time period and geography.

Chapter 7 examines the policy implications and research of the findings of the literature review under a number of question headings based upon current Department for Transport and Office of the Deputy Prime Minister policy documents. It briefly: summarises the evidence related to some key questions arising from current UK government policy documents, and; identifies some major gaps in knowledge that still remain.

2. Some Trends in Business Location

Key References

Breheny (1999) (Ed.) *The People: Where Will They Work*, Town and Country Planning Association, London

Chakrabarti (2001), Determinants of FDI: A Comment on Globalization-Induced Changes and the Role of FDI Policies, UWM, report to the World Bank

Cooke, P. (2002). Knowledge economies: clusters, learning and co-operative advantage. London: Routledge

Core Cities (2002) *Cities, regions and competitiveness*, interim report from Core Cities Working Group, Birmingham

DTI (2001a) Ernst and Young figures show that UK is Europe's favourite place to invest Department of Trade and Industry report, 2 May 2001

Hospers, G.J, (2002) "Beyond the blue banana? Structural change in Europe's geo-economy" Paper presented at 42nd European Congress of the Regional Science Association, Dortmund, Germany, 2002

Kokko, A (2000) *Globalisation and FDI Incentives*, Stockholm School of Economics, report to the World Bank

Scottish Executive (2002a) *Scotland: A Global Connections Strategy*, Edinburgh

2.1 Introduction

This chapter provides a broad overview of some current and recent historical trends in business location, within the UK and internationally, in order to help set a general context. The chapter does not include the considerable public information on business and commuting traffic flows and their links to, for example, changing Gross Domestic Product. Care must be taken when considering trends, as most of the time series are extremely short, so the data are only indicative and not conclusive.

2.2 International Trends

Worldwide Foreign Direct Investment (FDI) has fallen substantially in recent years with a 40% drop in 2001. The drop of inflows into developed economies was even higher at 50% (Scottish Executive, 2002a), including several of the UK's European competitors such as France, Ireland and the Netherlands. The UK had 26% of the European market share in FDI in 2000/01, the next largest nation being France with 15% DTI (2001a).

Traditionally, within the European Union it has been the "core" (sometimes referred to as the 'Blue Banana', 'Bunch of Grapes' or various other fruits such as 'grapes' etc., and stretching approximately from London to Milan) that has attracted the majority of investment in Europe. Another emerging growth pole is the 'Latin Arc' or 'Mediterranean Arc' stretching along the Mediterranean from Barcelona to Genoa. This area has seen a surge of investment in high technology and advanced service sector industries in the past decade. These industries are relatively mobile and are greatly influenced by the need for a skilled workforce that can be relatively easily attracted due to the favourable climate and lifestyle of the area and investment in higher education and research centres. It has been compared to the 'Sunbelt' in the US, which has seen considerable new and relocated investment compared to the traditional 'Rustbelt' industrial areas of the north.

Some researchers have speculated that the current 'Blue Banana' core will be eroded as a magnet for business location due to the emergence of the 'Yellow Banana' stretching from Paris to Warsaw or

even further into Eastern Europe, and the continued growth of the Sunbelt from Valencia to Milan (Hospers, 2002). The introduction of monetary union and the single currency has arguably meant that geographical differences, including the transport infrastructure, are increasingly important, rather than exchange rate policies in the fight for FDI (Cooke, 1995).

The exact factors that will attract a company to a region are varied, and reflect location attractiveness, resources and skills. In some instances the quality of the environment will be a sufficient attractor. In many financial and economic pressures will also be significant.

Chakrabarthy (2001) charts the increase in FDI as a result of globalisation and deregulation in the marketplace in many countries. However, the choice of location remains a question of physical, natural and economic competitive benefit. Chakrabarthy observes that following the size of its market, a country's openness to trade is more "likely" to be correlated with its FDI than other potential determinants. The World Bank¹ summarised that [developing] countries with better policies, reduced restrictions on foreign investment, and progress in health and education indicators were more likely to receive Foreign Direct Investment.

The growth of knowledge industries is important (Cooke, 2002) and their location needs are related more to quality of environment, plus personnel movement including air travel, and also commuting at a local level. Further, Kokko (2000) comments on the necessity for competing countries to provide access to information technologies infrastructure, this in turn reducing the reliance on market size as a determinant of investment location. Subsidy per job and the level of government backing for FDI is also highly significant. Given that few countries compete for foreign investment without any form of subsidies today (UNCTAD 1996) the level of subsidy per job, and the extent of subsidy between competing countries, may increase inward investment while reducing the benefit of the investment.

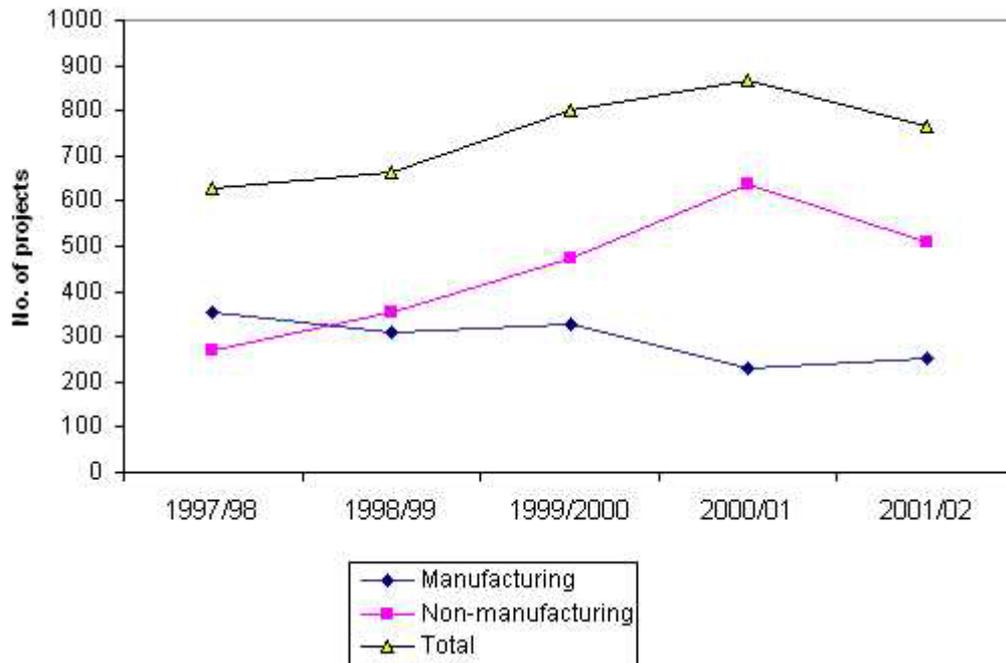
Chart 1.1 shows the number of successful inward investment projects (defined as a case where an overseas company specifies an interest and successfully completes an investment in the UK), over the period 1997/98 - 2001/02. This indicates that:

- the UK experienced an increase in FDI during the late 1990s and start of the millennium (leading up to the Single Currency);
- this fell again during 2001/02 and the trend may now be downwards;
- overall, investment projects increased by 22% over the period 1997/98 - 2001/02;
- manufacturing sector investment showed a slow decline until 2000/01 with a slight increase in 2001/02;
- there was a steady increase in non-manufacturing sector investments until 2000/01, but a decline in 2001/02.

Chart 2.1: UK Direct Inward Investment Project Successes

¹ <http://www.worldbank.org/prospects/gdf2002/slideshow/slideshow/sld015.htm>

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In monetary value, the inflow of FDI into the UK in 2000 was £86.2 billion compared to a total of £52.1 billion in 1999, an increase of 65% (DTI, 2001a), although this has since fallen. This created 71,788 new jobs and increased Britain's total global investment stock to £341 billion (DTI, 2001b). Such figures need to be considered alongside factors such as potential displacement.

Table 1.0 puts this in context by illustrating the value of FDI in Europe. This shows that:

- The UK experienced the largest total FDI in 2001/02, closely followed by Belgium/Luxembourg and Germany.
- Ireland experienced the largest increase over the period (80%)
- Greece experienced the largest fall (-8%)

Table 1.0: Number of Direct Inward Investment (Inflows), FDI Inward Stock, EU 15, US \$m

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	1997/98	1998/99	1999/2000	2000/01	2001/02	Change 1997/02
Austria	17,510	23,564	23,472	30,431	34,400	49%
Belgium and Lux.	140,818	189,880	185,550	431,111	482,107	71%
Denmark	22,268	31,175	41,222	64,397	64,397	65%
Finland	9,538	16,464	18,315	24,272	26,267	64%
France	195,910	246,214	244,667	257,806	310,430	37%
Germany	192,151	255,379	299,705	449,066	480,899	60%
Greece	15,234	15,319	15,890	12,499	14,059	-8%
Ireland	14,975	26,010	40,939	65,056	74,831	80%
Italy	81,145	103,094	108,701	113,046	107,921	25%
Netherlands	122,193	164,473	192,248	243,430	284,212	57%
Portugal	19,287	24,465	23,519	28,161	32,671	41%
Spain	100,021	118,111	116,665	144,508	158,405	37%
Sweden	34,784	41,513	50,986	82,748	81,275	57%
United Kingdom	252,945	337,410	385,120	435,422	496,776	49%

Source: UNCTAD/DITE

2.3 UK Regional Trends

Table 2.1 below shows the number of successful inward investment project successes, broken down by region, over the period 1997/98 - 2001/02:

- Figures vary considerably year by year, although the recent trend is downwards;
- London had the largest number of new investments in 2001/02, with 176;
- London also had the largest increase (176%) over the period 1997/98 and 2001/02, followed by South East England (121%);
- North West England experienced the largest decline (-54%), followed by Northern Ireland (-42%).

Table 2.1: Number of Direct Inward Investment Project Successes, by UK region.

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	1997/98	1998/99	1999/2000	2000/01	2001/02	Change 1997/02
North East	47	35	49	34	56	19%
North West	71	66	80	39	33	-54%
Yorkshire and Humber	65	86	44	33	40	-38%
East Midlands	18	19	31	17	17	-6%
West Midlands	81	71	99	103	98	21%
East	33	41	37	56	54	64%
London	62	105	159	220	176	184%
South East	57	74	110	191	126	121%
South West	40	34	47	38	30	-25%
England	474	531	656	731	630	33%
Wales	55	48	47	39	61	11%
Scotland	75	54	76	72	59	-21%
Northern Ireland	24	31	20	22	14	-42%
United Kingdom	628	664	800	864	764	22%

Source: ONS Industry sector

Table 2.2 shows the number of successful inward investment project successes in the UK, split by industry sector, over the period 1997/98 - 2001/02. This shows that:

- The sectors with the largest number of investments in recent years are Mining and Quarrying, Financial Services; Retail/ wholesale trade & repairs; Real estate & business services;
- The number of investments varies considerably from year to year for some sectors.

Table 2.2: Net foreign direct investment flows into the United Kingdom analysed by industrial activity of UK affiliates, 1998 to 2001

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	1998	1999	2000	2001
Agriculture, forestry & fishing	16	14	18	10
Mining & quarrying (including oil/gas)	8504	-148	3175	13844
Food products	989	623	717	-148
Textile & wood, printing & publishing	1797	1887	3926	-406
Chemical, plastic & fuel products	3058	1689	627	2067
Metal & mechanical products	1619	525	1165	848
Office, IT & communications equipment	-208	2683	496	1144
Transport equipment	2497	3271	2797	-607
Other manufacturing	1211	440	1201	7232
Electricity, gas & water	1875	57	4920	166
Construction	13	113	-15	23
Retail/ wholesale trade & repairs	1205	12036	1766	5606
Hotels & restaurants	667	-35	318	236
Transport & communications	3209	26964	30489	-2878
Financial services	9858	3989	13898	8779
Real estate & business services	8358	-115	12217	4562
Other services	212	384	782	1496
TOTAL	44877	54376	78495	41972

Source: ONS, Foreign Direct Investment 2001 - (Business Monitor MA4)
<http://www.statistics.gov.uk/StatBase/Product.asp?vlnk=9614>

In terms of employment trends, there has been evidence of a continuation of the 'North-South divide', with employment increasing in southern regions and decreasing in northern regions. The exception to this is London, which has experienced a decline in employment (Breheny, 1999). Hence intra-regional (in terms of the South East) factors are of considerable importance. Table 2.3 gives a summary of regional employment change, measured by employee job estimates over the period 1992 - 2002. This shows that it is southern Britain and Northern Ireland that have experienced the largest gains in employment.

Table 2.3: Change in Employment by Region, 1992 - 2002 (000s)

The Importance of Transport in Business' Location Decisions

Region	1992	2002	Change	% Change
East Anglia	825	934	109	13.3
East Midlands	1,581	1,730	150	9.5
London	3,352	3,973	621	18.5
North West	2,443	2,686	243	9.9
Northern	1,146	1,144	-2	-0.1
South East	4,093	4,884	790	19.3
South West	1,763	2,090	327	18.5
West Midlands	2,073	2,301	229	11
Yorkshire and Humberside	1,930	2,065	135	7
England	19,206	21,808	2,602	13.5
Wales	994	1,068	74	7.5
Scotland	2,110	2,257	147	7
Northern Ireland	544	659	115	21.1
United Kingdom	22,853	25,792	2,938	12.9

Source: ONS

The Core Cities Interim Report (Core Cities, 2002) also highlights that while the UK is a key investment location for international business, most of this investment takes place in the South East, particularly in the case of high value knowledge-based businesses. This is resulting in concerns (that were also present half a century ago) about the relative under-performance of peripheral regions and congestion and overheating in the South East. The report also highlights that this is not the case in all other European countries, with areas such as Rotterdam/Amsterdam, the Ruhr, Frankfurt, Stuttgart, Munich, Lyon/Grenoble, Turin and Milan attracting considerable business investment and outperforming the UK regional city regions. However, there are two important points regarding this. Firstly, although the above are non-capital city regions, they roughly lie inside the traditional EU 'Blue Banana' core and are therefore difficult to describe as peripheral. Secondly, in more geographically peripheral countries of the EU, such as Ireland or Portugal, the bulk of new business investment is in or around the capital city.

2.4 Intra-Regional Trends

At an intra-regional level, there is considerable evidence of a trend over recent decades of movement of business from large cities to urban fringes, and nearby rural areas (exurbs) and smaller towns. There are notable exceptions to this, such as in the financial services industry, which are examined later. Table 2.4 provides a summary of trends in employment change during the 1980s and mid-1990s. While not a direct representation, this does give an approximate picture of trends in business location and shows that the most rapid growth was in towns and rural areas, while the large conurbations experienced a decline. However, care must be taken with the definition of 'rural', as many such areas might be better classified as 'exurbs' that have strong employment and service ties to urban areas. Hence they may be better seen as expansions of metropolitan influence rather than the re-population of rural areas. Transport, in particular the growth of road transport, has had a significant effect on both urban decentralisation and the decline of remote rural areas through increased access to out-of-town developments. However the effect of transport investment on remote rural areas is under debate, as

illustrated in section 4.5.4. The fact remains that exurbs are growing whereas remote areas are often seeing continued employment and population decline.

Table 2.4: Employment Change ('000) by Area Type, 1981-1996

Type	1981	1996	Change 81-96	% Change
Conurbations	8,057	7,556	-501	-6.2
Free-standing cities	1,730	1,749	19	1.1
Towns and rural areas	11,278	12,953	1,675	14.8
Britain	21,065	22,258	1,193	-

Source: Breheny (1999), adapted from Turok and Edge (1999)

Breheny (1999), in a report for the TCPA, states that the urban cores of cities and towns are unlikely to regain their former status as centres of employment. This is mainly because there are only a few industrial sectors (banking & finance, catering, education and recreation & culture) that have remained in urban centres in any strength, and even among these there is expected to be some movement to decentralised locations. For example, changes in technology will allow downsizing and 'back-officing' of financial service operations to relocate in cheaper locations outside urban centres. Also, the growth of suburban and ex-urban areas has been sustained enough for current and future growth to be based on indigenous factors. In the same publication Gillespie, in Breheny (1999), argues that because of this, a policy of reverse commuting, encouraging business location at the urban fringe, combined with residential development in the core may be successful in both meeting business location needs and promoting urban renewal. However, it is likely that the existing public transport forms and infrastructure, often based upon high densities, would not support this without considerable fundamental change, as existing networks are established around carrying people from suburban locations to a central city point, rather than from inner and outer suburbs to dispersed edge of city developments. At a national level the centralisation takes a different form. Polese and Shearmur (2002) found that ICT helped centralise services and employment from remote rural areas to metropolitan areas in Canada (although they may be in the suburban or peri-urban part of the metropolitan area). So there may be relative centralisation at national level to metropolitan areas, with potentially a concurrent to decentralisation within these wider metropolitan areas.

2.5 Size of Business

Table 2.5 below shows the breakdown of businesses in Britain by size over the period 1998-2000. This indicates that the businesses between 1-10 employees make up the majority (83%) of businesses. The time period is too short to consider long-term trends, so the percentage changes are simply given as illustration. However, in terms of number of employees, large firms are relatively more important, as shown in Table 2.6.

Table 2.5: Number of Workplaces in Great Britain by Size, 1998 - 2000 (000s)

The Importance of Transport in Business' Location Decisions

Size band	1998	1999	2000	% change
1-10 employees	1,712	1,780	1,802	5.3
11-49 employees	274	273	278	1.4
50-199 employees	61	60	64	5.2
200 employees	15	16	15	3.4
Total	2,062	2,128	2,160	4.8

Source: ONS

Table 2.6: Employees by size of workplace, Great Britain, 2000

Workplace sizeband	Number of employees	Percentage of employees
1-10 employees	5,436,888	22
11-49 employees	6,153,678	25
50-199 employees	5,898,541	24
200+ employees	7,570,108	30
Total (% rounded)	25,059,215	100

Source: ABI/NOMIS (excludes Census of Agriculture data)

Table 2.7 shows the percentage business size composition of industry by region in Great Britain in the year 2000. Data were not available for Northern Ireland. This indicates very little regional variation, but with Northeast England having the lowest proportion of small businesses and the largest number of medium sized businesses. London has the highest percentage of small businesses.

Table 2.7: Number of Businesses by Size and Region, 2000

The Importance of Transport in Business' Location Decisions

Area	1-10 employees	11-49 employees	50-199 employees	200+ employees	Total
North East	78%	17%	4%	1%	100%
North West	82%	14%	3%	1%	100%
Yorkshire/Humber	81%	15%	3%	1%	100%
East Midlands	82%	14%	3%	1%	100%
West Midlands	82%	14%	3%	1%	100%
Eastern	85%	12%	3%	1%	100%
London	86%	10%	3%	1%	100%
South East	85%	11%	3%	1%	100%
South West	84%	12%	3%	1%	100%
England	84%	13%	3%	1%	100%
Wales	82%	14%	3%	1%	100%
Scotland	80%	16%	4%	1%	100%
Great Britain	83%	13%	3%	1%	100%

Source: ONS

Table 2.8 provides a breakdown of industry sector by region. This highlights the following.

- Distribution, hotels and restaurants, followed by banking, finance and insurance are the largest sectors in all regions.
- London has the highest proportion of banking, finance and insurance employment. Wales has the lowest.
- The West Midlands have the highest proportion of manufacturing employment, London has the lowest.
- The East Midlands have the highest proportion of transport and communications sector employment, London has the lowest.

Table 2.8: Percentage Employment by Industry sector and region.

The Importance of Transport in Business' Location Decisions

Area	Agric. & fishing	Energy & water	Manufaturing	Constru ction	Distn, hotels, rests	Transp & comms	Bank, finance, insure	Public admin, educ, health	Other services
North East	0.6	0.3	8.2	7.9	35.6	4.7	21.5	11.5	9.7
North West	0.3	0.2	8.8	8.3	34.6	4.8	25.6	9.3	8.1
Yorks/Humber	0.5	0.3	9.7	8.9	34.7	5.2	22.6	9.3	8.7
East Midlands	0.4	0.4	11.5	9.6	32.3	5.3	23.3	8.9	8.3
West Midlands	0.3	0.2	11.9	9.3	32.4	4.9	24.6	8.5	7.8
Eastern	0.6	0.3	8.9	11.2	28.3	5.2	29.7	7.6	8.2
London	0.1	0.1	6.3	5.5	26.1	3.9	40.0	6.3	11.7
South East	0.5	0.2	7.5	9.8	26.9	4.2	33.7	7.5	9.7
South West	0.9	0.3	8.1	10.4	32.1	4.4	26.3	8.9	8.6
England	0.4	0.2	8.6	8.8	30.2	4.6	29.7	8.1	9.2
Wales	0.5	0.4	7.9	10.3	36.0	5	19.8	11.1	8.9
Scotland	2.2	0.7	6.6	8.5	33.3	4.7	22.9	10.8	10.3
Great Britain	0.6	0.3	8.4	8.9	30.7	4.6	28.8	8.5	9.3

2.6 Conclusions

What we know

- Worldwide Foreign Direct Investment (FDI) has fallen substantially in recent years.
- Research indicates that following the size of its market, a country's openness to trade is most likely to be correlated with its FDI.
- Access to IT infrastructure may reduce the reliance on market size as a determinant of investment location. Subsidy per job and the level of government backing for FDI is also significant.
- The UK experienced an increase in FDI during the late 1990s and start of the millennium; this fell again during 2001/02; but overall, investment projects increased by 22% over the period 1997/98 - 2001/02.
- Within Europe, the UK experienced the largest total FDI in 2001/02, followed by Belgium/Luxembourg and Germany. Ireland experienced the largest increase (80%) and Greece experienced the largest fall (-8%).
- In the UK FDI is following the trend of employment as a whole with most projects in the non-manufacturing sectors and a decline in manufacturing.

The Importance of Transport in Business' Location Decisions

- Most of UK investment takes place in the South East, particularly in the case of high value knowledge-based businesses. Southern Britain and Northern Ireland have experienced the largest gains in employment.
- There is evidence of a trend over recent decades of movement of business from large cities to urban fringes, and nearby rural areas (exurbs) and smaller towns.
- In the UK, businesses between 1-10 employees make up the majority (83%) of businesses. However, in terms of number of employees, large firms are relatively more important.
- North East England has the lowest proportion of small businesses and the largest number of medium sized businesses. London has the highest percentage of small businesses.
- Distribution, hotels and restaurants, followed by banking, finance and insurance are the largest sectors in all regions.
- London has the highest proportion of banking, finance and insurance employment. The West Midlands have the highest proportion of manufacturing employment. Many of the transport needs of each sector are very different.

What we don't know

- Will the current European 'Blue Banana' core from London to Milan be eroded as a magnet for business location due to growth eastwards, and the continued growth of the 'Sunbelt' from Valencia to Milan?
- Has the introduction of Monetary Union and the Single Currency meant that geographical differences, including the transport infrastructure, are increasingly important in the fight for FDI?

3. The Drivers of Business Location

Summary

- There is a wide body of literature on the theory of business location, stretching back to before the start of the 20th Century. Examples of models or approaches include: neo-classical; institutional; behavioural; economic base; location; cumulative causation; core-periphery; industrial district; innovative *milieu* and competitive advantage.
- Early neo-classical theories place importance on the need to minimise transportation costs to and from markets or inputs.
- The attractiveness of a region to business is influenced by factors such as: infrastructure quality; factor cost and supply (e.g. labour cost and quality); market demand; good communications; international links; stable political situation; entrepreneurial culture; technological development; and the nature of competition between firms. Attractive business locations are likely to score highly on a number of these measures.
- Empirical research in the UK has highlighted the access to markets and availability of skilled labour, sufficient business accommodation and transport links as key drivers of business location. Access to markets and skilled labour are generally the most important factors, especially for higher value adding firms, although transport can help this by improving local accessibility to a workforce.
- Porter's model of competitiveness highlights the interdependence of conditions necessary to attract and sustain competitive businesses, noting that the quality of the business environment, including transport infrastructure, is of high importance.
- Competitiveness theory also argues that transport provision in an area increases the effective market size of an area and therefore increases competition, thus attracting more businesses, and also increases competition.
- Transport can affect business location through: goods transport financial costs; relative time costs and savings; certainty/reliability of travel time; the need to physically meet customers and suppliers; and staff and customer travel costs.
- Empirical evidence from the UK suggests that perceived accessibility can be as important as actual accessibility.
- Empirical research shows that road infrastructure investment can increase commercial development.
- Other research highlights the limitations of transport in influencing location:
 - labour quality issues can often outweigh the impact of transport;
 - transactions costs of relocation can be too high to make a move economically viable;
 - transport infrastructure primarily reduces variable costs, which can be small relative to fixed transport costs (e.g. vehicle depreciation).
- In summary, although transport factors are often less important than some other factors, they may still be of some significance in influencing location. Often both transport *and* non-transport factors are necessary to attract business to an area.

3.1 Introduction

This chapter provides a brief overview of some of the main theories that seek to explain: firstly, the drivers of business location; and, secondly, the relative importance of transport in location decisions. It then presents some empirical evidence from studies that have sought to determine what effect transport factors have on business location.

As set out in chapter 1, business location has been taken to involve each of the various components of location change, involving businesses that move all or part of their activities into or away from an area (relocation), but also businesses that start up or stay in an area (location). The decision to locate (or relocate) will be influenced by specific pressures on the business (e.g. external factors such as the state of the economy; or internal factors such as lack of space to expand), as well as the range of alternatives that the business has (location, logistic, production, or financial alternatives etc.). Internationally mobile firms will usually have a wider range of alternative locations, while small businesses usually relocate nearby so as not to lose staff and customers.

The definition of business can cover not just commercial businesses but also other organisations (e.g. third-sector or government). Change is usually measured in terms of numbers of firms or employment (and type of employment; e.g. full- or part-time; quality of jobs etc.) but could be measured in other terms (e.g. turnover). It can be useful to disaggregate the differing effects of transport in terms of each component of change, although most of the applications of the theories or models considered below focus primarily on change in total employment or firm numbers.

3.2 Theoretical underpinning

3.2.1 Business location and firms' decision-making processes

The determinants of business location are multifaceted, complex and interactive. However, it is necessary to provide a framework in which these can be classified. Within a national context, businesses will locate where they have best access to markets and factors of production. Access to markets and inputs (including employees, links to suppliers, knowledge of and access to production and product technology changes, market knowledge), and their availability, quality and costs, will be influenced by transport infrastructure, and increasingly by telecommunications or ICT infrastructure.

There may also be other financial factors such as taxes, government grants, or perceived or real non-economic factors influencing location such as: the quality of the physical environment (see TSU New Horizons, forthcoming); low crime rates; and access to quality school and leisure facilities etc. When faced with international location decisions, businesses are also likely to take into account factors such as current and expected political stability, regulations, exchange rates, taxation and freedom from restrictive legislation etc.

The HM Treasury report on Productivity in the UK (Treasury, 2001) states that successful cities require 'proximity factors', and those factors which are most effective in influencing the location decisions of organisations are:

- existing institutions specialising in innovations in technology and work practices;
- good transport links;
- access to risk and venture capital; and
- a lifestyle that may attract highly-mobile knowledge workers

In addition to the attraction of a location ('pull' factors), there may be 'push' factors which lead to a business moving, all or in part, from an area (e.g. due to expansion or congestion etc.). We now outline some theoretical approaches to business location.

At a policy level, emphasis has generally been given to location factors. During the last decade Porter's Competitiveness model has been prominent amongst regional development and national policy makers, although the model has been criticised (see below). Porter's model emphasises transport and communications as important factors that affect the competitiveness of a region and of businesses within the region. It gives greater prominence to one factor that has arguably been relatively neglected by policy makers - that is the effect of transport on *international* competitiveness for the UK as a whole, and also for the international competitiveness of individual regions (although it has been raised somewhat in the airport review and by regional development agencies). Of increasing

importance is likely to be the effect of changing logistics on business organisations and their location, and how transport influences this, although there is relatively little published evidence on how these interact. Policy makers have also implicitly and explicitly used export base theory, as government support has generally been restricted to 'export' industries (i.e. 'exporting' from the region, which would exclude local retailers and service providers from getting assistance) although this does not necessarily have an explicit transport element.

Classification of theoretical approaches

There are many overlapping approaches, theories or models concerned with the location of business and the influence of different factors on this. Some examples are:

- *neo-classical* models based upon free markets (see below and, for example, Borts and Stein, 1964, or Fujita *et al.*, 1999, on the 'New Economic Geography');
- *behaviouralist models* focusing mainly on the individual business behaviour and assuming that decisions are made with limited information, resulting in the choice of satisficing, not optimal, locations;
- *institutional models* which argue that economic activities are the result of external factors such as values and institutions. Factors such as mergers and take-overs are important in influencing the location of business (e.g. Pellenbarg, *et al.*, 2002);
- *economic base* models focusing upon industries that export from the region or locality (e.g. see Armstrong and Taylor, 2000);
- *location* theories considering different specific factors and the importance of agglomerations of economic activity and regional characteristics (e.g. see Malecki, 1997);
- *cumulative causation* theory (Myrdal, 1957) where success breeds success (or lack of success can lead to a downward spiral for an area);
- *core-periphery* models which focus on the different functions of regions and particularly the relationships between core regions and peripheral ones. Access and transport often being crucial as to whether one is within the core or determining a region's relationship to the core (e.g. Parkinson *et al.*, 1992);
- *industrial district* models focusing on the importance of networks, entrepreneurship, innovation, co-operation, flexible production and specialisation that help to make a successful regional economy - initially using the example of the success of northern Italy (e.g. Piore and Sabel, 1984);
- *innovative milieu* models focus upon the importance of the cultural and institutions (i.e. wide synergies among local actors which give rise to fast innovation processes) in successful regional economies (e.g. Campagni, 1995); and
- *the competitive advantage* theory of Porter (1990; 1998).

Useful overviews of neo-classical and behaviouralist models can be found in McCann (2001) and comparisons of theoretical approaches in McCann (1998). Some of the main approaches are now briefly considered.

The importance of location characteristics

The characteristics of the region and the interaction and synergy of these characteristics are key to identifying the likely attractiveness and development of a location. For example industrial structure, the quality and scope of physical and business infrastructures, factor cost and supply, market demand including links to international markets, institutional infrastructure and networks, a 'culture' supporting 'civicness' and entrepreneurship, indigenous company growth, agglomeration economies (incorporating static and dynamic externalities) and technological development, are all important to

the development of regions. In addition inter-regional relationships (e.g. in terms of transport and communication costs), and overlapping intra-regional factors such as inputs, agglomeration economies and production networks need to be fully considered.

The importance of non-economic factors, such as climate, crime rates and other quality of life measures have also been highlighted as important in attracting business investment. The pleasant working and living climate of the Mediterranean 'Arc' or 'European Sunbelt' has contributed to the attraction of new high-tech and service businesses (RECLUS, 1999; Schatzl, 1993; Hospers, 2002). Further evidence for the importance of non-economic factors is considered in Section 3.3.1. The effectiveness of regional development agencies may also be important.

The abilities to develop and utilise new technologies (products and production processes) are important for a firm and affects location choice. Research on the development of successful technological regions, such as the UK's "M4 Corridor" suggests that policy played an important role, as did institutional factors and inter-firm links (e.g. Hall *et al.*, 1987). While in the U.S. the East and West coast high-tech industries exhibited very different forms of co-operation, with considerable informal knowledge transfer even among competitors in Silicon Valley but lower levels of such co-operation among East coast firms (Saxenian, 1995). This is discussed further in Section 4.2. Technological change includes access to new technologies and help in utilising them, propensity to innovate and opportunities for skilled staff so that they may be retained in the region.

Hence, the competitive advantages for firms and people in regions are based on various, overlapping, factors according to different authors but based around forms of agglomeration economies or clusters of industries (as discussed by Marshall in 1890, but popular currently through the work of Porter); flexible production and specialisation; competition with rival firms, pressure from customers, specialised suppliers and factor inputs such as labour and technology; economies of scale (Krugman, 1991); and also dynamic inter-industry clusters (Doeringer and Terkla, 1995).

Networks of formal and informal relations between organisations are important for regional growth (Mazzonis, 1989), as well as wider "un-traded interdependencies" such as labour markets, public institutions and locally or nationally derived rules of action, customs, understanding and values (Storper, 1995, p. 205). As an example, Pal *et al.* (2001) explore what they believe to be a neglected issue in retail store location by considering policy networks operating at the interface between retailers and central government. They argue that informal networks, together with the economic power of retailers and the legitimisation of their activities in the 'consumer interest' have provided retailers with influence to exert power over the regulatory environment within which they operate. This study draws on a case study in the UK and identifies the existence of these networks, the authors arguing that these must be recognised in the development and implementation of PPG6 in order to ensure maximum effectiveness. This implies that informal networks may currently allow retailers to circumvent planning regulation.

Further evidence is provided by Walcott (2001) in an international case study, which identifies the importance of informal networks in high-tech life science business location. Walcott discusses informal 'learning location' networks that allow these businesses to exchange information and thereby gain competitive advantage. Almeida and Kogut (1997) argue that choice of location is particularly important to manufacturing businesses that rely on face-to-face networking with suppliers and customers, citing Silicon Valley semiconductor manufacturers as an example. Transport factors in this sector are secondary to the need to be located in proximity to other firms in the 'cluster'.

This also suggests that as many employers become increasingly footloose then a key location factor is the ability to attract workers to live there, so quality of life becomes very important (e.g. Richard Florida has done recent work in the US on this and there are proposals to extend this to the UK). Florida (2002) argues that localities that attract 'creative' people will be the centres of wealth generation in the future as the economy increasingly is based upon knowledge and the exploitation of ideas. This core of key economic actors are "people in science and engineering, architecture and design, education, arts, music, and entertainment, whose economic function is to create new ideas, new technology, and/or new creative content." So the ability to attract such people, including quality

of life factors relevant for such core people will be increasingly important for economic prosperity. However, this perhaps underplays the importance of the globalisation of work (e.g. transferring software design to India), underplays the creativity in good management and production of existing industries). Informal networks from former university friends etc. can help convince key staff to come to an area.

Hence policies need to address these issues as well as the physical and direct business support and labour supply issues, particularly in peripheral regions with limited levels of economic development and where large historic out migration may weaken the institutional base. The relative effectiveness of regions in providing the necessary economic, social and physical infrastructure is important to maximise the opportunities presented by the existing and future industrial structure and development opportunities.

Cluster Theory and Competitiveness

The nature of business competition and co-operation in an area or region will have implications for business location decisions. The level of competitiveness of different geographical areas varies considerably. A competitive environment will allow more firms to operate and therefore attract business or assist the expansion of existing or new indigenous businesses. Good transport provision in an area will increase effective market size and competition in any given area, thus allowing a greater number of businesses to operate. Without good transport links, markets are likely to become segmented (separated) (Treasury, 2001), thus reducing competition and the potential for new businesses to enter.

The DTI (1998) defined clusters as "concentrations of competing, collaborating and independent companies and institutions which are connected by a system of market and non-market links." Agglomerations or clusters of businesses, which may consist of one, or a series of interconnected industries, may be vital to a region's ability to attract and retain high productivity businesses. Clusters attract business through the potential for knowledge transfer, increased market size and inter-industry linkages and a pool of appropriately skilled labour. Porter (1990, 1998) argues that clustering allows businesses to operate in close competition with each other, thereby increasing the competitiveness of the whole cluster (and region or economy). It also allows firms to take advantages of factors such as information flows as noted above.

Porter's model of competitiveness has influenced economic development policy in a number of countries and regions. He argues that there are four broad determinants of the competitive advantage of nations -factor conditions, demand conditions, related and supporting industries and firm strategy, structure and rivalry. Government and chance also play a role. The model argues that the inter-connectedness of economic factors influences the ability of business to compete effectively; that public policy can have positive and negative impacts; and that it is firms that compete not nations. Porter (1998, p. 80) states, "the sophistication with which companies compete in a particular location, however, is strongly influenced by the quality of the local business environment. *Companies cannot employ advanced logistical techniques, for example, without a high quality transportation infrastructure.* Nor can companies effectively compete on sophisticated service without well-educated employees. Businesses cannot operate efficiently under onerous regulatory red tape". Porter (1990) argues that a demanding home market is crucial to the development of an industry, although for different products or services the 'home' market may be, for example, at the regional, national or EU level.

However, Krugman (1994) argues that there is a danger of policy makers treating nations as large firms competing on world markets, without considering the implications or validity of this hypothesis. There has also been considerable debate over the definition of competitiveness and how it can be measured (Begg, 1999; and Deas and Giordano, 2001). According to Krugman (1994, p.31-32), the most popular definition of competitiveness is "our ability to produce goods and services that meet the test of international competition while our citizens enjoy a standard of living that is both rising and sustainable". Krugman (1996) also argues that cities, as such, do not compete with one another. They are merely the locus for firms and enterprises that compete. The groups of asset which cities develop

do not facilitate inter-firm competition, which is based fundamentally on cost efficiency, innovation, marketing and other factors internal to the firm. At best, the characteristics or attributes of locations are basic requirements, or necessary conditions, for competitive success but are not sufficient conditions.

Competitiveness has influenced policy despite limited agreement on its precise meaning (e.g. the European Commission's Competitiveness White Paper, 1993). The DTI states that capabilities are the "bedrock of our competitiveness" (DTI, 1998, p.6) and that "to compete more effectively we have to collaborate more intelligently" (p.7). The White paper also stresses, "competition is the sharpest spur to improve productivity and the best guarantee of reward for talent and innovation" (p.8). The World Economic Forum (2000, p.17) states in their *Global Competitiveness Report* "successful economic development is thus a process of successfully upgrading, in which businesses and their supporting environments co-evolve, to foster increasingly sophisticated ways of producing and competing".

The issue of competitiveness was examined in considerable depth in the report on Transport and City Competitiveness (Department for Transport, 2003b). The report highlights that although city and wider regions strive to achieve 'competitiveness', there is a lack of consensus regarding the meaning of the term and how it can be achieved. It also highlights the need to identify the role of transport in creating an attractive business environment. The report concludes that there are several competing definitions of competitiveness, highlighting Porter's (1990) model. It states that research into the direct role of transport on city competitiveness is fairly scarce, but there is a wide field examining the nature of city competitiveness and the role of transport in economic development.

In many industry sectors, for example biotech and electronics, the existence of other firms in the cluster can be as, if not more important that the provision of transport infrastructure, provided that infrastructure meets a minimum standard. This implies that policies aimed at building clusters in areas with weak industrial bases may be unsuccessful if conducted through the provision of infrastructure. Transport has a role in enhancing competitiveness, but is only one of a number of contributing factors. Policies aimed at directly encouraging other business, especially 'anchor' firms in the cluster may be a better use of resources (Karlsson, 2003).

3.2.2. The role of transport in business location decisions

This subsection aims to focus on the theory of transport-related drivers of business location. It provides an overview of literature examining whereby, and mechanisms by which, changes in transport infrastructure and costs impact upon business decisions.

To put this in context, SACTRA (1999) noted that changes in transport costs have economic effects through:

- the location decisions of firms;
- their influence on regional patterns of commerce;
- incentives to invest and to innovate;
- the commuting and migration decisions of households.

Transport improvements can influence location decisions through market and competitiveness changes, such as costs of delivery or increased reliability of logistics systems and lower costs of access to supplies; labour market impacts through access to a larger pool of labour, which might have efficiency benefits; land and property impacts arising through access to land for business development and expansion or the attraction of mobile investment (SACTRA, 1999).

Similarly, McQuaid (2000) argues that transport affects the characteristics of a location in terms of: transport costs (e.g. large low value goods such as insulation material); travel costs for staff, customers, (including tourists); time (which is becoming the main 'cost' in manufacturing according to Drucker (1990) but more specifically can be important when industry logistics are organised in a manner such as 'Just-in-Time'); risk and uncertainty (this relates to time in the sense that if delivery is

highly reliable then the time a delivery takes need not be such a significant disadvantage); need for liaison between supplier and customer; need for supplier to access market information and innovation directly in the market. Many costs are inter-related, with for example improvements in logistics reducing storage as well as transport costs, hence improve productivity, as well as opening new market and production opportunities.

There is no simple link between transport costs and distance. Transport between nodes may be cheaper than from a node to its hinterland (i.e. costs may not be geographically linear), so parts of regions (often the capitals) may not be particularly disadvantaged. Additionally the transport of people, ideas and capital may not be closely related to the transport costs of goods, yet these are crucial to the competitiveness of organisations in a peripheral region and investment to these regions. So using standard costs of transport may not reflect the costs of different industries, and even if these are weighted by industrial structure the actual costs may differ due to the particular transport infrastructure and logistics, such as return loading, and transport costs may be non-linear and subject to varying uncertainty or risk

Looking at some of the mechanisms behind these effects, investments in transport infrastructure can have a direct economic effect by reducing transportation costs for firms and increasing the effective size of regional and local markets. This in turn creates new growth opportunities for successful companies and increases the attractiveness of an area to new businesses. The Treasury (2001) state that falling transportation costs may allow some economic activities to move to lower growth regions, as this enables firms to reorganise and outsource certain aspects of their production to take advantage of lower costs of production in peripheral, low-wage regions.

3.3 Empirical Evidence

This section examines more recent empirical evidence drawn from a range of reports and academic studies. It examines the empirical evidence for the relative importance of factors that influence business location, and the specific role of transport within these. These are often behaviouralist type studies, asking businesses what factors influence their choices.

3.3.1 Drivers of Location

As stated in SACTRA (1999), firms have to determine the availability of a suitable labour force at an appropriate cost as part of their location decisions. Firms may choose a location based on the cost and quality of labour, and market accessibility, balanced against other transport costs. The AA/CBI (1998) survey of local authority economic development officers indicates that issues such as the availability of suitable sites and a skilled workforce are as important as transport, if not more so, to investors when they choose where to locate.

Cushman and Wakefield (2002) reported on London being voted the top European trading location for business by the European Cities Monitor 2002, based on the views of senior executives from over 500 European companies. The ranking was based on a broad range of issues. These included all the communications factors and the availability of qualified staff, which, for the first time, was seen as the single most important factor in deciding where to locate. London was rated first in seven out of 12 key criteria. These were:

- availability of qualified staff;
- easy access to markets;
- external transport links;
- quality of telecommunications;
- availability of office space;
- internal transport;

- and number of languages spoken.

Another report (London First Centre, 2002) mirrors the above findings. This shows that the main factors influencing the decision to locate in the UK capital were access to European markets, London's status as a global business city, proximity of the client base, the English language, and good transport links.

Invest UK (2000) also reported on the establishment of a client service centre in Glasgow, by a major US company. The company vice-president stated that the primary reasons for locating in Glasgow were:

- the availability of a technologically skilled and customer-service-focused workforce;
- property availability at a reasonable cost was also a factor;
- the college and university systems are a definite asset to a growing company;
- and the availability of excellent public transport adds to the effective size of the labour market.

A study by the Corporation of London (2002) highlighted the importance of air travel to business in the City of London. The findings highlighted that:

- almost 70% of firms consider air services to be critical for business travel by their staff;
- 50% consider air services critical for travel by their clients to meet with them;
- video conferencing and other technologies provide useful communication aids, but are no substitute for face-to-face meetings when it comes to client relationship building.

Non-economic factors have also been highlighted as important. Studies in the UK have found that the quality of life and environment was an attraction for inward migration and inward investment, in one report 57% of executives surveyed quoted this as the most important factor in relocation decisions (Cornwall County Council, 1999). The importance of scenery in attracting investment has been noted in an extensive consultation conducted by Scottish Natural Heritage (1997), concluding that it is an intrinsic element of the package that helps to make Scotland an attractive place for inward investment. In a US survey of inward investors in North Carolina, quality of life was ranked third behind labour supply and transport as attractors (Rondinelli and Burpitt, 2000). Notably, government incentives such as tax breaks were ranked low. However, it is important to note that there may be necessary conditions (such as the profitability of the location) that may be more important than these quality of life factors. In addition, many people appear to rank their own area as having quite high quality (perhaps due to *ex-post* rationalisation).

3.3.2 The Role of Transport

Road Infrastructure

One aspect of asking firms how important transport was to their location choice is that the answers may confuse local (site choice) factors from more significant regional factors (Hall *et al.*, 1988; McQuaid and Greig, 2002). For instance, firms may say that the presence of the M4 may have been crucial to their choice of location. However, when questioned further they may say that they if their major customer relocated in another region, then they would relocate there also. Hence the Motorway is an important intra-regional location factor, but is relatively unimportant in the more significant inter-regional location choice. Many studies do not explicitly distinguish such inter- and intra-regional factors.

Halcrow Group (2002) in a case study of the M65 extension in Lancashire, used a weighted average of location determinants based on employer interviews and found that, overall, 27% of decision-making processes were influenced by factors that had some transport component. The most important factors cited by businesses when making the decision to locate at the M65 were:

- cost of premises;
- quality of site environment;
- access to customers;
- availability of suitable sized site.

The report highlights that although transport-related factors were overall less important than combined non-transport factors, they still contributed significantly to the economic regeneration of the area. What this study does not show is the interaction between different factors, for example, if there were only poor transport links would businesses consider the cost of premises at all? This is addressed in the section below on decision processes.

A study by the Welsh Economy Research Unit (1997) on economic development in Merthyr implies that improved road access has been an important factor in influencing the location decisions of recent investors. As a result, in addition to direct transport cost savings for existing businesses, there have been even greater wider benefits in terms of income and employment from new business investment. However, recent Welsh government evidence has highlighted the importance of putting transport factors in context, citing cases where labour quality issues have deterred new business investment in the valleys, despite the presence of new road transport infrastructure.

Another example is the A14 link between the A1 and M1 that is reported to have saved 30-35 minutes on journeys accessing the motorway network (Government Office for Eastern Region, 1997). Since completion of this road link, SACTRA (1999) reports that industrial and commercial development within seven miles of the road increased by 470%, although this includes expansion of existing companies. It is not clear how much of this was influenced by changes in planning policies as well as increased demand.

Ernst & Young (1996) found that congestion and the unreliability of trips adds to business costs, particularly for companies in the service sector and those serving urban areas. Although they note that through improvements in logistics, transportation unit costs have fallen in real terms over the past 5 years for many businesses. SACTRA (1999) argues that to overcome these problems, substantial investment is needed to improve the existing network in the UK to ensure competitiveness, primarily road, heavy rail, urban public transport and airports.

Transport Interchanges

McCalla *et al.* (2001) studied 196 manufacturing and wholesaling firms in the areas around eight Canadian inter-modal freight terminals - three seaports, three airports and two rail yards. They found that transportation land use dominated other industrial land use, and crucially, that linkages between industry and the transport hubs were weak, i.e. businesses in proximity to the terminals make relatively little use of the facilities and very few businesses indicated that proximity to the terminal was a primary location consideration. They found the industrial location-transport terminal relationship was indirect, business located there because of the high level of accessibility found in the terminal zones.

Accessibility and Labour Supply

The OECD (2002) report concludes that accessibility is one of the wider benefits from transport infrastructure investment, and that improvements in accessibility can increase the market size for labour. This finding is backed up by Trinder (2001), who argues that this may be due to reductions in job search time, cost and accessibility (e.g. convenience, comfort, reliability and safety of travel). Trinder also states that although other factors such as planning and other urban policies have an effect, transport efficiency does influence the location of both firms and workers. SACTRA (1999) notes that transport affects not just labour as an input to production (commuting), but also as an input to other activities (social, leisure, etc.) that constitute the final demand for an increasing set of activities and therefore influence the market for goods and services. This will affect a business through direct,

indirect and induced demand. There is therefore evidence that the influence of transport on labour supply can be an important component of business location.

While transport is a factor in determining labour supply for businesses, there is more debate over whether labour supply itself is elastic to changes in transport. In other words, are improvements in transport in a given area likely to induce workers to move to or from that area? If not, this makes the choice of business location all the more important. SACTRA (1999) finds that in most studies carried out, transport factors were not a major influence in causing people to move either employment or residential locations, although it may influence choice of location once the decision to move has been taken. So transport may influence local moves rather than, for instance, inter-regional moves, so it is important to distinguish the different spatial scale of choice.

Trinder (2002) argues that workers may be encouraged to migrate into an area with improved transport to take advantage of lower house prices made possible by the extension of the effective commuting area, and may also be attracted by improved living conditions (e.g. larger gardens and/or house) that the transport improvements bring. This is supported by SACTRA (1999), which states that transport acts as an input to both commuting and other (social and leisure) activities.

EEDA (2000) note that infrastructure investment might alter the *perceived* accessibility of places, thereby attracting inward investment, regardless of any change in actual accessibility. This is also noted by others in relation to air and rail infrastructure (see below). They also state that transport infrastructure can play an important role in supporting industry clusters by increasing labour catchment areas and enhancing intra-area interactions. In relation to inward investment, they find transport investment to be an important factor in firms' location decisions, and therefore a useful policy for regions competing for mobile investment.

Limitations of The Influence of Transport on Location

There is further evidence that points to the limitations of transport-related factors in influencing business location decisions, which are explored further in Chapter 4. SACTRA (1999) notes that traditional approaches have suggested that because transport costs are generally a relatively small proportion of total business costs, we can expect the response to any change in transport costs to be small, although transport costs might have a larger role if we assume that they are more variable than other costs of production, thus increasing the relative their impact. However, the transactions cost to any change in transport may be too high to enable the firm to respond fully to a change in transport costs. Therefore businesses are likely to change operations in discrete steps, and it is only when certain cost thresholds are reached that it becomes efficient to the firm to revise its number or location of depots.

Ernst & Young (1996) note that fixed costs, such as terminal and vehicle standing costs, can make up a large proportion of transport operating costs and therefore improvements to transport infrastructure will reduce only the variable (i.e. transport movement) elements of cost. This implies that transport infrastructure improvements will have a limited effect on business location decisions as other factors such as land costs, vehicle purchase price and depreciation will also be major decision criteria. Indeed, SACTRA (1999) argues that it is not sensible in general to attribute any product market benefits, and hence any price/cost margin benefits, to individual road and transport schemes. In other words, transport improvements alone are unlikely to boost the market share, turnover or profitability of businesses. An exception to this is where the new link makes possible economic activities that are inherently fixed in location and for which transport costs are a significant proportion of total costs, for example, mining, quarrying, forestry and fishing. In this case transport investments may reduce costs to the threshold where it becomes commercially viable to engage in a new activity.

Lawless and Gore (1999) argue that transport, in particular public transport, is of fairly minimal importance in explaining business location decisions, with only 7% of their Sheffield case study sample of 300 indicating that public transport was a main 'push' factor in location. In this case they were considering primarily relatively 'local' (re)location. The majority of businesses in the LRT investment area indicated that they did not believe that the investment would change the amount of

business they had, and this increased only slightly in a follow-up survey 2 years later. Good road access was listed as important by over 30% of respondents; however, the study was not designed to test the impact of a new road scheme.

There is also evidence, although somewhat speculative, to support the argument that certain types of transport infrastructure development may cause businesses to relocate out of an area, especially at the micro level. For example, the Scottish Executive (2000) report highlights that many local businesses in Edinburgh blame new style bus lanes for a decrease in turnover, mainly due to parking restrictions. Similar concerns have also been raised regarding congestion charging. And this point is also raised by the STAG report (Scottish Executive, 2001).

3.4 Conclusions and Some Questions Arising

There is a wide body of knowledge stretching back to the 19th Century outlining the theoretical transport-related drivers of business location, taking into account a range of economic and non-economic theories. This initial review indicates that transport is a factor in business location decisions but is neither the only, nor the most important factor. There are cases where the linkages between transport investment in isolation and industrial location appear to be weak, or indirect. However, there is strong evidence to suggest that while not sufficient, adequate transport may be a necessary condition for business location. Of fundamental importance is the need to distinguish the influence of transport on long distance (re)locations (e.g., long distance intra-regional, inter-regional or international), and relatively local business location decisions where transport infrastructure changes are likely to be more influential.

It is therefore important to address in more depth the following questions regarding the precise relationship of the nature of the linkages between transport and business location. In other words, there is a need to 'unpack' the role of transport in determining business location in different circumstances.

Because the factors influencing location are inherently dynamic in nature, theories that ignore them, or treat them as static, are likely to be incomplete. Some of the questions that are raised help form the basis of our literature review in the following chapter. In particular the following factors influence the relationship between transport and business location decisions:

- Changing business organisation due to changing circumstances, globalisation and complexity, including the role of logistics to business location, technology and transport provision and requirements.
- The spatial scale that the decision is taken at (international, national, inter-regional, intra-regional and local) including the merits of different regions.
- Firm characteristics (e.g., size, sector, ownership, function).
- The issue of growth versus redistribution, i.e. do transport investments generate new activity or merely cause relocation of existing activity? This is strongly linked to the scale of the analysis, as inter-regional moves may be considered as growth for one region, but redistribution at a national level.

In summary we can say the following.

- The evidence suggests that transport is a necessary, but not sufficient condition in determining business location. Other factors such as a skilled and/or cost of workforce, the quality of the local environment and cost of premises have been shown to be equally, if not more important when considered in isolation.
- Research has also shown that climate, business environment and government assistance may be magnets for business location.

The Importance of Transport in Business' Location Decisions

- When combined with other measures, such as up-skilling, and integrated into part of a business development programme, transport can help to influence location.
- The evidence for road transport alone to attract business is mixed, however. Road investment is unlikely to compensate for poor quality labour and some research suggests road building can have negative effects in certain circumstances.
- Research indicates that business clustering around transport interchanges is a result of the generally high levels of accessibility found in such areas, rather than the interchange itself.
- Air also appears to be important in promoting the perceived accessibility of an area - a function that motorways can also perform in some circumstances.
- Good transport links can increase the supply of labour in an area directly through easier access to the workplace, but also through increasing the attractiveness of an area to live.
- Transport costs are often a small proportion of firms' total costs and make little or no contribution to fixed costs. Also businesses change location in discrete steps. Hence (re)location responses to changes in transport costs will occur only after a substantial cost saving threshold has been reached.
- Transport infrastructure is likely to be relatively more influential at local levels of (re)location than at broader levels, where other factors may be relatively more significant.
- Evidence implies that informal networks among retail businesses may currently allow them to circumvent planning regulation when locating.

4. The Role of Transport in Business Location

Chapter 4 provides a review of evidence on the effects of different factors on the role of transport on business location decisions. In order to assist in identification of issues relevant to current policy issues, summaries are separated according to: Air Transport and Infrastructure; Strategic Networks; and Localised Networks.

It is divided into six sections considering the influence of transport according to: changes in business organisation; firm characteristics; labour supply, travel to work and social inclusion; spatial scale; growth versus displacement; and conclusions.

4.1 Changes in Business Organisation and Technology

Summary

Air Transport and Infrastructure

- Air transport has had a key role in facilitating globalisation, through reducing travel times and cost and increasing accessibility to markets and supply chains.
- Businesses most dependent on air transport have a requirement for rapid goods delivery and for international business travel.
- Research indicates that the most important factor governing whether a company needs to be near an airport appears to be the degree to which it is involved in multinational trading or contacts.

Strategic Networks

- Changes in world markets and the increase in globalisation have led to increasing complexity in business structures. Tighter delivery and stockholding through practices such as Just-in-Time (JIT) and an increasing demand for added value in components have all increased the logistical demands of businesses.
- The increasing demand for transport firms to become involved in pre-assembly (and adding value to components supplied by, for example, sorting and packaging them) has led to changes in the location of depots, and consolidation of these.
- Multinational Enterprises (MNEs) have increased the complexity of their operations while using outsourcing to reduce their own internal transport provision (and their own internal production).
- This has changed the relationship between suppliers and consumers of transport services. In particular, more businesses are becoming reliant on externally contracted transport services, who can offer lower costs through economies of scale and scope in both transport and other services (e.g. pre-assembly as discussed above).
- As a result, it is the impact of transport upon freight businesses, as well as on actual final manufacturing or service firms, that is becoming increasingly important. The existence of networks of these freight companies is becoming more influential in business location, with hub locations of such firms (e.g. the East Midlands) becoming more attractive. Competition between countries and regions to host such hubs may increase.
- Global sourcing may lead to the consolidation of suppliers in fewer locations.
- Cost, speed, reliability and the quality of links between firms and suppliers/customers are important.

Localised Networks

- The emergence of 'City Logistics' - centralised delivery to the city edge combined with local scale deliveries within the city - is likely to lead to a shift from large to small business premises within the city area.
- The emergence of Information and Communication Technologies (ICTs), particularly teleworking, may have the potential to reduce business location dependence on proximity to the labour market. However, evidence examining transport substitution rates suggests that this potential is limited. Studies have shown teleworking may reduce conventional commuting by between 1 and 8%.
- In addition, ICT developments can increase business' reliance on physical transport infrastructure by facilitating automated and fragmented production and increased geographical separation.

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4.1.1 Introduction

The interaction between transport provision, business and infrastructure is an established element of the production cycle. As the markets for production and consumption develop, so do the demands on transport provision and use. Recent changes in business organisation and structure are affected by a range of factors ranging from an increased reliance on a global marketplace and new technologies, especially ICT, to local and intra-regional issues of access to retail services. Similarly transport provision and the nature of the relationships between the supplier of transport services and the consumer has developed. This is in part as a result of the changes in the global marketplace, and in part as a driver of the decisions that allow for the development of wider market opportunities.

Transport of raw materials, semi-finished goods, and products between points of production and consumption forms the basis of the supply chain, while further elements of retail consumption include consumer access to goods and services.

Theoretical approaches (see Paelinck and Kulkarni, 1999) relate spatial location to systems, including those of production, in which movement of goods and people is a function of distance, cost and need. Classic theories (see Von Thunen; Alonso; and Lösch) provide relevant concepts of distance and cost equilibrium within which the role of transport can be clearly identified.

Complex business structures have emerged as a result of changes in world markets, the emergence of global corporations, and increasing expectations of suppliers. The development of world and regional markets in turn increases dependencies on the transport infrastructure facilitating movement.

Outman (1975) identifies three areas of this relationship, economic activity, demographic activity and transportation facilities. As the nature of business develops, so the demand and need for transport services change, but so do demands on the workforce. This in turn impacts on the use and needs of personal transport. Shared commercial and personal infrastructure (e.g., Highways) can be impacted upon by either transport form, the one impacting upon the other. Equally, developments in the provision of transport services, their reliability and the perception of accessibility all play a part in the location decisions of the company, its suppliers and consumers of its product(s).

Transport is not a separate element in business decision-making, but an integrated and vital component of the logistics of operating a business, impacting upon and influenced by changes in the business, business economies, location specific demographics and existing travel patterns.

4.1.2 Changes because of globalisation

Change in the structure of businesses is an inherent facet of the business economy. Recent changes range significantly from an increased reliance on a global marketplace, to local and intra-regional

issues of access to retail services. Similarly transport provision and the nature of the relationships between the supplier of transport services and the consumer has developed. This is in part as a result of the changes in the global marketplace, and partly as a driver of the decisions that allow for the development of the wider market opportunities.

Gillis and Casavant (1994) observe a shift in manufacturing and secondary industrial markets from own account to contracted and third party service provision, i.e. an increasing reliance on the use of externally contracted services. In transport terms, this is witnessed by the growth of the logistics and total distribution providers including express freight and logistics services companies. Economies of scale achieved within the transport sector by logistics providers act to reduce the costs of provision of the transport element of a business, together with increased complexity and benefit of using Intelligent Transport Systems (ITS) in the delivery of the logistics 'product'. UK High street retailers including Marks and Spencer and Sainsburys regularly contract a majority of their distribution functions to third party suppliers, although Sainsburys maintains a small number of own account transport distribution facilities.

Key to the increasing globalisation of industry is the provision of quality air transport. Air services have a vital role in reducing travel times, increasing accessibility and therefore improving economic efficiency and productivity. Critical factors in companies' decisions to locate near an airport include the need for rapid delivery of products (air freight) and for international business travel. Airports serve an important role in attracting inward investment, particularly from overseas, help to stimulate and sustain the growth of local businesses by opening up new markets and supply chains. Of course of particular importance for air transport is the level of services provided (e.g. direct flights to relevant locations at suitable times or good inter-connections) and surface access as well as the actual physical infrastructure.

Businesses in computing, software, research and development, biotechnology and some food manufactures as well as the banking, finance and insurance are heavily dependent on air freight and air services. However, research has shown that *the most important factor governing whether a company needs to be near an airport appears to be the degree to which the company is involved in multinational trading or contacts* (Smyth, 2003).

Airports can promote the 'clustering' of businesses, whereby a number of interlinked manufacturing and service activities are concentrated in one place. Airports are frequently the focus of 'clusters' of businesses serving the aviation industry directly or requiring easy and frequent access to air services, and to freight-orientated businesses and business parks. Companies in many clusters are directly related to air-dependent services, such as aircraft maintenance or the manufacture of aeronautical parts. Wider clusters may develop of industries dependent on frequent air transport such as business services and high technology manufacturing. Additionally smaller, more localised clusters of businesses may develop in areas such as catering, cleaning and security that may provide accessible employment for local people.

4.1.3 Transport of goods as an element in the supply chain

McCann (1998) notes that transport costs are only part of logistics costs, estimating this at between 10% and 30%. He concludes, "Transport costs, although central to classical location theory, are empirically of very little significance in explaining overall costs faced by firms."

Having said that, it is important, to examine where and how transport fits in to the logistics process, as other transport factors such as timing, reliability and perception of cost can be as important as cost itself. Movement of goods both upstream and downstream of elements of the manufacturing process has become typified by inclusion within the wider production process. The transport elements of the production become internalised to the costs and pressures of the wider supply structure. Tighter control of delivery and use of stock (Lai, *et al.*, 2003), Just In Time (JIT) practices, and a demand for added value in components (part finished and partial component assembly) increases demands on the logistics elements of the supply chain.

Possibly as a result of this, the way transport and logistics companies operate has developed with a reappraisal of modal combinations. As an example, traditional rail using industries, such as the Royal Mail have moved in a large part to road and air transport. Speed of delivery and distance attainable are improved, benefiting from the faster mode(s), while facility requirements change as a result.

Transshipment points between the old and the new infrastructures may be required, introducing a further element of potential delay and costs. Transshipment and the accuracy of information exchange may be a particular issue (Fuller-Love, and Cooper, 2000) where third party facilities are used, airports, shipping terminals and/or railway services handle many differing operators shipments and may add delay (Vis and de Koster, 2003) in the total logistics chain.

Demands placed on businesses and supply are also changing, in line with increased accuracy and flow of information, and in terms of consumer expectations. Multi-national and large firms have maintained and increased the complexity of their operations while reducing own account transport requirements, while many smaller sized companies have developed around geographical and technical clusters resulting in changed demand and reducing costs of transport provision. Ellison and Glaeser (1997) observe that the presence of one firm in a location reduces transport costs for subsequent firms and this forms a driver for geographic concentrations.

There are also secondary transport influences that impact on the reliability and costs of transport within the logistics chain. ITS and communication systems have impacted on the perceived and actual reliability of the transport element (Groodvahl and Hill, 2000). Ability for customers to track and trace products in real time improves the reliability and reduces the need for stock holding, while internet and automated ordering and customer handling reduces the costs of provision. The Financial Times (09.01.2003, companies and markets) compares the cost to YellowVan Trucks, a US contract hire company, of 6 cents (US) for electronic orders to US \$1.50, for traditionally manned enquiries.

4.1.4 Further development of logistics 'models' and changing impacts upon transport.

Role of transport firms in location.

As firms increasingly outsource transport services, it is the impact of transport infrastructure upon freight companies, rather than actual manufacturers or service companies (Horner, and O'Kelly, 2001), that becomes key in many circumstances. For instance, a firm may not be concerned with transport as once the goods leave the factory it is up to the freight company to deliver. So the unit of analysis may most appropriately be the freight companies and their networks, economies of scale, scope etc. (and it may be these economies of scale, scope etc. of the freight companies that may influence overall transport costs in a region, rather than the simple transport costs of a single manufacturer). The existing, and potential, networks of these freight companies may then be a necessary, but not sufficient, condition for a firm's location.

Widening role of assembly and transport

The changing pattern of logistics especially (but not solely) in manufacturing has potentially profound implications for the role and impact of transport upon employment location (consumer service companies are also greatly affected by logistics changes but front line premises are more dependent upon the best customer location, although warehousing may be affected by logistical changes). Taking logistics to mean the management and flow of inputs through an organisation, then the operation and control of logistics is undergoing change. Just-in-time production has been used for some decades (some argue that its original introduction was based upon Japanese firms trying to reduce the cost of inventories (Arnold and Bernard, 1989), and not to do with transport *per se*). Just-in-time does not necessarily imply close geographical proximity between supply source and customer, but rather factors such as certainty and precise timing of delivery. The increase in 'Build-to-order' products or requirements for rapid adjustments to changing sales, often on a national or supra-national scale, (e.g. many computers are built to a particular customer's specification, with possibly only one plant servicing the whole of the EU) suggests that supplying and transporting components needs to improve in terms of speed and flexibility. Also increasing emphasis is given to small batch deliveries to dispersed customers (emphasising the importance of access to delivery company hubs). Further moves

have been made to reduce storage and other inventory costs and also, importantly, administration costs, through delivery direct to the production line, so that inputs do not need to be stored, but also they do not need to be (for instance) counted as any shortfall or surplus of inputs will be identified at the end of the production process. Strict quality penalties can also further transfer risk and obligations to the suppliers.

Increasingly this has moved even further with suppliers responsible for pre-assembly (including packaging) of components, so a partially assembled component is delivered to the production line. In addition many firms have been moving towards global sourcing (Minner, 2003), so only one (or perhaps two to avoid over-reliance) firms needs to supply components, or services, globally. This can force smaller firms into difficult choices (e.g. one Scottish firm had to decide whether to set up a new supply centre in California as its main customer in Scotland had moved towards single global sourcing. This involved important risks for the firm, but if it did not expand overseas, it would lose a major customer). This trend could be moved to dealing with other inputs such as staff, where a subcontractor may be responsible for ensuring that a particular function is provided for within a wider 'production process' (i.e. an intense form of out-sourcing).

This may have profound impacts upon transport and transport firms. First, increased speed, reliability and certainty of transport links between firms and suppliers, and firms and their final customers, is increasingly important. Also transport firms may have to get increasingly involved in the pre-assembly of components (or assemblers/suppliers need to become more involved with transport services). This is likely to influence the location of their depots and possibly the merging of depots and assembly functions. In either case this should affect the location of employment. The global sourcing also forces firms to reorganise their entire firm and distribution system and leads to consolidation in the freight industry and an increase in assembly.

4.1.5 City Logistics

Taniguchi *et al.* (1999, 2001) introduce concepts of city logistics - *a process for totally optimising the logistics and transport activities by private companies in urban areas* - as complimentary to the development of the city structure. The concept of centralising delivery functions to the city periphery and providing local scale deliveries within the city, will also impact on the ability of the city scale to compete for larger business locations. The concept is, however, a positive drive in environment and access for city users in other areas of activity and may provide a longer-term benefit to location of SMEs.

4.1.6 The Role of Changing Technology in Business Location

There has been a considerable amount of research, stretching back several decades, concerning the potential for changing technology, in particular the implementation of Information and Communication Technologies (ICTs) to facilitate 'e-working' or 'teleworking' from remote locations. Arguments by Weber (1909, 1929), Castells (1993, 1996) and Cairncross (1997) have suggested that the rise of technology will diminish the importance of business location as communication over distance becomes easier.

ICTs can also lower costs of communication and can lead to improved efficiencies in production and logistics. Implemented in parallel to the development of traditional transport services, ICTs have had an impact on location and transport choices and this is expected to increase.

E-Working

Huws and O'Regan (2001) define eWork as: "any work which is carried out away from an establishment and managed from that establishment using information technology and a telecommunications link for receipt or delivery of the work".

A study by the European Commission (2002) highlighted the results of the EU EMERGENCE project which showed that under current technology, approximately 10 million new e-workers are likely by 2010, however, if changes in technology continue at the current rate, this is likely to reach 27 million

by 2010. The study found that the most common forms of eWork have become use of remote offices, such as call centres, and employment of multi-locational workers, rather than fully home-based eWork. The study found that the single biggest (and most rapidly growing) sector is outsourcing driven by the search for technical expertise, cost and quality.

Huws and O'Regan (2001) identified eight factors that appear to influence eWork location:

- relative service sector salaries
- graduate availability
- language
- time zone
- telecommunications infrastructure
- trust or previous contact
- internet literacy
- economic development and 'openness'.

Studies have shown that workers in lighter industries are more able to engage in e-work, i.e. telecommute, work from home or split work between locations, (Graham, 1998), although Corporation of London (2002) notes that video conferencing and other technologies provide useful communication aids, but are not a substitute for face-to-face meetings when it comes to client relationship building. E-work can also involve the outsourcing of work *en masse* to remote locations, for example, to take advantage of low rates of taxation and/or labour costs. A commonly cited example would be the outsourcing software production to India and business services to the Cayman Islands.

There are, however, arguments as to the extent to which of e-work can influence location and substitute for conventional travel. Huws and O'Regan (2001) argue from the results of an empirical study that the skills of the workforce and technical expertise in a region are the most important drivers of location and that this leads to a clustering of similar firms. They argue that transport factors play a minimal role; therefore the potential for e-work to influence location through substitution is limited. A study by the Home Office Partnership & Hague Consulting Group (1997) estimated that uptake of teleworking in the Cambridge area could result in traffic reduction of between 4% and 8%, mainly in the morning peak, which is a significant but modest figure. A similar study by Amárach Consulting (1999) estimated traffic reduction figures from telecommuting in Dublin to be around 1 to 1.5%.

The above figures are disappointing and suggest that there may be factors limiting the expansion of telecommuting. A report by HOP Associates (2000) states that problems expanding telecommuting result partly from an industrial age culture, i.e. an inherited model of work that involves belonging to a company, having a designated workplace and commuting. Other problems identified were social isolation, quality issues, and lack of employer support.

Technology, Production and Logistics

Freeman (2002) states that ICTs have had a significant impact on the location and transport choices through lower costs of communication and can lead to improved efficiencies both in terms of production and in terms of logistics. This does, however, vary dependant upon the nature of ICT application. In addition, evidence from Greenaway and Nelson (2000), and Venables (1998) implies that changes in the firm, use of automated production, differing patterns of labour forces, and fragmentation of the production process has increased the need for carriage over distance in some elements of the production process, and led to the development of new trade theories.

4.1.7 Conclusions

What we know

- Changes in the operation of business and markets, particularly increasing globalisation, have increased the complexity of business operations.
- This has changed business' transport and logistics requirements. One consequence of this is that more transport services are being externally contracted, but also these external transport firms are increasingly carrying out assembly functions. This can lead to changes in location and merging of depots.
- As a result, it is the location of specialist logistics firms that may increasingly attract other businesses. Transport has an increasing influence on these specialist firms but less influence on manufacturing and service firms.
- Partly due to the above, the presence of other firms in the same sector can lower transport costs for a business and increase the attractiveness of a location.
- Air transport has a key role in the increasing globalisation of business and increased European integration, due to firms' requirements for rapid goods delivery and international air travel.
- Air transport is an important factor in attracting global inward investment and local and regional clusters of businesses.
- Businesses involved in multinational trading, or with multinational contacts, are most likely to be dependent on air transport.
- The development of city logistic techniques may increase the attractiveness of CBD locations.
- Changes in technology have led to outsourcing of work (including services) to remote locations often in developing countries.
- The impact of telecommuting has so far had a relatively small impact on business location, although there is increasing relocation of service as well as manufacturing functions abroad.

What we don't know

- The full influence of transport infrastructure and management on the location of international and national distribution companies.
- The extent of the influence that networks of freight companies have on location decisions of other business.
- What are the significance of transshipment and information-exchange costs (time and money) at transport hubs?
- The increased demand for pre-assembled components has placed greater demands on links between suppliers and customers. However, to what extent is the merging of assembly/supply and transport functions influencing the location of their depots?
- Will the role of telecommuting expand to influence physical commuting and location decisions?
- How does the distribution and services provided (e.g. flight destinations) of the airport system influence business location?
- Can we develop a more logistics-based model of business location?

4.2 Influence of Transport Varies by Firm Characteristics

Summary

Air Transport and Infrastructure

- Air transport is vital to Business Service firms - air transport per employee in this sector is 6 times the average for UK businesses in general.
- Air transport is of less importance to the other sectors, but still important in computing, software, R&D, biotechnology and some food manufacturing. These businesses tend to manufacture high-value, low-weight and/or perishable goods, and/or are likely to have highly mobile staff. Like Business Services, air transport primarily provides access to external expertise and face-to-face meetings.
- Research has shown that air is the most influential transport factor in the location decisions of most overseas-based business investing in the UK, and is important in attracting tourism.
- Regional air links within the UK are also important in attracting and maintaining business investment.
- Air transport is important to the perceived quality of a location, particularly when a business is unfamiliar with the area.
- There have been concerns raised about air infrastructure investment, specifically overheating of local economies (e.g. Southeast England) and subsequent wage, land and house price inflation, deterring business investment, particularly among SMEs.
- However, the benefit of air transport in regional development has been questioned, specifically that road infrastructure, labour accessibility and a skilled workforce are all more important factors in attracting business investment.

Strategic Networks

- Research has shown transport and communication to be among the most important factors affecting Business Service firms location decisions.
- Traditional location theory suggests that heavy industries usually incur the highest transport costs and are likely to be the most location dependent. However, there is growing evidence on location dependency of light manufacture and service firms - particularly road and air access.
- Research suggests that large firms' location decisions are most likely to be influenced by large-scale transport that allows international movement, and that small firms are less affected, as they will tend to subcontract out international connections.
- Motorway links are of prime importance to UK headquartered businesses investing in the UK. Air links are seen as more important by overseas-based investors.

Localised Networks

- Retail location is influenced mainly by consumer accessibility. Transport development that facilitates this access is likely to attract retail business. This has resulted in a proliferation of out-of-town retailing, accessible to the private motorist and road-based suppliers.
- Specialist retailers are concentrated in city centre locations, as they tend to sell smaller, high value goods, and have less demand for car access. Also city centres may retain agglomeration economies for specialist shops, but this may change as more retail activity is concentrated in suburban areas and also as larger shops sell specialist items. Public transport infrastructure development in and to cities will attract this type of business.
- Similarly, businesses in the tourist sector are dependent on customer accessibility. Although they are tied to specific locations, access may influence the viability of a potential development.
- High-technology manufacturing businesses often 'cluster' together in technology parks, where access to road infrastructure is important.
- However, for many high-tech manufacturing firms, transport is of secondary importance to the accessibility and proximity of staff and other firms to allow face-to-face networking.

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4.2.1 Introduction

Particular types of firms have particular needs for transport. Historically the movement of perishable goods by train increased the range of their market (Cole, 1986) and for example encouraging the development of dairy sectors in the South and West of England. Current transport speed and service levels are more evenly distributed across a wider spatial area. However differing firm types still demand differing transport provision, and are influenced differently by the infrastructure and transport operations. Nicolaidis and Dobson (1975) model clusters of homogenous populations, including industries, on the basis of common pattern of preferences.

Changes in the firm, use of automated production, differing patterns of labour forces, and a fragmentation of the production process (Greenaway and Nelson, 2000) has increased the need for carriage over distance in some elements of the production process. These led to the development of new trade theories (described in detail in Venables, 1998) and models in the 1980s including increasing distance trade barrier and market access issues. Individual sectors are also documented in terms of their dependencies on transport as a factor of production.

4.2.2 Sectoral Differences

"As we enter the age of human capital, where firms merely lease knowledge-assets, firms' location decisions will be increasingly based upon quality of life factors that are important to attracting and retaining this most vital economic asset. In hi-tech services, strict business cost measures will be less important to growing and sustaining technology clusters... locations that are attractive to knowledge assets will play a vital role in determining new economic successful regions." R C DeVol, Scottish Executive (2002a).

The above quote highlights the shifting emphasis from physical input-based location decisions to decisions based on the availability of skilled labour, as the economy moves towards high value-added service activities. However, access to suppliers and customers still remain important location criteria for many industries.

The Business Service Sector

Phelps et al. (2001) identify transport and communication as first ranked factor in choice of location for business service sectors. The Corporation of London (2002) study argues that good air transport in particular is important for attracting business service firms as average spending per employee on air services by the financial services sector is six times the average for UK business as a whole.

Figures from Chapter 2 show that financial and business services make up at least one quarter of total UK investment flows in 2001, although no long-term trend is clear. Analysis suggests that the banking, finance and insurance sectors are heavily dependent on air freight and air services (Smyth, 2003). As well as requirements for rapid delivery by air, business travel is also a critical factor in many companies' decision to be near an airport. This highlights the importance of air travel to business investment as a whole in the UK.

Retail

Retail business location differs significantly from manufacturing and industrial requirements, as it is normally the consumer that collects goods, rather than the producer that delivers them. Transport influences on location are as much to do with consumer accessibility as producer supplier requirements. Typically mass retailing has seen a move away from city centres, where access for private vehicles may be restricted, to peripheral locations where access is increased (Kawamura, 2001). The result has been a proliferation in many western economies of out of town retail centres easily accessible to the private motorist and equally to the supplier delivering goods to outlets.

However, a number of factors have developed against this trend. The UK, as with most western nations, has experienced a split between mass retail - tending to become established in 'Out of Town' shopping locations on the urban periphery, and specialist sale within the central area. What Audretsch (1998) sees as a paradox - the importance of local proximity precisely at a time where scale appears to dominate economic activity - highlights the divergent pressures on the location of businesses by type influenced by and impacting upon transport facilities and use. The city centre location is therefore experiencing a comeback, both in terms of the specialist retailer for whom mass access by private transport is not as significant a factor, and as a result of reaction against out of town shopping by consumers and legislators.

Chapter 2 highlights that the Retail/wholesale trade and repairs sector accounted for around 15% of total FDI flows into the UK in 2001. This provides one reason as to why road infrastructure is important to FDI in the UK, although the value to the economy of retail FDI is unclear as it is likely to involve substantial displacement of domestic retail investment.

Manufacturing

Evidence from Chapter 2 (Chart 1.1) shows that manufacturing investment remains an important component of overall FDI, although its relative share has declined in recent years. Manufacturing and technology industries have also experienced location specific pressures identifiable by sector. Agglomerations (concentrations) of industries, and the benefits of proximity of similar industries and their suppliers and or consumers is noticeable in different sectors. Ellison and Glaeser (1997) identify a propensity to agglomeration, in specified Standard Industrial Classification (SIC) codes, i.e. a clustering of business of a given industry in the same location. Natural propensity exists in industry types dependant on natural resources (ship building is given as an example), while benefits of reducing transport costs are often cited (Bennett, 2000) as factors in the location of similar industries in the same location. As discussed in Section 3.2.1, Almeida and Kogut (1997) argue that choice of location is particularly important to manufacturing businesses, citing Silicon Valley semiconductor manufacturers as an example. Such businesses require being located in the proximity of businesses in the same cluster to allow face-to-face networking and ensure competitiveness. In this sub-sector transport is a secondary location factor.

Light industrial and electronics sector companies appear to favour new computing parks with particular characteristics. These are often located at the periphery of the city, and in open and preserved 'green' land. Examples of this can be found in most countries, including the UK, such as Cambridge Technology Park, and Tandem (formerly Wang and Compaq) in Stirling (Markusen *et al.*, 1986; Feldman, 1994; Acs and Ndikumwami, 1998; DeVol, 1999). The location and form of these parks often leads to the production of reverse commuting from inner cities to the outer suburban locations. Also there is often a spatial mismatch between some labour tasks to company location. In terms of FDI, Chapter 2 highlights that light manufacturing in the Office, IT and communications

equipment sector accounts for only around 3% of total investment flows, although the value of this may be higher.

Gillis and Casavant (1994) highlight the following regarding manufacturing location:

- Investment in road infrastructure is a key to the location values of light industrial and commercial businesses;
- Air freight has an increasing impact on the development of some areas of manufacturing;
- Development of a regional economy should encompass parallel ICT and ITS.

Analysis suggests that computing, software, research and development, biotechnology and certain food manufactures are heavily dependent on air freight and air services (Smyth, 2003). Many of these sectors are producers of high-value, low-weight products, with an international customer base that demands rapid delivery. Typically these companies are in high-tech, 'knowledge-intensive' industries. Sectors with a high degree of research activity, such as biotechnology and pharmaceuticals, need easy access to air services, because their staff are often highly mobile and their competitive position depends on accessing external sources of expertise and information. The manufacturing sector only accounts for around 15% of demand for inter-industry air services, although much of this demand can be accounted for by the higher order activities within the sector that the regions are trying to attract.

In addition research has shown air transport links to be important for manufacturing businesses that require face-to-face meetings (Almeida and Kogut, 1997) and that the quality of air transport provision is an important determinant of perceived location quality (for example, Corporation of London, 2002)

Electronics and computing industry businesses remain the most adaptable to ICT and other electronic developments. Evidence suggests, however, that the benefits of agglomeration are significant to these industries. (Almeida and Kogut, 1997). In contrast, heavy industry is likely to incur the highest transport costs, and have the highest location dependencies. The workforce is less likely to telecommute than in lighter industry and service sectors.

Tourism

In tourism, although natural assets are fixed, transport infrastructure can influence the viability of investments that maximise the economic potential of these assets. An example might be a road leading to a mountain area that allows development of a ski resort. In addition to road access, the DfT (2001a) report highlighted the importance of air transport in tourism.

SACTRA (1999) notes regarding tourist attractions that as natural assets are fixed in location, transport costs are a significant proportion of total costs and tourism is important to many peripheral economies. It is also important to cities (e.g. cheaper air travel has permitted greater inward and outward 'short stay' and other tourism) However, transport costs in this case are borne mainly by the consumer, not the service provider. In some case slow transport may be part of the tourist experience (e.g. single track roads or ferries), but this only operates at a local level and good access to the region is still required. It also notes that there are problems in measuring the effect of transport on tourism, as the tourist 'industry' is comprised of multiple sectors. SACTRA recommends that further research be undertaken into the effects of transportation on tourism due to the importance that this industry plays in the economic performance of many fragile economies.

4.2.3 Firm Size

It is suggested that the impacts of transport infrastructure reflect the scale of the business itself. A multi-national enterprise necessarily needs to move products across national boundaries and is influenced the most by the ability to operate on a large scale internationally. This does not, however, remain the case for smaller scale companies sourcing internationally, in which international movements are often contracted to either supplier or third party. The same can be demonstrated downstream of production, in which small and medium sized enterprises are considered more likely to

contract to third parties than operate own account (Tibbet and Britten, 2003). An exception to this exists at the local urban level where retailers with a community or neighbourhood district are providing delivery to consumers, such as local supermarket delivery services (e.g., SuperValue, COOP to house etc.)

Mairel and Sedillot (1991) identify a correlation between physical size of business and scale of location, including access to raw materials for manufacturing production; historical possession and location possession for secondary industry; knowledge and concentration for technology industry. Button *et al.* (1995) in an empirical study based on a survey of 939 firms in new premises in west-central Scotland found bus links had a greater importance for large firms (probably for travel-to-work for lower skilled workers). They found that the quality of transport infrastructure did not induce firm migration but influenced location decisions once firms had decided to move.

4.2.4 Ownership of Business

Leitham *et al.* (2000) carried out an empirical stated preference study of 40 firms in west-central Scotland. They found that different types of firms (e.g. foreign inward investors, UK inward investors and local firms) varied in their views as to the importance of transport and of different modes, and of different proposed transport infrastructure investments. Specifically firm location factors were found to vary according to the origin of the firm - classified as local relocations; foreign inward investors, and; branch plants sourced from national bases.

The importance of road links to location choice varied considerably between these groups with the latter rating motorway links the highest of any of the groups of firms. In contrast, overseas sourced branch firms found road links largely unimportant, being outweighed primarily by considerations of workforce and premises. Local relocations fell into two distinct groups with respect to the importance attached to road links (between relatively important and non-important), whilst considering the other factors simultaneously.

Similarly, using different data, Button *et al.* (1995), found that there were important differences in the type influence of different types of transport infrastructure investment on firm location. Road and air infrastructure had a greater impact on inward investment than endogenous firms, (with roads particularly important for UK headquartered inward investment and airports for overseas inward investment).

Because of the importance of air transport to foreign inward investors, it is useful to examine the effects of air transport provision in more detail. The DfT (2001a) air transport study drew upon consultation with a wide range of interested organisations and individuals. The study examined, among other issues, the effects of developing air transport on business and the economy. Feedback on positive effects linked to business investment included:

- good air transport links to and from regional airports are an important factor in decisions about inward investment and location of business;
- airports brought in tourism and inward investment;
- airports boosted GDP and provided many thousands of jobs;
- airports provided arteries for trade and investment in the global economy.

There were some concerns raised regarding negative effects of air transport that could impact on business location decisions including:

- overheating of local economies in areas of high employment (such as the South East), leading to labour shortages, wage inflation, increased land and house prices;
- damage to small firms;
- road congestion;

- regional imbalance caused by concentration in the South East;
- accessibility to skilled workforce and road links, rather than air links, are more important for air links and cause less environmental damage, especially for short- and medium-trips in the UK.

4.2.5 Conclusions

What we know

- Business Service firms' location decisions are very transport-dependent, particularly related to air transport.
- Air transport is also important for many light manufacturing and research businesses, and for tourism.
- The location of foreign investment in the UK is influenced by air transport, workforce and premises, whereas domestic investment is more dependent on road transport.
- Road infrastructure is important to the location of domestic light industrial and commercial business.
- Air transport investment can have negative location impacts through increasing congestion and wage inflation in high-growth areas.
- There is evidence to suggest that the size of the firm may be proportional to the scale of the transport infrastructure that it is dependent on.
- Proximity to other businesses in the cluster is important to many, especially, high-tech, manufacturing firms.
- Many retail businesses depend on consumer access by car. This is generally maximised in out-of-town locations.
- New retail location appears to be splitting between mass retail on out-of-town locations and specialist retail in the CBD.
- Transport infrastructure provision does not induce relocation but can affect location decisions.

What we don't know

- Is there a potential long-term trend back to town and city centre retail development?
- How important is perceived relative to actual transport quality in location decisions of investors?
- The effects of transportation on tourism, particularly in fragile peripheral economies where it is of most importance.
- Which types of business can realistically be encouraged to locate in more centralised locations?
- How will the location requirements of businesses change and how will this differ between type of business?

4.3 Labour Supply, Travel to Work and Social Inclusion

Summary

Air Transport and Infrastructure

- The presence and development of airports accessible from deprived areas can create employment opportunities both directly, and indirectly through encouraging business clustering, inward investment and tourism.

Strategic Networks

- Transport improvements can increase the market size for labour and reduce the search time for job seekers.
- Increased ruralisation of business location in the UK has been attributed to the reduced need for access to large pools of labour found in conurbations. However, much of the apparent ruralisation is about movement to 'exurbs' and small towns accessible to urban areas by strategic roads (i.e. expanding the city influence as suburbs did 50 years ago, a process reinforced by jobs moving to suburbs and hence accessible from 'rural' and small nearby towns areas).

Localised Networks

- There is no clear consensus as to whether shifts in business location induce long- or short-distance labour migration.
- There is a body of evidence to suggest that suburbanisation of business location follows population movements, but also evidence to suggest that business investment cores attract residential development.
- Following from the above, there is a lack of consensus, particularly at city scale, as to whether workers relocate to follow employment or vice-versa.
- Take-up of Travel Plans/Green Transport plans in the UK has been limited in the private sector, but more successful in the public sector. This could be improved by increased Central Government guidance to local authorities, grants for surrendering parking spaces and tax incentives for work bus provision.
- Inappropriate location of business and/or poor transport provision to centres of employment and services can contribute to social exclusion. Socially excluded people may be prevented from accessing employment because they have no access to private transport or cannot afford fares or there are inadequate services and connections. This reinforces existing exclusion.
- Research has highlighted that women, lone parents, part-time workers and residents of rural areas are groups particularly at risk from transport-induced exclusion.
- Business relocation to decentralised locations can create accessibility problems for certain employees, particularly those on low wages, those dependent on public transport, part-time workers and black manual workers (in US). Improvements to transport can help solve this but decentralised locations are more difficult to service by public transport.
- Measures to reduce accessibility exclusion can include both business location and transport provision:
 - planning policy to encourage major employers to locate in urban cores and near to public transport interchanges;
 - subsidising commuting costs;
 - grants for driving lessons and/or car purchase;
 - transport improvements at a local level are likely to be the most effective.

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4.3.1 Introduction

Access to labour is often cited as the most important determinant of business location (Invest UK, 2000/2002; AA/CBI, 1998). Conversely, the location of firms and the subsequent ways they source their labour supply can also have an effect on transport efficiency and job accessibility. Because of this it is important to identify:

- how do transport factors influence business' ability to source labour?
- what are the impacts of business location on travel to work and commuting?
- does firm location and transport provision impact on the ability of socially excluded people to access employment?

4.3.2 Labour Accessibility

In this section we examine the evidence examining how transport affects business' ability to access labour supply and how this in turn can influence location.

The influence of transport on labour supply

There exists a body of literature assessing the impact of transport infrastructure on labour accessibility. The OECD (2002) report found accessibility to be one of the wider benefits from transport infrastructure investment. It stated that improvements in accessibility can increase the market size for labour, but noted that this could have positive or negative implications for the region in question (for example, if an area of high unemployment was opened up to increased labour market competition). Additionally, EEDA (2000) stated that transport infrastructure can play an important role in supporting industry clusters by increasing labour catchment areas and enhancing intra-area interactions. Bruinsma *et al.* (1997), found that road construction was beneficial to travel and perceived travel times; this would increase the effective labour supply of businesses in the area. Trinder (2001) puts forward evidence that investment in transport infrastructure can reduce the search time for job seekers, which will increase the potential labour supply for businesses in the area.

Felsenstein (2002) argues that suburbanisation of the labour supply, i.e. a movement of the residential population from the city to the suburbs, has resulted from changes in the accessibility/cost equilibrium

and is largely related to transport infrastructure. In other words transport factors do not just increase firms' access to an existing fixed supply of labour, but can be instrumental in inducing labour itself to move (Trinder, 2002). Although such labour migration has been found to be selective (Houston, 2001) with lower skilled people 'left behind'.

The influence of labour supply on location

Looking at evidence for the mechanisms by which labour accessibility can influence location, Phelps *et al.* (2001) argue that part of the reason for the recent urban to rural shift in location experienced in the UK can be explained by companies retaining a large majority of labour inputs from immediate and local vicinity, rather than conurbations. They argue some elements of an observed urban-rural shift may centre on the phenomenon of 'borrowed size' - the formation of agglomeration of firms and other factors (including labour) with similar interests. Small firms may locate in small settlements while having access to specialised labour from nearby conurbations.

Whereas Phelps *et al.* (2001) consider the impacts of borrowed scale as positive to labour production; Keeble and Tyler (1995) suggest the 'Ruralisation' of a business as an opportunity for reducing workforce size. Their study provides a review of a shift, seen as generic, of industry away from city centre locations to urban periphery and rural locations.

Felsenstein (2002) from the theory of suburbanisation (above) argues that move of population out of the centre, impacts on the move of some industry sectors to the periphery partly as a result of following the population for market share. At the city scale, the factors that impact on the residential population are driving forces for the light industrial and commercial businesses with limited barriers to movement. This finding is significant, as a disparate body of empirical evidence suggests the opposite sequence, i.e. people follow jobs. However, it is important to distinguish literature that refers to short distance migration (e.g. intra regional or within a city) and long distance (inter-regional) migration. High technology flagship employment centres such as science parks and government laboratories have been credited with producing the seeds of metropolitan expansion. Different high technology locations such as Lawrence Livermore Labs in California, the British defence establishment facilities along the M4 motorway west of London, Bell Labs in New Jersey, French government research centres in Sophia Antipolis and Federal facilities in the Research Triangle in North Carolina, all suggest major high technology clusters which lead to residential development and in-migration in their wake (Hall *et al.*, 1987; Markusen *et al.*, 1986; Catells and Hall, 1994; Luger and Goldstein, 1991).

Travel plans

A recent policy tool used by the UK government has been the promotion of Travel Plans, formerly known as Green Transport Plans. Travel Plans are basically packages of practical measures to encourage staff to use alternative commuting methods to single-occupancy cars, and to reduce the need to travel to work, or as part of work, at all. A report by the Department (DfT, 2001b) showed that the take up of Travel Plans has been limited among private sector businesses, but more successful in certain areas of the public sector. Among the findings were that:

- 24% of local authorities, 61% of hospitals and 50% of higher education establishments had a travel plan in place;
- however only 7% of the businesses surveyed had a travel plan in place or were developing one, and only 4% were considering one.

The figure for businesses is low, but the report highlighted that that 22% of businesses might be encouraged to implement a travel plan if provided with more assistance by the local authority in their development. The report concludes that there may be a case for more Central Government guidance for local authorities in helping businesses to implement plans.

The reasons for take up, or lack of take up of travel plans was also examined in the Department for Transport (2001b) report. It concluded that:

The Importance of Transport in Business' Location Decisions

- the main motivation for local authorities was to 'lead by example' - they felt that they could best persuade businesses to take up travel plans if they had one of their own;
- the main incentive for hospitals was pressures on parking space;
- the main reason for higher education establishments was to gain planning permission - those who did not develop one reported lack of funding and time to be the main obstacles.
- the primary motive for businesses was environmental reasons, and the main impediments were lack of financial support from Central Government.

The report noted that one possible method to increase the attractiveness of travel plans to businesses would be to offer employees a tax-free sum for surrendering their parking space. It was also noted that there were currently tax disincentives for companies running work buses.

Chapter 7 examines the policy implications of the findings of the literature review. It examines the policy implications arising from the areas outlined in Chapters 3, 4, 5 and 6 under a number of questions headings arising from current DfT and ODPM policy documents.

4.3.3 Transport, Business Location and Social Inclusion

Introduction

The right employment location and transport provision can have positive social inclusion impacts by connecting workers and potential workers in vulnerable social circumstances to employment. Conversely, the wrong location and/or lack of transport can reduce employment accessibility, with negative inclusion impacts. For example, the location of a bank call centre in an out-of-town location with ample car parking but poor public transport to the site will limit the employment opportunities for those without private transport. The OECD (2002) report concluded that transport infrastructure investment could have positive (through increased accessibility and mobility) or negative effects on social inclusion within a region.

The policy agenda

The ODPM (2003a) Social Exclusion Unit report highlights the importance of accessibility planning in reducing social exclusion. Accessibility planning is the co-ordinated transport, business and inclusion planning to identify those most at risk and take action to increase employment access. The report identifies the following issues;

- People may be prevented from accessing employment and services because they are socially excluded. In particular the lack of access to private transport is a barrier;
- Inappropriate location of employment and services combined with poor transport provision act to reinforce social exclusion;
- Negative transport externalities also impact on socially excluded people as they are often affected by traffic noise and pollution.

Groups at risk

Specific groups at risk have been highlighted. Hamilton and Jenkins (2000) in an analysis of secondary data sourced mainly from UK government statistics, found that poor transport limits women's employment and quality of life, as women rely more upon trip-chaining and off-peak travel (due to part-time work). They suggest that reforming public transport to meet the needs of women would have commercial, inclusion and environmental benefits. In addition, evidence shows that women can face constraints in their travel patterns, and hence employment opportunities, due to household responsibility - the 'household responsibility hypothesis' - has been advocated by Pickup (1989) and Turner and Niemeier (1997). McQuaid *et al.* (2001) found that socio-economic factors such as females, having dependent children and low education levels were more influential in

determining shorter potential travel times of job seekers (and hence the chance of gaining employment) than provision of public transport, accessibility or access to private transport.

The Select Committee on Education and Employment (1998), reported that lone parents were at a disadvantage in getting to work as only 35% have access to a car, compared with 90% of couples with children. Similarly, McGregor *et al.* (1998) found that travel problems, connected with child care, low wages and part-time work can act as a barrier to employment and that some employers also discriminated on travel-to-work grounds.

Residents of rural areas are at risk from exclusion, particularly if they do not have access to private transport (Monk *et al.*, 1999). A survey of unemployed job seekers in the north of Scotland (Lindsay *et al.*, 2003) highlighted that despite the majority of these job seekers holding current driving licences, relatively few had access to their own transport. The cost of owning and running a vehicle was cited as the main reason for this. For 54% of long-term unemployed the sample the costs associated with private transport were viewed as an important barrier to work.

Business relocation

Houston (2001) conducted a retrospective longitudinal study of firms who relocated to decentralised locations within the Glasgow conurbation. He found that when firms relocated to decentralised locations difficulties were created for certain groups of workers that could not relocate or move house, particularly lower paid and lower skilled workers and those dependent on public transport, especially women. Houston stated that improvements in transport infrastructure would partially alleviate this, however, there is a problem in that decentralised locations are more difficult to service by public transport.

Studies in the US have identified the problem of employment shift to suburban areas not served by public transport. This creates problems for inner-city residents, particularly black and manual workers (Zax and Kain, 1996). Similarly in the US, Goldenberg *et al.* (1998), in a US study of unemployed and evaluation of a project to link transport measures into employment initiatives, found that problems exist where jobs move from urban centres to outlying areas not served by public transport. This is an issue that we consider in more detail in Chapter 5.

Tackling the problem

The ODPM (2003a) report states that promoting inclusion through accessibility will involve improvements to the planning and delivery of local transport and the location of employment and key services in accessible locations. Existing planning policy guidelines are designed to promote the location of employment in accessible areas by ensuring that new business developments that employ large numbers of people are located in urban centres and/or near public transport interchanges.

A number of micro-level studies have sought to evaluate specific investments in addressing social inclusion. Grant (2001) examines the role of transport in combating exclusion in Liverpool. He argues that because of the specific nature of transport demands by each community, transport planning must involve early engagement with the community to ensure that such demands can be properly examined and realistic aspirations established. He also notes that due to the complexity of journey demands, investment in smaller-scale community-based transport projects may be the most effective solution to transport exclusion. He gives the example of flexible demand-responsive transport at below taxi cost, running alongside main line services.

Other evidence comes from Goldenberg *et al.* (1998) as mentioned above, who found that in several demonstration projects, the transportation services provided through the initiative enabled individuals to get a job or to increase work to a full-time basis. Zenou (2000) used a theoretical model based on the residence of workers relative to employment in a monocentric city and found that improving transport by subsidising commuting costs of all workers reduces urban unemployment, but increases inequality, whereas a policy of subsidising transport for only the unemployed reduces inequality but increases unemployment. Hine and Mitchell (2001) argued that improvements to transport services

can help promote social inclusion, particularly among the elderly, those without a car who live in peripheral estates, low income groups, bus users and women.

Grants for driving lessons and even towards the cost of a car have been used in the UK to reduce social exclusion caused by lack of accessibility. Stafford *et al.* (1999) found that possession of a driving licence increased the chance of finding work among men and women aged 18-24 in a UK. This may be because of travel-to-work issues, but also because a driving licence is often an essential part of an employer's person specification and/or is seen as a proxy for motivation.

Around the UK, regional airports are seen as a potential focus for local economic development and regeneration and can help to boost previously rundown areas as part of wider regeneration strategies. Airports can facilitate the generation of business clustering and help to attract inward investment and boost tourism. While the presence and growth of an airport near deprived areas is only one of a whole host of fact that can contribute to regeneration, it is nevertheless an important one for improving employment prospects and promoting economic growth in local communities. The inward investment and tourism that airports attract can also help to regenerate areas, as with the new McCausland hotel (formerly a derelict warehouse), the Hilton and Posthouse Hotels that have recently opened in the heart of Belfast.

It has been estimated that around 180,000 people are employed directly by the aviation sector in the UK and a further 200,000 indirect jobs are supported by the sector (OEF, 1999). The study estimates that, on average, 1.3 indirect jobs are created for every direct job in the aviation sector in the UK, although this will vary from airport to airport and with circumstances. Induced employment multipliers for regional airports have been produced by ECOTEC (2001). These estimate jobs not directly related to the aviation industry that are generated by the aviation sector. The multiplier varies between regions and airports, but evidence points to an average figure of around 0.3 induced jobs created for every direct job at UK regional airports.

There is also evidence to suggest that Information and Communication Technology (ICT) may be of use in order to overcome problems of social exclusion caused by lack of mobility. Examples include SACTRA (1999), which reported that telematics could substitute for journeys, facilitate initiatives such as community car clubs, provide 'on demand' special transport and improve information on public transport routes and times. Grieco *et al.* (2000) argued that ICT may be able to enhance the mobility of excluded people through: quality information and timetabling; intelligent and in-home reservation systems; on demand transport for those working unsociable hours; expanding the role of the third sector through private car use where deregulated bus services fall short of service requirements; and through the extension of car clubs to cover low income areas. In addition, Carter and Grieco (2000) note that ICT provides possibilities for breaking down gender, class and racial boundaries, assisting in delivery of the New Deal and improving the transport environment.

Conclusions

What We Know

- Evidence suggests that both changes to business location and improvements to transport can help to increase social inclusion.
- Poor accessibility can act to reinforce exclusion by limiting access to employment to those already most disadvantaged.
- Particular groups, such as those without access to private transport, the low skilled and the low paid are more at risk.
- Moves to increase accessibility are most likely to be effective if addressed at community level. Successful measures have included improvements to local public transport and grants for driving lessons.
- Business relocation to suburban and other decentralised areas creates accessibility problems and makes retrospective public transport provision more difficult.

The Importance of Transport in Business' Location Decisions

- Large-scale business relocation appears to induce population movement, whereas small-scale relocation often follows population movement.
- Take-up of Government Travel Plans has been successful in the public sector, but less so in the private sector. Increased financial support from Central Government may help to improve this.
- Investment in air transport can address inclusion, particularly through creation in indirect jobs from inward investment and tourism development.
- Investment in 'transport telematic' technology can help improve accessibility, for example through Demand Responsive Transport and improved timetabling information.

What We Don't Know

- How do the factors of transport improvements, improved planning regulations and suitable development policies effectively and efficiently interact?
- What employment potential do major developments such as airports offer to excluded groups, especially as they are not centrally located and often have poor public transport links to relevant housing areas?
- Is the urban to ex-urban shift of business caused by: agglomeration of firms in these areas; by reduced demand for a large pool of labour; or is it following population shifts? Or are other factors responsible?

4.4 Influence of Transport Varies by Spatial Scale

Summary

Air Transport and Infrastructure

- Airports and air services are important at a regional level by encouraging inward investment and industry clusters. Air services improve access to markets and suppliers and links to capital/central regions, therefore increasing the viability of peripheral regions as business locations.
- The development of regional airports can create job displacement within a region, leading to a smaller net impact.
- Air transport, and connection to it, is particularly important to the City of London due to the concentration of business service and multinational firms, but is also important for regional centres.

Strategic Networks

- Research has shown that businesses regard transport costs as less important than other factors such as marketing, skilled labour, broadband connectivity, property market, tax/exchange rates and image when making international location decisions.
- Where transport is a factor, research has shown that reliability is more generally important than speed or cost.
- Research has shown that peripheral nations and regions in Europe are not perceived to have higher transport costs than the 'core' and that businesses located there do not face substantially higher costs. However, this research requires updating and it is important to distinguish real and perceived costs.
- The majority of foreign investment decisions take place through mergers and acquisition rather than the desire for physical (re)location. This inherently limits the potential for transport to influence total investment flows.
- Where supra-national authorities (such as the EU) have influence, transport infrastructures tend to be of a higher quality, reflecting economic integration. Guidelines on business transport policies are also enforced by these authorities, resulting in less national divergence.
- There is a lack of consensus on the role of transport in influencing inter-regional location decisions. Some research indicates this is marginal, others that specific infrastructure can be beneficial.
- Specifically, much research shows motorway development to be related to regional economic development and that road improvements can increase location values to light industrial and commercial business.
- However, other research shows that transport infrastructure can only boost business investment if strategic land use planning and other required characteristics, such as a quality workforce, entrepreneurial culture and business linkages are in place. Evidence suggests that it is difficult or impossible to replicate the success of some regions through transport measures alone.

Localised Networks

- There is stronger evidence to suggest that transport may be able to influence business location decisions at a local level.
- Good transport infrastructure is more likely to influence intra-regional than inter-regional location decisions.
- Some research has found intra-regional difference in transport costs to be negligible in the UK. However, perceived differences in transport cost can still influence location.
- Transport developments have improved accessibility of suburban and ex-urban locations relative to city centre locations. This has moved the accessibility to cost ratio in favour of out-of-town business location.
- There exists speculative evidence on negative impacts of schemes such as road user charging, bus lanes and pedestrianisation schemes. However, studies have shown that these schemes are often

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4.4.1 Introduction

The geographic scale of analysis influences the apparent impact of transport and the significance of its constituent elements. Similarly the role that transport plays in providing locational advantage differs by spatial scale, type of company and time dependencies of product elements. SACTRA (1999) states the case put forward by business for transport investment, that an efficient transport network is vital to a strong economy at local, regional and national level, by providing access to labour, suppliers and customers. Transport costs can therefore influence the location of economic activity between towns, regions and countries. The needs and determinants of the relationship between business and transport vary further by the nature of spatial distribution, whether in terms of upstream input supply, distributed production or extent of the spatial distribution of consumers.

4.4.2 Linkages Between Spatial Scale and Transport

What Audretsch (1998) sees as a paradox - the importance of local proximity and geographic clusters precisely at a time when globalisation seems to dominate economic activity - and highlights divergent pressures on location of businesses influenced by and impacting upon transport facilities and use. Transport, and its influence on business location, varies by the spatial scale of the markets of production and supply. Significant are the distances required to source materials, the spatial distribution of the business itself, and the distances required to transport products downstream to customers.

Storper *et al.* (2002) identifies within trade and location theory, forces that could lead to locational dispersion (comparative advantage) or locational concentration (scale economies) in the face of global markets. Spatial scale impacts on the role and importance placed on transport in the choice of

location, while access to infrastructure will in turn impact on the competitive advantage of the location. Transport influences are addressed equally as contributors to locational advantage - a driver of globalisation, and influenced by regional business location - a driver of comparative advantage.

Fujita (1999) provides the broad picture of linkages between both approach and discipline with reference to the work of Walter Isard. An Economic Geography approach to location and spatial economy (see: Isard, 1956, 1960, 1969) defines the theory of location and space-economy, as embracing the total array of economic activities, with attention paid to the geographic distribution of inputs and outputs and the geographical variations in prices and costs. The influence of space and location are allied to the cost of locating, and implicitly the availability of transport facilities.

Cost elements are also explicit factors in the Lösch spatial equilibrium model (Paelinck and Kulkarni, 1999). The desire to minimise transport costs equates to profit maximising behaviour of the company. Scale is significant to cost and contributory to benefits in production. The needs and determinants of the relationship vary both by company complexity and geographical scale. This varies further by the nature of spatial distribution, whether in terms of upstream input supply, distributed production or extent of the spatial distribution of consumers/customers.

It is not, however, appropriate to seek a general equilibrium of production (Fujita, 1999). The prevailing concepts of general equilibrium in the tradition of Walras, Pareto, and Hicks fail to consider spatial dimensions explicitly. More importantly, the framework of such a general equilibrium analysis based on perfect competition is not comprehensive enough to incorporate the particular effects of transport and spatial costs on the distribution of economic activities in space. As the scale of production is increased, complexity of transport, and its costs increase. Extended transport chains contain monopolistic elements, reduced choice of transshipment locations, access to airports etc.

Transport supply and effective performance of the differing modes is significantly affected by the scale and distances being covered. International travel that necessarily crosses oceans necessitates particular forms of transport services, air or sea rely on the efficiencies of the port and transfer facilities typical of those transport modes, while land based international, national and regional scales are influenced by more localised factors. The following sections examine these points in more detail.

4.4.2a International Scale

Dimitrios *et al.* (2002) provides an extensive analysis of the location decisions across national boundaries. International trade issues and spatial modelling were examined by several studies, including Benson and Hartigan (1983, 1984, 1987), Stegman (1983), Porter (1984) Hatzipanayotu (1991), and Herander (1997) who employ Hotelling-type spatial models. (Spatial models recognise that distance separates households and firms and incorporate a cost in economic transactions among them.) These models add a geographical dimension to economic activity both within and across national borders in order to provide a convenient mean to examine the issue at hand. Factors that are likely to impact upon the cost and efficiency of the operation include the following.

- Availability of air and sea routes
- Transport Costs and extent/impact of competition in transport market
- Efficiencies of interchange points, perceived and actual delay
- Efficiencies of routes taken, non-stop, direct and 'hubbed' services

The role of transport

The Pidea (1984) study, reported the findings of a major survey of manufacturing businesses in three peripheral regions of Europe (Scotland, Northern Ireland and the Republic of Ireland) and one central location (the Ruhr in Germany). The study examined the role of transport costs on business location decisions and sought to determine what, if any, disadvantages were faced by peripheral regions seeking to attract business investment. The research produced a number of interesting findings.

The Importance of Transport in Business' Location Decisions

- Businesses in peripheral regions did not face substantially higher transport costs.
- Most businesses did not regard transport costs as a major factor in location decisions.
- Most businesses regarded transport costs as relatively unimportant to competitiveness compared with other factors, e.g. marketing
- Where transport was mentioned, the most important factors were reliability, with speed and cost less important.
- Peripheral areas were not generally perceived to have higher transport costs than the central region.
- Where transport *was* mentioned as a significant factor, potential shipment distance was the main determinant of businesses perceptions of transport costs.

Table 4.4.1 below shows a detailed breakdown of the reported transport costs as a percentage of turnover and the number of businesses reporting that distribution costs were the most important barrier to trade.

Table 4.4.1: Transport Cost As A Percentage Of Company Turnover

%	% All German Co's	% All Scottish Co's	% All RoI Co's	% All NI Co's	% All NI Core Co's	% All NI Perip. Co's	Companies Quoting High Distribution Costs As Most Important Barrier To Trade			
							German	Scottish	RoI	NI
6% +	15.4	15.7	26.4	16.4	4.0	26.7		25.0	6.3	42.9
4-6%	11.5	7.8	32.1	18.2	12.0	23.3		12.6	37.5	21.4
2-4%	46.2	43.1	30.2	30.9	48.0	16.6	100.0	50.0	12.5	14.3
0-2%	26.9	33.3	11.3	34.5	36.0	33.4		12.5	43.8	21.4
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Source: Pidea (1984)

Further evidence for the factors determining international location decisions includes Core Cities (2002) which seeks to identify factors which influence the location decisions of international business and concludes that London and the South East attract investment due to investor perceptions about a highly skilled workforce, broadband connectivity, a superior business property market and London's reputation as a business and lifestyle location. The report highlights factors that place UK regional cities at a disadvantage compared with their Continental counterparts:

- strength of the knowledge based economy;
- cosmopolitanism and culture;
- social polarisation;
- environmental sustainability and;
- fragmentation of governance and resource allocation.

Notable from the above list is the absence of any factors related directly to transport, although environmental sustainability could be seen as depending partly on an adequate public transport network.

As a cautionary note, it should also be recognised that the dominant proportion of FDI flows (e.g. over 80% to Scotland in 1999) are accounted for by non-contestable (in location terms) mergers and

acquisitions (Scottish Executive, 2002) and therefore transport factors are likely to be able to influence a maximum of around 20% of capital inflow decisions. In other words, the majority of inward investment decisions are triggered by factors other than the desire to physically relocate operations; therefore the potential of transport to attract FDI is limited. This does not mean that transport has no role in attracting FDI, just that the impact of transport investments is likely to be small when measured as a percentage of total FDI into a country.

4.4.2b Supra-National Scale

The supra-national scale is applied to groups of countries operating free trade areas, or with multi-national agreements for free movement within specified areas. These included the EU, EEA and North American Free Trade areas. Combesa and Linnemer (2000) observe that the development of free trade areas have impacted on the location of businesses and (partially as a result of this) led to the development of new transport priorities. *"...better infrastructures are typically developed when economic integration increases. The European Union offers a good example."*

Influence from supra national authorities, such as the Commission of the European Communities may also impact on the direction and influence of transport within the EU. The commission already provide guidance through 'Good Practice in freight transport' Such practices are seen as universal - *'...all of these approaches can be implemented by small and medium-sized enterprises (SMEs) as well as by large national and multi-national operations'* and include the following.

- Reducing the impact of each mode through cleaner engines, cleaner fuels, new fuels and in the case of road freight, energy efficient truck design
- Action on Driver training and behaviour
- Switching to environmentally friendly modes of transport, e.g. rail, coastal shipping, waterways and any of these in combination with road transport
- Reducing the actual number of vehicles running, vehicle kilometres and tonne kilometres by increasing load factors (reducing empty or partly loaded running of lorries), and
- Improving routing, utilising new information technology to maximise backloading, consolidate deliveries, sharing loads and pick-up deliveries with other companies

Examples of development of schemes under these goals include City Logistics, a co-ordinated freight transport scheme for urban conurbations. These partnerships (known as City Logistik companies in Germany) are in operation in Berlin, Bremen, Ulm, Kassel and Freiburg. The Freiburg example has several pointers to the future shape of freight transport in urban areas. The Freiburg scheme has reduced total journey times from 566 hours to 168 hours (per month), the monthly number of truck operations from 440 to 295 (a 33% reduction) and the time spent by lorries in the city from 612 hours to 317 hours (per month). The number of customers supplied or shipments made has remained the same. The Kassel scheme showed a reduction of vehicle kilometres travelled by 70% and the number of delivering trucks by 11%. This has reduced the costs of all the companies involved and increased the amount of work that can be done by each vehicle/driver combination.

4.4.2c National and Inter-regional Scale

Transport factors may influence the location of businesses within a nation state, in other words between regions of a country. Factors likely to influence location decisions include the following.

- Extent and nature of competition in transport market
- Efficiencies of interchange points
- Efficiencies of modes
- Policy impacts on transport operations

The influence of transport costs

There has been a wide body of research arguing that the role of transport in influencing inter-regional location decisions is marginal. McCann (1998) argues that most firms pay only for outward deliveries therefore the location of the supplier is not important to business location decisions within a national boundary the size of the UK. Specifically, he argues that in a market dominated by a few oligopolistic suppliers, transport costs will be absorbed by these suppliers.

The Pineda (1984) report into transport costs in peripheral areas found that regional variations in transport costs are actually very small, around 1% of sales value, and that it is *perceived* accessibility that can sway location decisions away from peripheral regions. Edwards (1975) argues that low regional variations in transport costs exist as businesses in peripheral regions are likely to have acted to reduce transport costs and are also likely to be involved in activities that involve low transport costs. However, we would question this, as industries such as fish farming and forestry are located in peripheral regions to take advantage of natural resources and both these industries involve substantial transport costs. In the case of timber the value to weight ratio of the output is also very low, which runs counter to traditional location theory.

Chisolm (1971) found that up to half of transport costs incurred by businesses are incurred by serving local markets and therefore transport costs are less of a factor in explaining regional variations in business location than has often been stated.

Transport infrastructure investment

There has also been research highlighting transport factors that do affect regional competitiveness. Regional and inter-regional access is increased by the availability of new infrastructure (Spence, 1992), particularly motorway infrastructure, which in turn alters modal split and comparative modal advantages, although Blackburn and Clay (1991) suggest that relief routes may not impact as significantly on local businesses as may be suggested. Linneker and Spence (1996) found that when the component of accessibility change which is caused by the actual construction of a motorway (in this case the M25) was isolated, then such changes are positively related to increased economic development.

Gillis and Cassavant (1994) in a study in East Washington State, USA found that the availability of good road freight opportunities is the most significant factor in the development of a location. Specifically, they found that investment in road infrastructure that facilitates increased or more efficient freight movements is a key in the location values to light industrial and commercial businesses. Also, they argue that airfreight has an increasing impact on the development of some areas of manufacturing. They note that regional development should take in to account other infrastructure facilities such as ICT.

Airports and air services are important to any region, not only because they are employers but also because they can encourage inward investment, stimulate the formation of economic clusters, provide access to markets and suppliers and increase leisure opportunities for people living there (Smyth, 2003). In peripheral regions of the UK such as Northern Ireland and Scotland they also provide a vital link to the mainland and access to London, increasing the viability of regional business operations.

Regional airports and air services can therefore be seen to affect regional economies in three ways. First, they operate directly as employers. Secondly, airports function as a catalyst for other on-site economic activities: these can be aviation related but may be businesses attracted, for example, by the accessibility of an airport. Finally, airports function as regional economic multipliers.

The Standort debate

The German Standort debate, regarding the attractiveness of a region to attract inward investment is reviewed in, for example, Brenner (2000). Brenner outlines the Rhine model (also called the German model) with the standard four party industrial relationships typified in the Rheinland automotive and Steel industries.

In this context, a goal of state policy was to alleviate spatial disparities through the 'spreading' of capital investment and population across the entire surface of the national territory. It was generally assumed, that a replication of formally homogenous patterns of industrial growth within the Länder, regions and cities would lead to balanced, sustainable growth on a national scale.

These regional programmes attempted to diversify the region's technological base by improving various place-specific economic conditions such as transport and other infrastructure, labour qualifications and production sites. These 'bootstrapping' regional policies were widely viewed as a means to establish new capacities for local economic development, to overcome technological lock-ins and thereby to counteract industrial decline.

Limitations of infrastructure investment

However, evidence suggests that there are limitations to the above argument. Hall *et al.* (1987) argue that there were a number of factors (such as market and labour access, government contracts and research funding, especially related to defence, etc.) that were supported by the combination of strategic land and transport planning, involving road, rail and air infrastructure investment that helped contribute to the M4 corridor as a successful industrial location. This could only be successfully repeated in areas that possess some of these required characteristics. In addition, recent Welsh government evidence has highlighted the importance of putting transport factors in context, citing cases where labour quality issues have deterred new business investment in the valleys, despite the presence of new road transport infrastructure.

Further evidence points to the limitations of using of transport infrastructure investment as a redistributive regional policy tool. Amin and MalMBERG (1994) note that large European urban centres such as London, Milan, Frankfurt and Paris have reconsolidated their influence by virtue of their command of finance and infrastructure. They point to the failure of 'technopoles' as a regional development strategy, suggesting that it is difficult to construct artificially the entrepreneurship and linkages that have developed 'organically'.

4.4.2d Intra-regional and local

While the evidence for the role of transport in inter-regional location decisions is conflicting, there appears to be more conviction that transport may be able to influence location decisions at an intra-regional level. Businesses may choose to locate in a given region due to a wide range of economic conditions such as labour supply, access to markets and image as described in Invest UK (2000, 2002). Factors likely to influence location decisions include the following.

- Location specific
- Historical bias in infrastructure
- Impacts of micro-level infrastructure change
- Regional and local restrictions on traffic movement

Inter versus intra-regional location

It is only when they come to make the choice of location *within* that region that businesses will examine specific transport factors. For example, Hall *et al.* (1987) found that many high-technology industries investing in the UK would not consider anywhere but South East England, and proximity to the M4 motorway corridor was primarily a factor when choosing location *within* the region.

However, there is evidence to suggest that some impacts may be neutral regardless of the scale. For example, Slowe (1981) conducted research into the impact of the cost of moving goods on businesses and found that inter and intra-regional differences are negligible in a small country such as the UK. Graham and Guyer (2000) in an analysis of passenger trends and flights in regional UK airports in the context of the 1998 UK transport White Paper found that the development of regional airports can

create job displacement within the region. This would imply that transport investments could have a small or net zero intra-regional impact.

ICT provision

As stated earlier, Gillis and Cassavant (1994) note that regional development should take in to account other infrastructure facilities such as ICT. Hughes (2001) notes that in broad concept ICTs do not comply with traditional concepts of scale, but that this is misleading. He argues there are biases and scale issues as a result of differences in the availability and implementation of ICT networks within regions, with the best facilities typically concentrated in urban areas. A current example would be the distribution of broadband internet and cable TV services, which, although spreading, is concentrated in larger urban areas and is very scarce in remote rural areas. Related to this provision, insistence on minimum numbers of subscribers by the telecommunications operators raise scale issues for small business users and agglomeration issues resulting from benefits of the technologies.

City-specific impacts: theory

Urban transport infrastructure plays a significant role in locational benefit. At the city scale, interaction is at its most acute between transport of different types and modes, private and commercial. Provision of new or redevelopment of existing infrastructure is often seen as a policy instrument in city revitalisation, with measured increases in land value (see impacts of BART; San Francisco County Report, 1986) resulting from such development.

Individual cities display distinct and identifiable characteristics. However, recent trends which have resulted in restricting capacity for vehicle movements in city centres will impact on the attractiveness of those locations for vehicle dependant retail and commercial companies. In parallel, the generic movement of population away from the city centre - suburbanisation (referred to as 'Sprawl' in relation to some US cities), and the move of some industry sectors to the periphery, either as a result of following the population for market share or to take advantage of land deals at the periphery of the city, has resulted from changes in the accessibility/cost equilibrium and is largely related to transport infrastructure.

Vaughan (1974) identifies four parameters of interaction in the urban area: the spread of homes, the spread of workplaces, the distance between the centre of homes and the centre of workplaces and the correlation between the location of a home and a workplace. Interactions between these elements are key in the identification of locational advantage at this scale.

At the city scale, the factors that impact on the residential population are driving forces for the light industrial and commercial businesses with limited barriers to movement. The impacts of spatial scale are most apparent in the choice factors that influence initial location decisions. (Immergluck, 2001) However changes in these factors by scale may produce secondary location and relocation decisions. Retail location, split by type of retail, has tended toward movement away from traditional city centres, while sector specific trends, such as financial service relocation to peripheral city locations can also be identified. Kawamara (2001) suggests limits to relocation outward in the city and notes distinct differences between the transport and logistics needs of the city centre and suburban business. Yang Zhang, Komei Sasaki (2000) examined the effects of decentralisation not only on utility level and city size but also on personal income and firms' profits.

City specific impacts: evidence

There are a number of studies and reports that have sought to evaluate the impact of specific transport investment projects at city level.

The Corporation of London (2002) study argues that quality air transport is particularly important to attract for business location in the City of London due to the prominence of financial and business service industries, where average spending on air travel per employee is high and firms in these sectors based in London tend to be more international than those based in other parts of the UK.

Knowles (1996) reviews the impacts of the Manchester Metrolink tram scheme. It is a useful case study as it provides a review of mode specific change. The scheme increased cross-city accessibility and the attractiveness of city central locations to users from the south of the city. The paper provides a tabulated comparison of location and accessibility related to business location and finds a lesser impact on business for traffic originating to the South of Manchester, where British Rail services had previously served the population more effectively than the equivalent in the North of the City. Knowles calls for a need to link light rail development to a policy of constraints on urban decentralisation, to increase the effective reach and impacts of the new infrastructure.

In contrast, Lawless (1999) and Lawless and Gore (1999) find that investment in a tram system in Sheffield has led to minimal business investment and regeneration impacts in the local area, although this is partly due to a lack of co-ordination between transport and urban planning, as identified by Knowles (1996) above.

There are examples of city-level transport investments having potentially adverse effects on business location and competitiveness. As mentioned earlier, many local businesses in Edinburgh have blamed new style bus lanes for a decrease in turnover, mainly due to parking restrictions (Scottish Executive, 2000). Similar concerns have also been raised regarding congestion charging in London and other UK cities. Goodwin (2003) reports findings of a study of city centre pedestrianisation schemes in Europe by Hass-Klau (1993) and also research by Carley and Donaldson (1997). Results indicate that retailers initially oppose such schemes, but become more enthusiastic over time, as the long run effect is often to increase footfall in urban areas. Goodwin notes that the success of such schemes is dependant on other transport and urban policies that are in place. For example, large-scale pedestrianisation in conjunction with a light rail scheme appears to be an effective combination, although the direction of causality is debatable.

Traffic Reduction Measures

A report by the Scottish Executive (2000) highlights that many local businesses blamed new bus lanes for a decrease in turnover; similar concerns have also been raised over congestion charging in London, Durham and Edinburgh, and over pedestrianisation. Gerrard *et al.* (2002) also found from a survey of businesses that congestion charging and workplace parking charging would reduce profitability, although this was an *ex ante* survey of attitudes rather than an *ex-post* impact evaluation.

City Bypasses

There is mixed evidence on the impact of town and city bypass schemes on business location. A study by Weisbrod (2001) suggests that road bypasses neither drastically reduce nor add to use of commercial premises in affected towns and cities. The resulting changes in traffic throughput can correlate to business relocation, although there is no clear data on the extent of this. However, established city centres appear to benefit from the diversion of through traffic away from the area.

Handy *et al.* (2001, 2002), examine the effects of bypasses on small communities in the US. They argue that there are both positive and negative effects, with benefits including a reduction in traffic and subsequent reduction in external costs, and development along the relief route. However, they argue that there may be a negative impact on businesses along the old route that were dependant on through traffic. The evidence for this is inconclusive. Similarly, Blackburn and Clay (1991) in another US study, argue that while the bypass of a town centre can remove externalities such as undesirable traffic congestion, truck traffic and the number of traffic accidents in the town, the economic viability of businesses located along the old route is often dependent upon the flow of traffic.

The above arguments may be less applicable to the UK where there tend to be less highway-oriented developments in small town-centres. Also Goodwin (2003) argues that traffic reduction benefits from bypasses may be short lived and are likely to generate traffic on a wider scale in the long run.

4.4.3 Conclusions

What we know

The Importance of Transport in Business' Location Decisions

- Transport costs, although influential, are not the primary business location driver on an international and national scale. Transport factors appear to become more important as we reduce the geographical scale of analysis.
- Good air transport is vital to businesses operating on an international scale and can be important in developing peripheral regions through direct and indirect employment creation.
- Quality air transport is vital for the competitiveness of 'world cities' as business locations.
- The integration of free trade areas such as the EU tends to lead to improvements in transport infrastructure. This in can increase both the mobility and concentration of business activity.
- As a regional policy tool, transport investment alone is unlikely to be able attract business enough to replicate industrial success in low-growth regions.
- The effectiveness of urban transport schemes is dependent on complementary urban development policies.
- Transport factors are more likely to influence intra-regional than inter-regional location decisions.
- Research suggests that motorway construction can increase regional competitiveness under the right conditions. This may depend on supporting infrastructure (transport and non-transport) and labour supply.
- Out-of-town locations have become more accessible to most people and have attracted an increasing number of businesses over the past two decades.
- City bypass schemes lead to growth along the new corridor and traffic reduction within the bypassed area in the short run.

What we don't know

- Up to date information on the extent to which transport links are a barrier to the development of peripheral regions.
- The extent to which regional airport developments increase or displace jobs.
- The longer-term effects of city bypass schemes on business location and traffic levels within the bypassed area.
- Under what circumstances can motorway construction increase regional competitiveness?
- Do traffic calming and pedestrianisation measures lead to an increase or a decrease in business activity? Will this vary between the short and long run?

4.5 Growth versus Displacement

Summary

Air Transport and Infrastructure

- As noted previously, the development of regional airports can create job growth but also displacement.
- The additional impact of increased air capacity is manifested through users who were previously unable to travel by air, or having to divert to a less convenient airport, and who are now offered a wider choice of destinations and frequency of service.
- However, additional air services lead to supply-side improvements that are purely additional.

Strategic Networks

- Transport-induced displacement of business from more to less congested areas is usually seen as a positive impact.
- However, state aid may be necessary to do this, and rules governing location may deter potential inward investors.
- Theory and practice suggest that investment in transport infrastructure is likely in practice to lead to the centralisation of economic activity in existing growth areas.
- The effect of transport investment may be dependent on the competitive structure of a region. Investment in a monopoly situation will bring needed competition and attract business, whereas an already competitive area may not improve and is likely to suffer from externalities such as pollution and congestion. More research is required on this.

Localised Networks

- Transport improvements that redistribute business to deprived areas at a local level can have positive economic benefits.
- As at strategic network levels, this may require aid and may deter inward investment.
- Research on train stations within cities has shown that developments must be tailored to the needs of each city to avoid displacing activity from areas with no stations.

Key References

EEDA (2000) *Infrastructure benchmarking study* Report by Steer Davies Gleave to East of England Development

Goodwin, P. (2003) *Unintended effects*, UCL Working Paper

OECD (2002) *Impact of Transport Infrastructure Investment on Regional Development*, OECD Publications, Paris

SACTRA (1999) *Transport and the Economy* Standing Advisory Committee on Trunk Road Assessment, DETR

Scottish Executive (2001) *Scottish Transport Appraisal Guidance A draft consultation document* Produced for the Scottish Executive with the assistance of Steer Davies Gleave in association with SIAS WS Atkins, July 2001

4.5.1 Introduction

The OECD (2002) report highlights the need to distinguish between overall growth and the redistribution of benefits following a transport infrastructure investment in order to avoid double counting. To expand on this, an investment in transport is likely to have two impacts on the immediate locality:

- there will be genuine additional economic growth brought about through lower travel costs, increased efficiency, extra employment and social inclusion, and the indirect and induced impacts of these;
- there will also be a movement, or 'displacement' of economic activity away from areas with less well developed infrastructure, or where investment has not been made.

In the latter case, there is no net economic benefit, *ceteris paribus*, as the activity has merely been moved from one geographical location to another. Any benefit will be dependent on the nature of the areas in question - e.g. a redistribution of activity from one group to another or from a congested area to a less well developed area will help spread growth evenly and help ease inflationary or capacity pressures.

Other prominent studies also raise this issue. SACTRA (1999) makes the point that the role of transport in influencing business location implies displacement from one area to another and therefore not all jobs created can be regarded as additional. The STAG report (Scottish Executive, 2001) argues that few transport infrastructure investments in Scotland are likely to have a net impact at a Scottish level, because they will usually induce movement of economic activity, such as business location, from one area to another.

4.5.2 Modal Evidence

Studies have highlighted the potential disadvantages of displacement. EEDA (2000) noted that investment in infrastructure is likely to promote centralisation of economic activity in existing growth areas and will thus benefit areas least in need of economic expansion. Van den Berg and Pol (1998) conducted an international comparison of 14 European cities to examine the impact of High Speed Train (HST) provision on economic development potential. They found that developments must be tailored to the individual needs of each city to avoid displacing economic activity from areas without a HST station. Graham and Guyer (2000) in an analysis of passenger trends and flights in regional UK airports, as mentioned earlier, found that the development of regional airports can create job displacement within the region.

An important point should be made regarding the additionality of investment in air transport. The provision of additional air capacity at appropriate locations has a number of important economic effects, both for the national economy and at a local and regional level. The most important economic impacts will be enjoyed by *additional* users who are able to use airports of choice rather than being diverted to other airports or not being able to travel by air at all and by all users of the airport who benefit from a wider range of destinations and more arrivals/departures. It has been argued that better air services lead to supply-side improvements that make companies in the wider economy more competitive (Smyth, 2003).

4.5.3 Is Redistribution Desirable?

It is acknowledged that it may be more desirable to induce businesses to locate in some locations rather than others (OECD, 2002; SACTRA, 1999) and this will depend partly on the nature of the areas in question. For example, there are efficiency gains to be had from inducing businesses from congested to less congested areas, and into locations such as clusters that may create net employment and economic growth. SACTRA also quotes from the ECOTEC (1999) report, noting that:

"attention has to be given to such questions as where firms might come to an area would relocate from, and where they would go in the absence of the scheme, as well as issues about the location of their competitors and markets."

The STAG report (Scottish Executive, 2001) makes the case that even at a local level, increased economic activity may have social benefits. This could occur, for example, by relocating business and employment opportunities to areas in need of regeneration. The appraisal guidance in this document is to treat such redistribution benefits as a positive impact.

A potential problem with shoehorning inward investment into more deprived areas is that this may deter potential investors from coming to a region or nation at all, and if they do it may be only with substantial amounts of state aid that could be deployed more usefully elsewhere.

4.5.4 The Appalachian Effect: Redistribution Away from Centres of Transport Investment

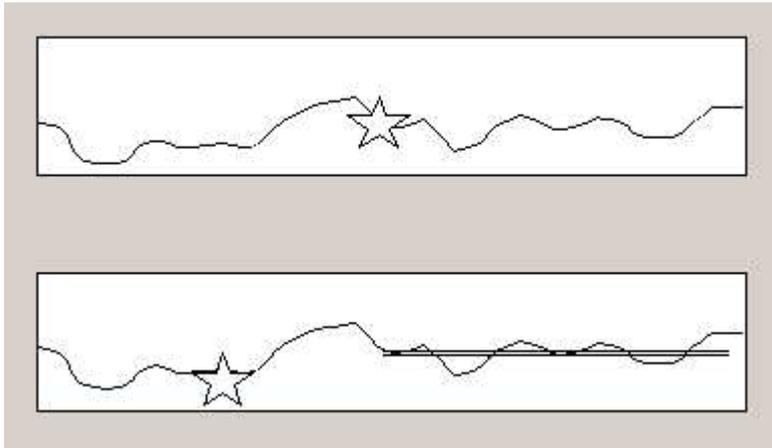
While the majority of evidence on growth and displacement involves the assessment of displacement to the area receiving transport investment, there is a body of theory and evidence to suggest that the reverse may be true under certain circumstances. An investment in transport infrastructure in a region or local area may lead to a displacement of growth *away* from that area

The 'Appalachian effect', also known as the 'Two-way road effect', takes its name from the highways that were built into the Appalachian mountain communities in the US in the 1960s and 1970s. The aim of the policy was to attract inward investment, thus helping to reduce poverty and halt population decline. In reality the highways had the opposite effect, opening up opportunities for people to leave and take up employment elsewhere, in the knowledge that they could return to their homeland for short visits. From businesses' point of view it opened up access to a new source of relatively inexpensive labour without the need to physically locate there. It also allowed outside firms to compete for the local consumer and industrial markets more effectively, leading to local job losses.

Similar effects have been noted in the UK. For example, arguments against upgrading the A1 from Edinburgh to Newcastle to dual carriageway status suggest that this may suck employment from Edinburgh and the Lothian area to Newcastle (as firms there could more effectively serve both the Scottish and North of England markets). Of course, better outward links should also allow local firms to more easily reach a larger market and achieve economies of scale etc. The M4 extension to Pembroke has been cited as another potential example.

Theoretical descriptions of this argument have been based on work by Hotelling (1929). A recent example is provided by Goodwin (2003) who describes a simplified model where a country is traversed by 1 slow road and split into 2 regions, bordering halfway along the road. Assuming that there is a population centre (and therefore a market) at either end of this road, Hotelling's theory would suggest that a rational business would locate midway along the road. However if the east region decides to build a faster road to try and bring in investment, Goodwin argues that this could lead to the business locating in the west region as time and cost will be equidistant. This is shown in Figure 4.5.1 below.

Figure 4.5.1. The Two Way Road Effect



Source: Goodwin (2003)

Goodwin (2003) also comments on the wider economic impacts of transport investment. He argues that in theory these depend on whether competition was perfect or imperfect, in particular whether prices - both transport prices and those in the economy as a whole, including wages etc. - are already well aligned with costs. If an economy is in a monopoly or oligopoly and this low competition is inflating prices, then a new investment may lower costs, encourage business investment (although possibly not in the target area as shown above), thereby increasing competition and lowering prices. However, if the market is already competitive then the investment may increase the scale of external costs (e.g. environmental costs) by encouraging transport movement with no compensating price reduction benefits. Goodwin notes that this argument is theoretical, and although it is accepted by many people, there is no clear supporting empirical evidence. We would suggest that further research is required in this area.

4.5.6 Conclusions

What we know

- New transport infrastructure may influence business location, but this can often involve displacing business from one area to another.
- This can be beneficial under certain circumstances, such as the redistribution from congested to stagnant areas.
- However, evidence suggests that transport investment will tend to displace business activity the opposite way, i.e. towards congested areas.
- The development of regional airports can create job displacement within the region.
- Improvements to air services can be considered supply side improvements and therefore genuinely additional.
- Policies to channel investment into low growth areas may deter potential investors.

What we don't know

- The extent of the 'Appalachian' or 'two-way road' effect, where new road developments suck activity out of an area they were designed to help.
- How the effects of transport investment depend on the market structure of industry in the recipient area.

- The balance between the growth and the redistribution effects of different forms of transport investment, in particular which forms yield greatest direct and indirect impact upon national inward investment and upon indigenous firms competing internationally?

4.6 The Role of Transport: Conclusion

The above evidence highlight that transport is an influential, but not the only or even the most important, reason for business location decisions. Good transport links, both internal and external are part of a portfolio of area assets that potential investors consider when making location decisions. It is also clear that the importance and effect of transport varies depending on firm characteristics, characteristics of the locality and external conditions. Most studies that we identified focused on the effects of new transport infrastructure in a before and after scenario. There appears to be much less literature examining the impact of existing infrastructure and infrastructure management.

Although specific findings are highlighted above, it is worth bringing out a number of key issues that have emerged from this chapter.

- Evidence has shown that transport costs are often a relatively small proportion of total costs, but that it is perceived costs, in terms of money, reliability and time that are equally or more likely to influence location decisions.
- Related to the above point, it is the location of specialist logistics firms, rather than transport infrastructure, that may increasingly attract other businesses. Transport has an increasing influence on these specialist firms but less influence on manufacturing and service firms.
- The location of FDI in the UK, (particularly business service and high-tech manufacturing), is influenced by air transport, workforce and premises, whereas domestic investment is more dependent on road transport.
- Measures to increase accessibility are most likely to be effective if addressed at a local level, for example improvements to local public transport and grants for driving lessons.
- Relocation of business to suburban and other decentralised areas creates accessibility problems and also makes retrospective public transport provision more difficult.
- Something that emerged as a strong finding was that the effectiveness of urban transport schemes is dependent on complementary urban development policies. Evidence suggests either policy in isolation to be less effective.
- Transport factors are more likely to influence intra-regional than inter-regional location decisions, in other words they influence the decision of where to locate within a region once that region has been chosen.
- New transport infrastructure can often involve displacing business and employment from one area to another, even within a region.

5. Land Use, Location and Transport

Summary

Strategic Networks

- There can be problems integrating national transport strategies - often stipulating demand management, with local economic development policies - often concerned with maximising economic growth.

Localised Networks

- The ODPM PPGs, along with other reports by the DfT and SEU, emphasise the need for a link between land use planning and transport to promote accessibility and reduce unnecessary travel. This can be applied to retail, employment or any major new development.
- Additionally, there are recommendations on the submission of Travel Plans, workplace-parking restrictions and park and ride developments.
- Evidence from the UK suggests that linking city light rail developments with policies on business location and urban decentralisation is vital to ensure success of both. Transport investment has been shown to be effective when this is done.
- In cases where there has been poor integration between transport and urban development planning, transport schemes have had limited impact.
- Evidence exists on improving integration between policy actors. This stresses the need for early dialogue, commitment and acknowledgement of key shared objectives.
- Similarly, research has shown that urban development schemes such as pedestrianisation are most effective when linked to transport schemes such as light rail.
- Studies have shown that some transport strategies are overly focused on accommodating transport demand and promoting modal shift to ensure local economic growth. Such policies would be more effective if land use planning was integrated as a form of demand management.
- Research has shown that effective demand management of road traffic (e.g. through road user charging) can significantly push transport onto the agenda alongside planning.
- Evidence from abroad suggests that investment in road infrastructure can reduce economic activity around rail stations, leading to urban sprawl.
- There exists some evidence that carefully targeted policies of decentralisation away from the CBD can create employment closer to residential areas, thus reducing travel distance and number of trips. However, this is only the case for high-density satellite developments with integrated public transport.

Key References

PPG11 (ODPM, 2000)

PPG13 (ODPM, 2001)

ODPM (1999) *The Economic Consequences of Planning to the Business Sector*

ODPM (2003a) *Making the Connections: Final Report on Transport and Social Exclusion*, Report by the Social Exclusion Unit

Department for Transport (2002a) *10yr plan: Delivering Better Transport: Progress Report*, 17 December 2002

5.1 Linking Transport and Planning Policies

5.1.1 The Policy Agenda

The Issue

The issue of land use planning and its effect on transport has moved up the policy agenda in recent years. Linking transport and planning policies is necessary to ensure that transport and other developments do not produce conflicting outcomes. For example, a policy of reducing car use combined with a policy to encourage new out-of-town business developments may make sense in isolation, but can have contradictory effects. In particular, with the emergence of the proposed Growth Areas in South East England, the issue has arisen as to how developments that accommodate the growth need of the region can progress while having minimal impact on traffic growth and maintaining high levels of multi-modal accessibility.

Policy Solutions

The ODPM Policy Planning Guidance notes (PPGs) set out the need for a link between land use and planning to increase accessibility and manage growth. PPG6 (cited under ODPM, 1996) emphasises the need to develop key services and retail developments in locations accessible by foot or public transport. Because of existing infrastructure these are usually town centre locations. This will have environmental, social inclusion and economic efficiency benefits.

Similarly, PPG4 (cited under ODPM, 1992a) highlights the need for centres of employment to be located in areas accessible by walking, cycling or public transport. This will open up employment opportunities to socially excluded people and those on low incomes who do not have access to private transport.

PPG11 (ODPM, 2000) states that an integrated transport policy must be one where transport policies and proposals and land use planning are integrated at the national, regional and local levels. This can increase sustainable travel as a proportion, and also reduce travel dependence. To achieve land use planning and transport integration, the guidance recommends the development of Regional Transport Strategies (RTSs). These aim to provide guidelines on: transport investment and management; strategic guidance on railways, airports, ports and inland waterways; increasing transport choice (partly through cross-modal integration); public transport accessibility criteria for new developments; off-street and workplace parking and; traffic demand management.

The revised PPG13 (ODPM, 2001) aims to ensure that transport implications of any planned new development are taken into account at planning stage. It stipulates that all major new developments should be accessible by walking, cycling or public transport. Among the recommendations of the guidance is that new developments should submit travel plans along with planning applications, that there should be maximum parking restrictions for new developments and that the planning system encourages park and ride developments.

The DfT (2002a) study recognises that transport has an important role in shaping and supporting new development, and likewise that the planning system must be able to respond to the need for new transport infrastructure. To ensure this, spatial planning and transport planning need to be closely co-ordinated. Policy linkage therefore often involves:

- Planning developments in a way that maximise accessibility and minimise unnecessary journeys and/or;
- ensuring that adequate sustainable transport is provided alongside new developments.

The ODPM (2003a) Social Exclusion Unit report highlights the need to co-ordinate transport, business and inclusion planning to increase accessibility, particularly for excluded groups. In particular, the report highlights the need to ensure that planning guidelines direct business towards accessible locations. It terms this 'Accessibility planning' - the co-ordination of transport, business and inclusion planning to identify those at risk and increase employment access.

The RTPI (2001) report into improving co-ordination between housing providers and planners, while not directly related to transport, draws some conclusions that could be applied to improving integrated working practices in any areas. The report particularly stresses the need for a closer working relationship at the pre-development stage, in other words the need to bring people on the ground together at the earliest opportunity. Key recommendations include the following.

- A commitment to change to build more constructive relationships.
- Understanding the pressures to deliver from the point of view of all partners.
- Invest 'up front' to promote certainty in relationships.
- Write down roles, responsibilities
- Meet early and often
- Both sides must be proactive
- Be constructive by adopting inclusive and transparent negotiation practices.
- Continual review of processes to allow constant improvement.
- Accept that there is no single route to best practice
- Reinforce the shared objective (in this case striving for better quality housing, but equally applicable to better quality transport or urban environment)

5.1.2 UK Evidence

Other UK evidence includes Knowles (1996), who reviews the impacts of the Manchester Metrolink, and provides a review of impacts. The paper calls for a need to link light rail development to a policy of constraints on urban decentralisation, to increase the effective reach and impacts of the new infrastructure. Knowles (1996) also highlights the need to combine transport and business location policies, in particular those designed to reduce urban decentralisation. In terms of the impact on urban central development, Knowles finds a link between the effectiveness of LRT schemes and the extent to which they are introduced along with supporting urban planning policy.

Lawless (1999), in a study of the Sheffield tram system, found that there is a problem of lack of integration between regeneration and transport providers. They found that this can limit the benefits of public transport investment. In addition, Lawless and Gore (1999) find that empirical evidence suggests that linking transport investment to city development has had limited success. The Sheffield case showed that the regeneration benefits from transport investment were small, partly due to the failure to link with non-transport planning policy.

Goodwin (2003) notes that the success of urban initiatives such as pedestrianisation schemes is dependant on other transport and urban policies being in place. For example, he notes that large-scale pedestrianisation in conjunction with a light rail scheme appears to be an effective combination, although the direction of causality is not proven.

Bulkeley and Rayner (2001) highlight the conflict between local policy agendas aimed at economic growth, and national transport and planning policy. They review the Local Transport Plans (LTPs) of Cambridgeshire and Leicester Councils, highlighting that transport strategies are too focused upon accommodating existing transport demand through additional transport infrastructure and persuasive measures aimed at modal shift away from road, rather than a more radical attempt to reduce travel demand, of which land use planning is an important component. Similar concerns have been raised by Hine *et al.* (2000) and Vigar (2001).

5.1.3 International Evidence

Priemus (1999) highlights problems in the lack of co-operation between urban and transport planning in the Netherlands, taking public transport provision in urban expansion areas as an example. He argues that the problem is an international one, and that to improve interaction between land-use and transport planning it is necessary to give public transport a competitive edge through measures such as road user pricing. This, he argues, would push public transport up the policy agenda.

Ryuzo (2000), in a study of the impact of road and rail infrastructure in Japan, highlighted the growing trend away from traditional high-density town centre developments towards US-style decentralisation of commercial activity. He identified that investment in road infrastructure in Japan is partly responsible for reducing economic activity clustered around stations as businesses relocate out of town. Felsenstein (2002) in a US study, noted the tendency for high-tech industries to locate in outer suburban areas creates urban sprawl and associated traffic and potential accessibility problems than if the same industry had located in an urban area.

Sim *et al.* (2001) review the potential for the planning strategy to develop regional employment centres outwith the CBD in Singapore. They conclude that regional centres have great potential for becoming alternative employment centres, therefore reducing commuting distances travelled and the number of trips. This will create a more sustainable approach to land use planning and reduce dependence on traffic management policies. However, they point out that this example may only be applicable to other areas of high-density development that are well served by public transport.

5.2 The Impact of Planning Decisions on Business Competitiveness

Concern has been raised over whether overly restrictive planning policies, including transport planning requirements, can have a negative impact on business competitiveness. In particular, policies to restrict business development to accessible sites as recommended in ODPM (2003a) may decrease business efficiency and in some cases may deter business investment altogether. This could have negative implications at local, regional and national level.

5.2.1 Tightening Planning Controls

Land Use Planning

Evidence for this impact is mixed. The DETR (2000) study showed that there was little evidence to suggest that council-led planning controls had lead to a reduction in new technology-based development. In contrast, research into city centre pedestrianisation schemes in Europe by Hass-Klau (1993) and Carley and Donaldson (1997) indicate that retailers initially oppose such schemes, but become more enthusiastic over time, as the long run effect is often to increase footfall in urban areas.

There has been pressure to increase the proportion of businesses (and residential) developments on brownfield sites (ODPM, 1992a; 2001). This is encouraged to promote a more compact urban form, thereby minimising demand for transport, promote urban regeneration and to conserve existing greenfield sites. The ODPM report on the economic consequences of planning to the business sector

(ODPM, 1999) highlights the following potential burdens to business associated with land use planning controls.

- The time involved in making planning applications, and in carrying this forward into permission to develop.
- Costs incurred in taking part in the plan making process.
- Costs associated with negotiating planning permission, such as planning agreements ('planning gain') and delay.

Restrictions operating on business both by the physical allocation and the permitted use of land. Research suggests this raises costs of land and rents. It can also lead to a loss of output where business operates in sub-standard accommodation, or have difficulty in obtaining premises. (ODPM, 1999).

The report concludes that hard evidence for adverse economic effects of planning on business competitiveness is tentative, but warns of complacency in ignoring business attitudes towards what may be seen as overly restrictive legislation. In addition, Gordon, in Breheny (1999) argues that restrictions on development in desirable locations is more likely to kill small business growth than to transfer it to other locations, with subsequent loss to national output.

Environmental Planning

There is also evidence on the location impacts of tighter environmental planning controls. Specifically, where transport development and scale has been seen to facilitate the export of waste. Alemdar (2002) talks of trans-boundary pollution. Waste Export is an issue in areas of strict control over waste management. It may also be an issue where waste management is charged on a commercial basis - business waste. The key example of waste management causing locational difficulty is in Germany following the introduction in 1991 of the German Gruene Punkt, and 'dual system' waste separation. This scheme, and schemes similar, are predicated on an environmental benefit, and often provide a good framework toward reducing waste. The German scheme includes restrictions on packaging, and requires removal of some materials by the manufacturer. It has reduced waste production.

The impact of waste management on business location relates to the relative costs associated with participating in the requirements of one area, as opposed to competing locations, and where the burden of waste management lies. Instances of suitability and operability of schemes may also be an issue, with potential for export of waste commercially and in some instance illegally (Reynolds, 1995). Difficulty in processing profitably within Germany led to an officially sanctioned export of waste to storage in low cost neighbouring countries.

A range of 'waste market' conditions from fully private commercial waste schemes to local authority single collection schemes will differentiate between locations, as will the level of cost and charging scheme in place. Although the German system might be seen as breaking new ground, there are other Green Point type schemes. Japan commenced its own system in 2000, requiring separation and sorting of plastics and recoverable materials. Many US states have various systems.

5.2.2 Relaxing Planning Controls

There is some evidence to suggest that the relaxation of planning controls would encourage business development. The DTLR (2002) study revealed that proposals to create 'Business Planning Zones' (a liberalised zone with limited planning restrictions) met with a mixed response. The CBI argued they would encourage business development, whereas some other consultees countered that they would encourage low quality and car-based developments. Previous similar schemes have been in force, most notably Simplified Planning Zones (SPZs) (ODPM, 1992b)

Ex-post evidence for the relaxation of planning controls can be found at Tandem (formerly Wang and Compaq) in Stirling where planning controls were overruled to encourage inward investment. This had limited success as the investment took place, as was short lived and the total number of jobs

initially predicted was never achieved. The original company left after a few years and various companies moved in and out of the site, often leaving the site unoccupied. As stated earlier, the location and form of these developments often leads to the production of reverse commuting from inner cities to the outer suburban locations. In addition there is often a spatial mismatch between some labour tasks to company location.

5.3 Conclusions

What we know

- Linking transport policy with non-transport policies (such as those connected with urban development and business location) has been shown to enhance the effectiveness of both the transport and non-transport objectives.
- Likewise, where such co-operation is absent, policies have been less successful.
- Research suggests early relationship building and acknowledgement of key objectives may help to aid co-operation.
- Transport policies that focus on infrastructure provision and modal shift at the expense of wider strategic demand management are likely to have limited success in reducing road traffic.
- Raising the profile of public transport through road traffic demand management can increase the likelihood of transport planning being put on the agenda alongside land use planning.

What we don't know

- A key concern is how might more effective co-ordination between and within bodies and agencies be achieved?
- How can more employers, especially in the private sector, be encouraged to take up government Travel Plans?
- Businesses investing in new developments are unwilling to fund transport infrastructure investments because of the uncertainty over future land prices. Where can funding for advance transport investment come from?
- Does the growth resulting from urban LRT implementation impact on the longer-term viability of centrally located businesses?
- Although we know that integrating land use and transport planning enhances transport and non-transport objectives, we do not know the direction of causality. Does transport enhance urban policy objectives, or vice-versa, or is there two-way causality?

6. Methodological Issues and Appraisal

This chapter briefly considers existing modelling techniques employed to determine the effects of transport on business location decisions, particularly Land Use Transport Interaction (LUTI) models. It then discusses the need for *ex-post* evaluation and the accuracy of existing *ex-post* appraisals. Additionally it looks at the robustness of existing evidence on the link between transport and business location - particularly in terms of data quality, scale, time period and geography.

Summary

- There are two basic ways in which LUTI models calculate the impact of land use on transport demand. The first type use measures of generalised costs or disutility, the second use vectors of accessibility to output vectors of future land use in an area.
- Quasi-dynamic LUTI models are not good at assessing the likelihood of development where none currently exists.
- The absence of a lag between accessibility improvement and activity location is a significant limitation in LUTI models.
- Limitations exist in LUTI models concerning changes in economic activity, for example the relocation of economic activities.
- There is inconsistency among LUTI models as to whether travel cost savings are passed on to commuters or employers.
- There is debate concerning the value of transport costs in determining business location, and therefore what role these should have in models.
- The existence of freight hubs and charges levied by freight subcontractors are becoming increasingly important in determining business location.
- If reliability rather than mean travel time is now the most important factor in business location, new paradigms and procedures are necessary in modelling to represent their effects.
- Evidence suggests a general need to perform more *ex-post* analysis of transport impact and appraisal studies, particularly on those reflecting current and future policy.

6.1 Modelling of Transport

6.1.1 Land Use Transport Interaction Models

Current LUTI (Land Use Transport Interaction) models are useful in modelling the economic effects of transport on business activity, but have a number of limitations.

SACTRA (1999) reports: "We think that the Department [Transport] needs to undertake an audit to determine what is the capability of the available models for the contexts in which they might be used, and then ... needs to consider the case for investment in model development. We are also concerned that the Department has very few trained personnel with operational knowledge of these models at a time when interaction between transport and location of economic activities is a live issue in the strategic policy context".

This section examines some of the theory of and issues surrounding LUTI models, the implications of these, and offers some conclusions on how these models need to be developed to address the limitations.

6.1.2 Economic Theory behind LUTI Models

LUTI models are based on a partial economic perspective on the inputs and outputs and operations of markets between various actors. These actors include residents and producers, developers and transport suppliers and also the interventionist role of government.

The principal markets within this framework are: property markets; labour markets producer markets (goods and services); financial markets; and transport markets. Transport demand can be viewed as a function of product and labour markets, producer activity and residents' travel and transport supply requirements.

Businesses as producers are engaged in a number of decisions including where to locate business investment, labour recruitment, purchasing of inputs, production of goods and services and marketing activities.

While many models are centred on transport, LUTI models are distinct through their emphasis on:

- spatial representation of producers, residents and transport supply activities
- links between transport markets and producers and residents, labour and producer markets

These models represent the main activities, which affect use and consumption of land. While there are a number of approaches in this framework, it should be noted that that the urban form of such models often do not explicitly address the movements associated with goods, while the larger geographical scale region models tend to address both passenger and freight movements.

A top-level distinction can be made between:

- optimising models focused on achieving an optimum design and;
- predictive models - which are more representative of typical real world situations, where response to design is represented.

A sub-distinction can be made within the predictive group between static and quasi-dynamic models. Quasi-dynamic models include entropy and activity based approaches (e.g. DELTA and URBANSIM) and spatial economics models (e.g. the MEPLAN and TRANUS packages).

Labour markets

Specifically regarding labour markets, there is inconsistency among models as to whether travel cost savings are passed on to commuters or employers. The MEPLAN models deal with the labour market in a central spatial input-output model calculation. This allows estimates of the number and location of households and the number and location of employees in different industries. This then allows a calculation of travel to work patterns to be made. Labour costs do not therefore influence the demand for labour (i.e. number of jobs) other than through the effect on commuting.

The DELTA model operates via a series of sub-models including one for employment status. The number of households is fixed and the number of jobs is fixed for each sector. Wages are treated as exogenous to the model. This results in employment status affecting only travel to work, although housing demand and location are influenced through income in the following round of the model. Research (see section 4) has shown that part- and full-time workers, and those with dependants, lower education levels and wages all have a lower propensities to commute longer distances or times and to use different modes. Hence to understand the links between residences and workplaces and traffic and other flows, it is important to seek to disaggregate workers, potential workers (and households) by such different characteristics.

Product markets

Regarding product markets, models such as EUNET use a central spatial input-output calculation to determine both the location of production and the pattern of trade between producers and consumers. In this model a reduction in travel costs leads to a reduction in production costs, which in turn results

in increased economic activity in an area. Similarly, the regional DELTA model uses a spatial input-output model.

The modelling process

There are two basic ways in which LUTI models calculate the impact of land use on transport demand. The first type use measures of generalised costs or disutility to produce a matrix of interactions in activity or economic units. These are converted into matrices of travel demand. With this given travel demand, travel choices are therefore mode, route and travel time.

Other models use vectors of accessibility to output vectors of future land use in an area. This can then be used to generate travel or modify existing matrices of travel demand.

Predicting Business Location

The effects of transport investment on development and business location can be modelled through three main effects: increases in accessibility and resulting planning consent; increases in perceived accessibility; and increasing the perceived profitability of development in underdeveloped areas (confidence building). However, few, if any, existing applied techniques explicitly examine the process of investment, other than the decisions of developers.

Quasi-dynamic LUTI models use characteristics of an area to predict the effects of changes in transport. These model the market for additional development and changes in land and floor space rental prices where investment occurs in a developed area. However, these models are not good at assessing the likelihood of development where none currently exists, as there are no characteristics to extrapolate from.

Business relocation is dealt with in many models through the redistribution of production and employment between areas. However, no account is taken in these models of the benefits from redistribution in terms of productivity gains.

Limitations of LUTI Models

Whilst the integrated land use/transport interaction models described above have been useful, they have their limitations. Hunt, Kriger and Miller (1999) reviewed six urban modelling frameworks (ITLUP, MEPLAN, TRANUS, MUSSA, NYMTC-LUM and UrbanSim) and the limitations they noted include:

- Most models are static equilibrium models with large time steps
- All models are zone-based, often with very large zones
- Goods movement only represented in MEPLAN/TRANUS
- All models use variations on conventional four-stage modelling systems, and so are susceptible to all the criticisms of these models

Of these, the most significant was deemed by Woudsma and Jensen (2003) to be the first, the absence of a lag between accessibility improvement and activity location. Important gaps in empirical research on the transportation/land use relationship were identified by Woudsma and Jensen (2003) to be:

- the lack of understanding of the causal links between urban form and travel behaviour;
- the lack of a common view about how to model land use response to transportation change;
- the under-representation of the movement of goods as a factor influencing the relationship.

Although choice theory is central to the development of LUTI models, in many models only a small proportion of choices are modelled explicitly. This is especially true of urban models, where production is not modelled as a function of producer choice but as a result of interaction between the

decisions of customers and developers. DELTA models tend to be more realistic than MEPLAN models in this respect.

Both the above models take similar inputs regarding residents' location choice, although they differ in the modelling process. MEPLAN models include all households containing employed residents at a given point in time, whereas DELTA models locate/relocate new or mobile households irrespective of employment status over a period of time.

Limitations also exist concerning changes in economic activity. The majority of models deal with the relocation of economic activities with fixed values for each point in time, or vary these only by marginal location change (such as the relocation of activities to "external" zones and the consequential loss of multiplier effects). However, there are exceptions, for example the EUNET application of the MEPLAN model which models endogenous increases in economic activity due to the productivity gains from cheaper transport.

Linked to the above, while the LUTI models mentioned above represent the effects of spatial changes in demand on the relocation of business activity, they do not take into account the changing spatial organisation of activities *within* firms.

Also, LUTI models have tended to focus on the behaviour of individual actors, such as residents, transport suppliers and government at the expense of analysis of the operations and features of the product and labour markets that they represent. In addition within these groups of actors there are significant differences that should be modelled if possible (e.g. difference transport patterns according to the characteristics of workers, as discussed under labour markets above). Some issues relating to these limitations are further discussed below.

LUTI Models - Conclusions

The majority of LUTI models have been applied in an urban setting, to passenger rather than freight traffic situations. This leads to emphasis is on the markets for land, transport and service industries rather than manufacturing industries.

It is important that the area modelled by LUTI is large compared with the transport impact area of the proposed scheme. This spatial requirement means that an appropriate model should always appear unusually wide by conventional transport modelling standards relative to the schemes or strategies to be examined.

LUTI models have a very limited ability to predict the degree to which road or other transport improvements can induce development in specific sites where little or no current activity exists. In order to address this a very detailed representation of the processes of development and take-up for each site within an area would be required.

We would also ask whether current land use elements of transport models could be extended or integrated to provide indications of impacts of industrial change.

There is a need to investigate more dynamic forms of model that better reflect actual business (and other) location decision-making.

In general, enhanced LUTI models must be complex and spatially very extensive compared with the projects to be examined, particularly when effects outside the immediate area are to be considered.

6.1.3 Isolating the Impact of Transport

There is a question of what methods can be used to isolate the impact of transport on business location from other factors such as the economic cycle, labour cost and quality, government incentives, planning policy.

Transport costs

The Importance of Transport in Business' Location Decisions

It has been argued that because transport costs are a relatively low proportion of total costs, transport is therefore not important in determining location. However, there are several methodological issues to be considered in assessing the value of this statement. Pineda (1984) reported that regional variations in transport are very small (around 1%) found that it may be perceived accessibility that is more important in determining location decisions. Edwards (1975) argues that small regional variations in transport costs are calculated from *ex-post* evaluations. These may be swayed by the fact that firms in areas of higher transport costs (i.e. peripheral areas) react to reduce their costs, or are involved in sectors with lower transport costs or there may be an element of *ex-post* rationalisation of previous decisions.

A study by the OECD (2002) into transport and regional development noted that although the average cost of transport as a cost of production in developed countries typically varies between 2 and 4%, this is an understatement due to hidden transport costs, including: costs of own-account transport (vehicles operated by firms to deliver their own goods); costs of petrol and cars for employee travel and; the value of the time spent travelling by staff. The report states that transport is more important to business decisions than basic cost percentages suggest, and that surveys of factors affecting business location typically give a high ranking to accessibility and transport-related factors.

McCann (1998) argues that a weakness of Annual Census of Production (ACOP) figures is that they are limited to UK freight movements and do not include the costs of moving goods to or from the UK. Edwards (1970) found that ACOP figures used at the time estimated transport costs as around 3.5% of sales value, but pointed out that this did not include final distribution costs that are usually paid for by distributors. Additionally, Edwards (1970) pointed out that a more realistic measure would be transport cost / (sales - purchases) as this would remove double counting of sales. For the reasons above, it may be that transport cost percentage figures systematically underestimate transport costs.

Another possible methodological downfall is that measuring the transport costs faced by firms as a possible determinant of location is inappropriate, as an increasing number of businesses subcontract out the movement of supplies and finished product (Horner, and O'Kelly, 2001). Firms will still have to pay for these services, but it is important that transport costs are taken to be the actual cost to the business rather than a proxy measure based on distance and/or weight and volume. From this it is likely that the transport costs faced by the *freight businesses* will influence how much customer businesses are charged, and therefore their location, although there may not be a direct relationship. However, it is also possible that location in close proximity to a freight business hub may be the overriding transport-related factor.

The methodological implications from this are that:

- more account needs to be taken of perceived transport costs, possibly involving some quantification of these;
- 'hidden' transport costs need to be measured and included;
- costs of moving goods to/from the UK should be considered;
- the cost of hiring freight subcontractors may be a more appropriate measure than direct transport costs based on distance.

Elasticities

Investment/performance/demand are not constant. The variable effects of increased transport provision and quality impact on the development of a location partly as a direct result of the increased accessibility of the location, and partly as a relative increase in accessibility in comparison with other competing locations. The feeling that investment in transport will necessarily lead to an increase in inward investment is not always the case.

From a demand side, the fact that increased demand is placed on a system will again only partially relate to an increase in the capacity of the infrastructure. This being dependant upon the ability and freedom to invest of infrastructure operators, and the perception of long term or short term demand

peaks. Examples from nationalised railways show a tendency to discourage demand through price control as a short-term response.

Given the discussion on the specificity of many transport impacts upon industrial location, it is likely to be a mistake to assume constant elasticity over time in links between transport and economic growth and associated business location. The relationship between transport and or mobility and GDP is variable and can be influenced by policy (ECMT, 2001). So strong economic growth can result in great transport growth.

The Wage Equation Issue

The way in which transport change impacts on employees and employers, i.e. the wage equation issue, is insufficiently understood. The quantification of constituent elements in the make up of a labour cost to a company is cited in some texts as its wage equation. Within this breakdown the cost of transport can be included, specifically the proportion of time and money costs allocated to accessing employment place. As the relative accessibility of a location alters, access costs change, as does the wage level necessary to attract workforce. See, for example, Manning A. (1993), Madhu and Mohanty (2001).

The wage that a worker receives is observed only when he/she is employed. The employment of the worker, however, depends on two sequential decisions: the worker's decision to work and the employer's decision to hire. Location specific costs including transport are integral to the equation as they influence the choice, and ability, of the employee to access work at an appropriate cost. Positive effects exist where access time and costs are reduced, with a potential for negative impacts where the costs and time are increased.

More empirical research is required on this matter, regardless of the modelling framework used. SACTRA (1999) states that this is an important question in relation both to projects (such as Cross-Rail) and policies (such as road pricing).

6.1.4 Urban and regional policies

A number of issues arise regarding the modelling of urban and regional policies.

The issue of whether infrastructure investment or transport policy will consolidate firms in their existing locations, or encourage reorganisation or restructuring. SACTRA (1999) states that the spatially differentiated production model offers a possibility of estimating this effect.

It is exceptionally difficult to measure the degree of embeddedness of an airport in its local economy and to assess the supply linkages and chains to the local economy and employment. It seems logical, however, to argue that smaller regional airports are much less capable of stimulating additional jobs in their regions. (Graham and Guyer, 2000).

We would ask what the impacts are of location development policies on the long-term market stability of the industrial company. This is considered in more detail below.

Location Policies and Long-Term Market Stability

The question of market stability is specific to impacts of policies on stability of industrial companies, and by extension to market segments. Policies that attract business to a location, through subvention or other incentive, act to influence the market for services, and the choices made by companies in location. Similarly policies that influence the location rather than the company will also have a knock on effect on the economics of the location for incoming investment. Various sources, see below, refer to this as dynamic macroeconomics, and employ equilibrium models to predict impacts for location, and 'best-location' for company operation.

A number of strands emerge in the literature; these concern concepts of Globalisation (Moshirian, 1998; Bates, 1996), Business Cycle (Ireland, 2003; Cogley & Nason, 1995), Market Stability and Equilibrium Modelling (DeJonga *et al.* 2000). In its global context, companies are increasingly

seeking incentives to locate in a particular location (Bates, 1996). As the flexibility of the company increases, often technology led (Bates cites Riall and Lann) so the ability to seek financial and operation incentives increases. Regions and authorities compete to 'invest' in location attractors, in some instances modelling costs and gains against other government services. (LOCI - the Location Impact Model cited in Bates provides a review of the competing demands on investment). The situation appears inherently unstable, with companies moving in where greatest incentives are offered. Moshirian (2003) talks in terms of global financial forces, and argues that a holistic approach may be required to achieve financial stability.

Business cycle research tends toward a company-based approach. Ireland (2003) sees the concept of macroeconomic stability as linked to business cycle stability. There being a link between the stability of the company, and the stability of the location. Cogley and Nelson (1995) suggesting that GNP growth appears to have a 'trend-reverting' component. Companies seeking investment, incentive and growth.

Modelling and impact assessment appears widely in the literature, and should provide a methodological basis for assessment of policy impacts. Much analysis centres on Equilibrium Modelling (Ingram and Whiteman 1994, DeJonga *et al.* 2000) identifying correlation between inputs to a 'neo-classical' business cycle model (Greenwood *et al.* 1998) and external environment, policy application and incentive. Sudden change 'shock' to the marginal efficiency of investment, as potentially resulting from incentive or change in incentive, provides a significant catalyst to business fluctuation. Greenwood *et al.* (1998) 'shocks and transmission mechanism...may be important elements of business cycles.' Guo (2003) 'a positive spending shock can lead to simultaneous increases in output, consumption, investment, employment and real wage.' A positive investment results in positive benefit, also noted in Aiyagari *et al.* (1992) are positive benefits from input, while uncertainty of incentive and fluctuation provide negative concerns and may result in movement or churn 'the impact on output and employment of a persistent change ... exceeds temporary change.'

Concerning variability, the impact of following one or a range of policies affecting business location varies by location and dependant upon external economic and productive factors. However, it is equally clear that policies attract businesses to a specific location will have an impact on the market, and may in turn affect the long term stability of the company and market sector, as well as impacting on the region / country concerned.

Areas of common and generic measures for policy implications.

Market Stability (Macroeconomic Stability) is seen to relate to any factor that influences the ability of a market to operate within a given sphere. Policies which affect business location may impact directly on markets, changing the nature of competition within the market; or indirectly, by changing the nature of markets for alternative or substitutable products. Regions with established intervention may also recognise that reduction or change in intervention may impact on market stability. An example for change in intervention is apparent in European subvention of Agriculture (Common Agricultural Policy) and as a result of trade negotiations of the GATT.

Impacts can be identified in three areas: those dependant upon type of policy being applied, those dependant upon regional characteristics, and those dependant upon company characteristics.

- Policy type and impacts
- Trends arising as a result of differences in regional and national policies:
- Transport
- Services/Infrastructure
- Investment
- Taxation

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- Region Type and impacts
- Urban Planning Policy
- Zoning Restrictive access
- Compact patterns of urban development
- Local Tax Incentive
- Local Rent Incentive
- Local Services Incentive
- Industry type and impacts
- Quality Control
- Quantity Control
- Environment Control
- Training / Education Policy

There is a need to relate to issues planning policies need to consider in developing longer-term spatial patterns, specifically:

- What issues are specific to company stability
- What issues are specific to market stability
- How are they defined
- How are they measured
- How are they evaluated

Research Development

The quantification of impacts resulting from corporate and market instability and the relationship between incentive/policy and markets is significant in assessing the impacts of individual policies. Literature addresses various issues pertinent to this assessment but will need to be drawn out further to establish linkages and measurable dependencies.

Two areas of common measurement exist: equilibrium analysis and business cycle analysis. Both include external factors, cost, location dependencies, and could form the basis of methodology for wider analysis. These might be seen as a bottom-up approach - what does a company seek to encourage development, and what are the impacts of location based changes in these factors?

We would suggest the following specific areas.

- A principal area of study would be to investigate the impact that continually changing incentive and counterincentive has on the ability of the company/market to function.
- Issues that planning policies need to consider in developing longer term spatial patterns
- What methodologies may be required to define, measure and evaluate these patterns?

6.1.5 Perception and response to information

We would highlight the following issues as important.

- What are the current and longer term impacts resulting from real time and traffic tracking information

- What responses are likely to lead to an increased availability of transport information in parallel with a decline in the actual reliability of some elements of the transport network.

6.1.6 Transport and Tourism

Our research has highlighted the need to measure the effects of transport investment on tourism, particularly in economies where this is a major industry. There are problems in measuring the effect of transport on tourism, as the tourist 'industry' is comprised of multiple sectors (SACTRA, 1999). One simple solution would be to correlate transport investment with visitor numbers, however visitors are subject to external influences, such as actual or perceived terrorism threats and exchange rate fluctuations. Also, visitor numbers are difficult to measure and give no indication of the value of tourism to an economy.

Economic impact studies have attempted to measure the value of tourism by examining spending by visitors on accommodation, transport, food and drink and shopping; sponsorship and merchandising (Crockett, 1994); public and private investment in infrastructure (e.g. new hotels). This has been done through both surveys of visitor expenditure and business surveys, examining increases in turnover in hotels, restaurants and other related businesses. Any impact needs to be offset against the economic deadweight and displacement. The issue of whether to include domestic expenditure as additional or deadweight is also a subject of debate. Felsenstein and Freeman (1998) argue that some domestic expenditure will be additional in that it will prevent local residents spending money on the same activity in alternative regions - a form of import substitution.

The values of economic multipliers in tourism are also constantly under debate. It has been argued that current multiplier analysis may overstate the economic benefit of tourist activity. This may limit the potential of tourism to regenerate low-growth post-industrial regions. (Egan and Nield, 2002). Other studies have examined the feasibility of alternative methodologies to calculate the impact of tourist expenditure. Examples include Tourism Satellite Accounts (Smith, 2000) and Social Accounting Matrices (Wagner, 1997). There is, however, no established consensus on an appropriate methodology, partly because the characteristics of individual events and regional economies differ substantially.

Even with a robust methodology to measure the value of tourism, there remains the methodological issue of isolating the impact of transport from the wider economic influences on tourist demand mentioned above. A possible solution would be to conduct a comparative study of two competing regions subject to the same economic influences, one of which has experienced a transport investment, for example a new road into a ski resort.

6.1.7 Further Research in Modelling

Perhaps the most important issue for research is the lack of causal representation in the models used. Whilst it is understandable that models developed for strategic land use transport planning purposes will not need to be at the same level of detail as those that could be used to represent (or to aid) the location decision-making processes of firms, there is confidence to be gained in their performance if some degree of consistency can be assured.

For this purpose one needs to distinguish between different types of organisation in a more refined way than is conventionally done.

Call centres, whose main business is at night-time for most of their customers, may choose to locate in a different time zone so that they pay day-time rates for their staff. Retail outlets will be most heavily influenced in their location choice by the competition - or lack of it - and will run detailed models to assess sales before deciding. Firms dependent upon particular supplies (like fresh water or raw materials) or suppliers are more likely to locate near to them than to their customers. Firms whose business is the distribution of goods will most likely locate near to motorways.

Each of these differences in characteristic will be taken for granted by those making decisions within an organisation, as will certain other organisational factors, once a relocation of some activity is

decided upon. This implies at the least a different disaggregation of the types of business activity than is usual. It may also imply that there could be an advantage in applying to the 'business location' decision process the approach developed by Tversky (1972) known as 'elimination by aspects'. Some locations just will not be considered, because they do not have the right transport (or other) characteristics.

To understand this one needs to understand how the 'search space' of alternative locations is defined. As Kirby (1993) remarked in relation to residential location decision-making, "distance may be no object" within the search space, but the determinant of the boundaries of that space may well be heavily influenced by distance - or rather by travel time - or rather by accessibility, not to the customer, but to a transport network that provides reliability of travel time to the customer. If it is reliability rather than mean travel time that is these days the most important factor in business location, then it is clear that new paradigms and procedures are necessary in modelling to represent appropriately their effects. Even micro-simulation models that are capable of generating many slightly different scenarios and assessing the effects of these, are rarely deployed for such a purpose - and it would be very expensive to do so.

There are a number of general points that are worth highlighting: theoretical frameworks and techniques for better micro-analysis are needed; better models or frameworks and techniques for multi-disciplinary and collaborative research should be developed; frameworks and techniques for incorporating behavioural approaches into standard economic and transport planning studies; greater incorporation of more realistic employment assumptions into Land Use and Transport models, e.g. assumptions about job characteristics (wage levels, part-time, shift work); employer characteristics (size; sector; Travel Plan); worker characteristics (childcare, access to transport); access to modes; and investigate the greater use of practical dynamic, non-equilibrium models.

6.2 Transport Investment Appraisal

6.2.1 *Ex-post Accuracy of Appraisals*

Evidence from this study suggests that there is a general need to perform more *ex-post* analysis of transport impact and appraisal studies, especially those that reflect current and future policy. Virtually every piece of transport investment takes place after an *ex ante* appraisal of the likely impact, however only some of these are followed up with an *ex-post* evaluation. We concur with the Department that there is a requirement to compare appraisal predictions of projects with their outcomes. There is a need to research why schemes have particular impacts, how this takes place and who is affected. Linked to this, we need to know if transport investment schemes had wider unanticipated impacts and if they can provide guidance for future appraisals and policy development.

An *ex-post* evaluation will not only give an evaluation of the project, but also of the accuracy of the initial appraisal. For this reason it is important that the methodology used in *ex-post* evaluations is appropriate. A number of key recommendations are set out below.

The first key point relates to planning *ex-post* evaluation before the project commences. There is a need to incorporate *ex-post* analysis into a range of current projects, so that relevant data can be collected from the start of the project. This would require setting up a system to track key indicators as the project progresses.

Secondly, *ex-post* research must be conducted while controlling for the presence or absence of complementary measures. For example, this would have to be carefully designed to isolate the effect of the transport investment against a background of other possible determinants, such as cyclical economic change and industrial restructuring.

Thirdly, for some investment projects where the impacts are not immediate (e.g. traffic calming schemes on town centre retail location) *ex-post* longitudinal evaluations should be conducted over several years to determine the scale and longevity of any effect.

Lastly, as mentioned earlier, there is a potential problem when using *ex-post* evaluations to measure transport costs. These may be altered by the fact that businesses in areas of higher transport costs (i.e. peripheral areas) react to reduce their costs, or are involved in sectors with lower transport costs.

6.3 Some Methodological Issues

The research reviewed in Chapters 3-6 relies on some contrasting methodological approaches, which can make comparison of results difficult. In this section we aim to highlight some of the differences in key pieces of research that we have reviewed and show how these may contribute to differences in findings. For example, a conclusion based on a case study in a single city area may have relevance to that area, but a similar national study may offer information that can be applied more widely. Therefore analysis of any contradictions in findings between these two studies would have to take the methodological differences into account and policy makers should be aware of these before using findings from a piece of research to inform policy.

Analysis of the literature has shown that differences in methodology have been found to exist in a number of areas including: geographical scale of analysis (e.g. Knowles, 1996; Lawless 1999; Lawless and Gore, 1999); characteristics of nation or region; whether qualitative (e.g. case study) or quantitative (e.g. large scale survey); the time scale of the survey (e.g. work on land use planning controls by DETR (2000); Hass-Klau (1993) and Carley and Donaldson, 1997); whether based on *ex ante* or *ex post* evidence (e.g. work on traffic calming by Scottish Executive, 2000; Gerrard *et al.*, 2002); and alternative methods to measure the impact of tourist expenditure (Smith, 2000; Wagner, 1997) although the latter two studies did examine the consequences of the methodologies employed.

A relevant example to examine in more detail is the case of light rail investment in urban areas. Studies by Knowles (1996), Lawless (1999) and Lawless and Gore (1999) have investigated the impact of similar investments. A brief summary of the findings and approach is given below.

Knowles (1996)

- *Findings:* Reviews the impacts of the Manchester Metrolink tram scheme and finds urban LRT in Manchester increased the attractiveness of city central locations to users from the south of the city. The link increased the attractiveness of central businesses most where existing infrastructure was weakest. Draws a correlation between policy in place, and the effectiveness of LRT schemes to impact on central development
- *Methodology:* A case study based paper, reporting findings of the Metrolink Impacts study completed by the University of Salford. Reviews economic and land use impacts of the Metrolink using before and after data provided from research in Salford, together with patronage and car commuting comparisons.

Lawless (1999)

- *Findings:* Investment in transport had a minimal effect on business confidence and regeneration, with road investment being more beneficial than the tram. There is a problem of lack of integration between regeneration and transport providers.
- *Methodology:* Before and after survey of the effects of new tram system and enhanced road provision on image, property, land use, business (re)location and labour mobility.

Lawless and Gore (1999)

- *Findings:* Investment in a tram system in Sheffield has led to minimal business investment and regeneration impacts in the local area,
- *Methodology:* Based on an empirical case study to develop a theoretical framework in which transport investment implications can be measured. Land use and land values are given in a before and after scenario. Breaks down impacts of investment into 5 areas (image, property, land use, business location & operations and labour market) and explores effects on each

On initial examination the Knowles study suggests that LRT developments can make an area more attractive to business, whereas Lawless and Lawless and Gore argue the opposite. However there are a number of differences: Knowles uses accessibility as a proxy for development potential, whereas Lawless and Lawless and Gore use several measures. Additionally, Knowles is concerned with the CBD, whereas Lawless and Lawless and Gore are examining the effects on a range of areas throughout the city. While all these studies are valid and useful, the range of application of each differs.

6.4 Conclusions

In summary there is a need to improve modelling, in terms of challenging basic assumptions and utilising different methodological approaches, especially more multi-disciplinary approaches.

Some of the factors to consider include: current land use elements of transport models could be extended or integrated to provide indications of impacts of industrial change; measuring transport costs faced by firms as a determinant of location may be inappropriate, as an increasing number of businesses subcontract out movement of supplies and finished product. Transport costs are increasingly a function of proximity to, and charges by, subcontractors rather than directly proportional to distance, volume and weight. It is likely to be a mistake to assume constant elasticity over time in links between transport and economic growth and associated business location. Given the variety of factors influencing the role of transport, there is a need for greater use of multidisciplinary, micro-focused studies looking at specific issues, and an improvement of the associated research tools. Transport is more influential in location decisions than basic cost figures would suggest. Spatially differentiated production models may be able to estimate the effect of transport investment or policy on location decisions. New modelling paradigms and procedures are necessary if reliability, rather than travel time, is the most important factor in business location. There is a need to perform more *ex post* analysis of transport impact and appraisal studies.

Specifically regarding Land Use Transport Interaction (LUTI) models, LUTI models are useful in modelling the economic effects of transport on business activity, but have a number of limitations. The majority of urban LUTI models have been applied to passenger rather than freight traffic. This leads to emphasis is on the markets for land, transport and service industries rather than manufacturing industries. It is important that the area modelled by LUTI is large compared with the transport impact area of the proposed scheme. In general, enhanced LUTI models must be complex and spatially very extensive compared with the projects to be examined, particularly when effects outside the immediate area are to be considered.

What we know

- Transport may be more influential in location decisions than basic cost figures would suggest.
- Transport costs are increasingly a function of proximity to and charges by subcontractors rather than directly proportional to distance, volume and weight.
- Spatially differentiated production models may be able to estimate the effect of transport investment or policy on location decisions.
- The majority of urban LUTI models have been applied to passenger rather than freight traffic. This leads to emphasis is on the markets for land, transport and service industries rather than manufacturing industries.
- It is important that the area modelled by LUTI is large compared with the transport impact area of the proposed scheme.
- In general, enhanced LUTI models must be complex and spatially very extensive compared with the projects to be examined, particularly when effects outside the immediate area are to be considered.

The Importance of Transport in Business' Location Decisions

- New modelling paradigms and procedures are necessary if reliability, rather than travel time, is the most important factor in business location.
- There is a need to perform more ex post analysis of transport impact and appraisal studies.
- Given the variety of factors influencing the role of transport, there is a need for greater use of multidisciplinary, micro-focused studies looking at specific issues, and an improvement of the associated research tools.
- New modelling paradigms and procedures are necessary if reliability, rather than travel time, is the most important factor in business location.

What we don't know

- Do transport basic percentage costs underestimate the true cost of transport to businesses?
- To what extent should models reflect that business location decisions are determined by the existence of freight hubs?
- There is a lack of causal representation in the current models used.
- LUTI models have limited ability to predict the degree that transport improvements can induce development in sites where little or no current activity exists.
- An understanding of the causal links between urban form and travel behaviour;
- A common view about how to model land use response to transportation change;
- The significance of the movement of goods as a factor influencing the transport-land use relationship.
- Can current land use elements of transport models could be extended or integrated to provide indications of impacts of industrial change.
- Is reliability more important than mean travel time as a determinant of location?

7. Key Messages and Gaps in the Evidence

7.1 Introduction

This chapter: briefly summarises the evidence related to these questions; sets out some key questions arising from current UK government policy documents; identifies the major gaps in knowledge that still remain; and makes suggestions on future research to fill these gaps.

Some key current policy issues include:

- Changes from a '*predict and provide*' system towards the management of road traffic levels in the 1990s arguably reduced the push for increased levels of road infrastructure to match changes in the demand for transport by road. Clearly a balance between both is required in an era of rising travel demand, although where this balance lies is uncertain.
- The link between *infrastructure investment* and business location is still unclear, as discussed earlier in this report. There is a need for more evidence about the specific types of infrastructure and services needed to promote regional and national competitiveness (e.g. air services).
- The issue of *congestion* affects both the transport of goods and in-work travel, and commuting to work. In city areas in particular the perception of congestion has led to the development of policy agendas to reduce the dependence upon private vehicles through an increased importance being placed on public transport, and the development of traffic management schemes, including road pricing.
- The links between transport and *land use planning, regeneration and social inclusion* is seen as important. The desire to link public transport investment to city development has not, however, proved entirely successful, as some evidence has observed that despite a strong commitment to transport investment, linked regeneration has not been strong. There is a danger that policies may be based upon relatively simplistic notions of causal links between transport and regeneration (see Chapter 5 for a discussion on policies).
- Changes in the *control and regulation* of transport have been at the forefront of transport policy in the United Kingdom, and in other EU states. Resulting changes in ownership of railways, bus companies and utility services have affected the provision of transport significantly. The UK operates a predominantly privately owned public transport system that can have an impact on the perceived quality and expectations of service levels. However, the degree of monopoly power in both infrastructure and service provision is very high in many parts of the transport industries (e.g. airport ownership or railways).
- Many of the issues raised concerning transport and the *environment*, such as: 'decoupling' the links between traffic and economic growth; the need to reduce traffic congestion; encouraging modal shift away from road transport; cutting down on unnecessary journeys through planning policy; the link between global environmental changes (e.g. global warming and the potential for higher transport costs, possibly higher rainfall, rising sea levels and higher winds) and the implications for Scottish transport and the economy (as well as wider influences of course).

To assist in cross-referencing, and as so many policies are inter-connected, this chapter follows the structure of the rest of the report:

- The Drivers Of Business Location (Chapter 3)
- Business Organisation And Technology (Chapter 4.1)
- Business Characteristics (Chapter 4.2)
- Labour Supply, Travel To Work And Social Inclusion (Chapter 4.3)

- Spatial Scale (Chapter 4.4)
- Growth versus Displacement (Chapter 4.5)
- Land Use, Location And Transport (Chapter 5)
- Methodological Issues And Appraisal (Chapter 6)

7.2 Key Evidence, Policy Questions and Gaps

This section highlights key evidence, policy questions, gaps in knowledge.

7.2.1 The Drivers Of Business Location (Chapter 3)

Key evidence

- The evidence suggests that transport is a necessary, but not sufficient condition in determining business location.
- Other factors such as a skilled and/or inexpensive workforce, the quality of the local environment and cost of premises have been shown to be equally, if not more important when considered in isolation.
- When combined with other measures, and integrated into part of a business development programme, transport can help to influence location.
- The evidence for road transport alone to attract business is mixed, however and some research suggests it can have negative effects in certain circumstances.

Policy questions and gaps in knowledge

How important is transport relative to other factors in determining location?	
Evidence	Gaps
<p>Huws and O'Regan (2001): empirical study - the skills of the workforce and technical expertise in a region are the most important drivers of location and that this leads to a clustering of similar firms. Transport factors play a minimal role.</p> <p>Button et al. (1995): Poor transport infrastructure does not induce firm migration but will influence location decisions for firms on the move.</p> <p>Linneker and Spence (1996): when the component of accessibility change caused by the construction of the M25 motorway is isolated, then it can be demonstrated that such changes are positively related to changing levels of economic development.</p> <p>Ryan (1999): property prices of business locations found to be higher around transport hubs indicating a higher demand by businesses to locate there.</p> <p>Lawless (1999): Investment in a new tram system in Sheffield had a minimal effect on business (re)location and regeneration.</p> <p>Ellison and Glaeser (1997): observe that the presence of one firm in a location reduces transport costs for</p>	<p>What are the drivers of change - what needs to be done to influence location decisions?</p> <p>How does transport provision influence business relocation, and how can this be forecasted?</p> <p>How important are transport costs to business location decisions? Are perceived costs more relevant?</p> <p>What is the role of transport in international, as well as regional, competitiveness?</p> <p>How does the distribution and services provided (e.g. flight destinations) of the airport system influence business location and competitiveness? What specific role do airports play in this?</p>

<p>subsequent firms and this forms a driver for geographic concentrations.</p> <p>Welsh Economy Research Unit (1997): on economic development in Merthyr which implies that improved road access has been an important factor in influencing the location decisions of recent investors. As a result, in addition to direct transport cost savings for existing businesses, there have been even greater wider benefits in terms of income and employment from new business investment.</p> <p>McCalla et al. (2001): linkages between industry and transport terminals are weak, i.e. businesses in proximity to the terminals make little use of the facilities and proximity to the terminal was not a prime location consideration. The industrial location - transport terminal relationship is indirect, business located there because of high accessibility found in the terminal zones.</p> <p>Goodwin et al. (1998): measures to reduce traffic capacity can result in a reduction in traffic volume in the long run as people change jobs, location or mode of travel.</p> <p>McCann (1998): transport costs, although central to classical location theory, are empirically of very little significance in explaining overall costs faced by firms.</p> <p>Button and Costa, 1999: changes in the control and regulation of transport been at the forefront of transport policy in the United Kingdom, and in other EU states, which will affect the infrastructure and its management and may influence business location.</p>	
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7.2.2 Business Organisation and Technology (Chapter 4.1)

Key evidence

- Changes in business operations affect the role of transport in influencing location.
- The outsourcing of many transport functions to third party firms and the increased demand for part-assembled components has elevated the importance of logistics businesses in determining the location of other firms, and reducing the direct effect of transport infrastructure on manufacturing and service firms.
- Technology has influenced the effect of travel, partly through allowing virtual communication to substitute for physical travel, e.g. telecommuting, and partly through improved efficiencies in logistics.
- Technological change has increased the need for travel and carriage over distance and therefore boosted the role of air transport in business location.

Policy questions and gaps in knowledge

The role of logistics in changing business location	
Evidence	Gaps
Taniguchi <i>et al.</i> (1999, 2001): centralising delivery functions to the city periphery and providing local scale	The influence of transport infrastructure and management on the location of

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<p>deliveries within the city, will impact on the ability of the city scale to compete for larger business locations.</p> <p>Tibbet and Britten (2003): smaller firms, and those further downstream in the production process, are more likely to subcontract out movements of supplies or produce, making transport infrastructure less of a direct influence on location.</p> <p>Adam and Putz (1999): in Germany additional transport implications are resulting from the 'Grüner Punkt' requirement to remove additional packaging and returned materials. This has had an impact on locational decisions specific to city and surrounding area.</p>	<p>international and national distribution companies.</p> <p>The extent of the influence that networks of freight companies have on location decisions of other business.</p> <p>What are the significance of transshipment and information-exchange costs (time and money) at transport hubs?</p> <p>To what extent is the merging of assembly/supply and transport functions influencing the location of depots?</p> <p>Can we develop a more logistics-based model of business location?</p> <p>"If e-commerce is able to capture elements of traditional business processes and to develop a comprehensive and integrated service industry, what traditional logistics service providers might be supplanted and what changes are occurring in the European logistics industry as a direct consequence to the introduction of e-logistics?"</p> <p>How are current and future trends in logistics likely to influence business location?</p>
Is technology changing location requirements?	
Evidence	Gaps
<p>Freeman (2002): ICTs have had a significant impact on the location and transport choices through lower costs of communication and can lead to improved efficiencies both in terms of production and in terms of logistics.</p> <p>Graham (1998): workers in lighter industries are more able to engage in e-work, i.e. telecommute, work from home or split work between locations, reducing transport requirements of these firms.</p> <p>Greenaway and Nelson (2000), Venables (1998): Changes in the firm, use of automated production, differing patterns of labour forces, and fragmentation of the production process has increased the need for carriage over distance in some elements of the production process, and led to the development of new trade theories.</p> <p>Weber (1929), Castells (1993, 1996), Cairncross (1997): the rise of ICTs will diminish the importance of business location as communication over distance becomes easier.</p>	<p>Have technological advances in telecoms diminished the role played by face-to-face agglomeration economies such as wages, transport and proximity to concentrations of services in determining the metropolitan location of firms?</p> <p>There is a lack of empirical data on the effect of changes in ICT on business location. This has resulted in a lack of consensus.</p> <p>Will the role of telecommuting expand to influence physical commuting and location decisions?</p> <p>Will ICT lead to greater concentration of business location in metropolitan areas and their hinterlands?</p>

Shen (2000): increasing ICT use has two major effects on transportation: (1) telecommunications partially substitute for travel to the workplace and to some other destinations; (2) often indirectly, telecomms stimulate new activities and generate *extra* travel.

European Commission (2002): results of the EU EMERGENCE project imply the dominant forms of eWork have become use of remote offices, e.g. call centres, and employment of multi-locational workers, rather than fully home-based eWork. The largest and fastest growing proportion of eWork is outsourcing looking for technical expertise, cost and quality. Under current trends, approximately ten million new eworkers are likely by 2010, however, if changes in technology continue, this is likely to reach 27.12 million.

HOP Associates (2000): Government (DETR) policy may be overly focused on modal shift at the expense of eliminating journeys altogether through ICT. Information age working practices must be linked to transport policy to take advantage of changes in technology.

DETR (1997): uptake of teleworking in the Cambridge area could result in traffic reduction of 4% to 8%, mainly in the morning peak.

Amárach Consulting (1999): traffic reduction figures from telecommuting in Dublin estimated at around 1 to 1.5%. However the study does recommend telecommuting as a policy due to the low cost of implementation compared with modal shift.

HOP Associates (2000): problems expanding telecommuting result partly from an industrial age culture, i.e. an inherited a model of work that involves belonging to a company, owning a designated workplace and commuting. Other problems are social isolation, quality issues, and lack of employer support.

Polèse and Shearmur (2002) provide Canadian evidence that ICT leads to greater concentration of business location in metropolitan areas and their hinterlands and reductions in remoter rural areas.

7.2.3 Business Characteristics (Chapter 4.2)

Key evidence

- In the UK, air transport has a greater influence on the location of foreign investors and business services, whereas road transport has a larger influence on domestic investment, light manufacturing and commercial businesses such as retailers.

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- In the UK, air transport has a greater influence on the location of foreign investors and business services, whereas road transport has a larger influence on domestic investment, light manufacturing and commercial businesses such as retailers. Air transport investment can be used to attract foreign inward investment, particularly electronics and business services, and to boost the tourism sector. It also appears to be important in promoting the perceived accessibility of an area - a function that motorways can also perform.

Policy questions and gaps in knowledge

Which type of business locate in response to which infrastructure changes?	
Evidence	Gaps
<p>Corporation of London (2002): good air transport in particular is important for attracting business service firms as average spending per employee on air services by the financial services sector is six times the average for UK business as a whole.</p> <p>Gillis and Casavant (1994): highlight that investment in road infrastructure is a key to the location values of light industrial and commercial businesses and air freight has an increasing impact on the development of some areas of manufacturing.</p> <p>SACTRA (1999): business location is usually determined by fixed natural assets - transport costs are borne by the consumer.</p> <p>Button <i>et al.</i> (1995): road and air infrastructure have a greater impact on inward investors than endogenous firms, with roads particularly important for UK headquartered inward investment and airports for overseas inward investment. Bus links had a greater importance for large firms.</p> <p>Almeida and Kogut (1997): transport factors among some high-tech manufacturing businesses are secondary to the need to be located in proximity to other firms in the 'cluster', due to the importance of face-to-face networking with suppliers and customers.</p> <p>Smyth (2003): the manufacturing sector only accounts for around 15% of demand for inter-industry air services in N. Ireland, and much of this demand can be accounted for by the higher order activities within the sector that the regions are trying to attract.</p>	<p>What are the differing requirements of predominantly international and domestic owned firms (and how do these vary according to markets served, industry and size)?</p> <p>Is there a potential long-term trend back to town and city centre retail development?</p> <p>The effects of transportation on tourism, particularly in fragile peripheral economies where it is of most importance.</p> <p>Which types of business can realistically be encouraged to locate in more centralised locations?</p> <p>How are the location requirements of businesses likely to change in the future and how will this differ between types of business?</p>

7.2.4 Labour Supply, Travel To Work and Social Inclusion (Chapter 4.3)

Key evidence

- Transport investment has been shown to increase workplace accessibility and therefore the labour market size and reduce job search costs (hence affecting the productivity of businesses).
- As labour supply is often one of the most important factors in business location, transport can be used as a tool to boost labour supply.

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- The implications for social policy are also centred on accessibility, and certain groups (e.g. those with dependants, part time or low paid workers etc.) are less able and willing to travel far to work.
- Improvements to public transport services can help promote access to employment and services to vulnerable groups, particularly those without private transport.
- However, in addition to transport improvements it is important to consider business location - employers must be also encouraged to locate in accessible areas.
- Business relocation to decentralised areas can result in accessibility problems. It is also difficult to 'retro-fit' public transport solutions into these locations.

Policy questions and gaps in knowledge

The importance of labour accessibility	
Evidence	Gaps
<p>OECD (2002): improvements in accessibility follow from transport investment; this can increase the market size for labour.</p> <p>Trinder (2001): transport investment may also reduce job search cost and time, thus increasing the potential labour supply.</p> <p>Invest UK (2000, 2002): labour supply can be the most important factor in business location decisions. Availability of qualified staff, easy access to markets and external transport links were the 3 most important criteria.</p> <p>SACTRA (1999): firms have to determine supply and cost of the labour force as part of their location decisions. Transport infrastructure also affects the overall level of economic activity and therefore the demand for goods and services.</p> <p>McQuaid <i>et al.</i> (2001): socio-economic factors such as gender, dependent children and education were more influential in determining potential travel times of job seekers (and hence the chance of gaining employment) than provision of public transport, accessibility or access to private transport.</p> <p>Scottish Executive (2003): availability of good quality housing and safe and attractive residential environments are factors in attracting business investment.</p> <p>Department for Transport, (2001b): the take up of Travel Plans has been limited among private sector businesses, but more successful in certain areas of the public sector.</p>	<p>How does the need to attract different types of employees affect location decisions?</p> <p>Can businesses locate to facilitate linked trips (e.g. work, school, shopping) by employees?</p> <p>How can road design be altered to take into account the existence of linked trips? Are more radial roads required?</p> <p>How do the factors of transport improvements, improved planning regulations and suitable development policies effectively and efficiently interact?</p> <p>What factors are behind the urban to ex-urban shift of business?</p>
The effect of business location and transport on social inclusion	
Evidence	Gaps

<p>ODPM (2003a): social exclusion can be a barrier to accessing employment and services, particularly when reliant on public transport. Transport is a barrier to getting a job; accessing training and further education and accessing medical help.</p> <p>ODPM (2003a): transport and the location of services can reinforce social exclusion by preventing access to employment and services.</p> <p>ODPM (2003a): road traffic externalities, for example pollution and accidents, have a disproportionately large effect on socially excluded areas and people.</p> <p>Hine and Mitchell (2001a,b): transport policy often fails to include the needs of all individuals. Improvements to transport services can help promote social inclusion. Groups who stand to benefit are disabled (physical, fear, space, time), the elderly (physical, time), those without a car who live in peripheral estates (geographical), low income (economic, time), bus users (time) and women (fear, time).</p> <p>Houston (2001) firms relocating to decentralised locations create difficulties for workers that cannot relocate, particularly lower paid and low skilled workers and those dependent on public transport, especially women. There is also a problem that decentralised locations are more difficult to service by public transport.</p> <p>Grant (2001): transport for those who do not have access to a car is most effective if addressed at a community level.</p>	<p>What employment potential do major developments such as airports offer to excluded groups?</p>
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7.2.5 Spatial Scale (Chapter 4.4)

Key evidence

- Much transport investment is likely to influence business location at local or intra-regional level, rather than generating regional or national growth.
- There is evidence to suggest that transport policies are more influential at influencing intra-regional and city level location decisions than those on a wider scale.
- Congestion is a major problem to be tackled in urban areas - it leads to unreliability of trips, adds to business costs and can drive business out of city centre locations.
- Transport policies aimed at moving business into cities are most effective if combined with other urban policies.

Policy questions and gaps in knowledge

In which areas is congestion the biggest problem?	
Evidence	Gaps
<p>Ernst & Young (1996): found that congestion and the unreliability of trips add to business costs, particularly for companies in the service sector and those serving urban areas.</p>	<p>A need to conduct a wide-ranging survey of the impact of congestion on logistic operations across a wide range of companies and supplement this with</p>

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<p>Scottish Executive (1999): congestion in urban areas can damage the viability and vitality of city centres by discouraging visitors and encouraging relocation to out-of-town areas.</p> <p>McKinnon (1998) effects of congestion on logistics are difficult to quantify, most companies found the effect on operating costs, inventory levels and investment in materials handling and IT to be weak or non-existent. Congestion did have some effect on labour costs and was a factor behind strategic decisions to increase depot numbers.</p>	<p>direct observation and measurement.</p> <p>Are measurements of congestion in different areas actual or perceived? For example is perceived congestion in Middlesborough as severe as in London? There is a need for reliable, comparable measures of congestion.</p> <p>The longer-term effects of city bypass schemes on business location and traffic levels within the bypassed area</p> <p>Do traffic calming and pedestrianisation measures lead to an increase or a decrease in business activity? Will this vary between the short and long run?</p>
<p>The role of aviation infrastructure in attracting regional investment</p>	
<p>Evidence</p>	<p>Gaps</p>
<p>EEDA (2000): infrastructure investment is an important factor in firms' location decisions and a useful policy for regions competing for mobile investment.</p> <p>Adams and Raeside (2001): tourism and electronics industries are very dependent on air transport - investment in airport infrastructure with supporting public transport infrastructure would provide economic benefits to Scotland.</p> <p>Corporation of London (2002): almost 70% of firms consider air services to be critical for business travel by their staff and 50% consider air services critical for travel by their clients to meet with them. Videoconferences etc. are no substitute for face-to-face meetings for client relationship.</p> <p>Scottish Executive (2002): the majority (over 80%) of inward investment decisions are triggered by factors other than the desire to physically relocate operations, therefore the potential of transport to attract FDI is limited.</p> <p>Department for Transport (2001): good air transport links to and from regional airports are an important factor in decisions about inward investment and location of business; and airports brought in tourism and inward investment.</p> <p>Department for Transport (2003): air links are particularly important for peripheral regions such as Scotland and Northern Ireland due to the limitations posed by physical geography and distance on surface transport and the reliance of key industries (financial services, high-tech manufacture and tourism) on aviation.</p> <p>Department for Transport (2003): air services attract inward investment, particularly from overseas and open up new markets and supply chains for local firms. In Scotland</p>	<p>Balancing the economic and environmental impacts of air infrastructure investment.</p> <p>The extent to which regional airport developments increase or displace jobs.</p>

<p>alone, air services support 15,000 jobs indirectly.</p> <p>Department for Transport (2002b): regional air services have an important role to play in attracting mobile inward investment, tourism, increasing existing industry competitiveness and supporting wider regeneration and development, although it is difficult to quantify this.</p> <p>COFAR (2001): airport infrastructure is a factor to attract increasingly volatile business activities and inward investment and act as a business generator for the whole region. Part of the benefit comes indirectly from enhancing the image of the region.</p>	
Does devolved government lead to differing outcomes?	
Evidence	Gaps
<p>There is little evidence on the differing effects of devolution upon transport policies as they affect business location. Partly this is due to the limited remit of devolved governments and partly due to the limited time scale.</p>	<p>To what extent do changes in the regulatory framework of transport across the devolved nations impact on the location of businesses?</p>

7.2.6 Growth versus Displacement (Chapter 4.5)

Key evidence

- Policies aimed at inducing business to move from high to low growth areas can have positive effects for both areas. However, there is a lack of consensus on whether building transport infrastructure into low growth areas would be significantly helpful.
- Evidence suggests that large-scale transport infrastructure policies are likely to be successful in supporting growth in under-developed regions, but may be relatively ineffective in stimulating new growth.

Policy questions and gaps in knowledge

The issue of growth versus redistribution (displacement) of activity - balancing excess growth in some areas with decline and market failure in others.	
Evidence	Gaps
<p>SACTRA (1999) It may be desirable to induce business to locate in some areas rather than others; there may be efficiency gains from inducing businesses to locate in industry or market clusters.</p> <p>DfT (2000): congestion is high in urban areas and is forecast to grow by 15%. Congestion is worst in London - large parts of the Underground are overcrowded in peak times & demand is forecast to grow, also 4/10 commuter rail operators exceed overcrowding standards. Road congestion in London is 3½ times average for England.</p> <p>Scottish Executive (2001): relocation of economic activity to areas in need of regeneration at a local level may have social inclusion benefits.</p> <p>OECD (2002): any benefit will be dependent on the nature of the areas in question - a redistribution of activity from a</p>	<p>There is a need to greater understand the growth versus redistribution debate.</p> <p>What is the best way to accommodate and sustain the growth of London and the South East?</p> <p>The extent of the 'Appalachian' or 'two-way road' effect, where new road developments suck activity out of an area they were designed to help.</p> <p>How the effects of transport investment depend on the market structure of industry in the recipient area.</p>

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<p>congested area to a less well developed area will help spread growth evenly and help ease inflationary or capacity pressures.</p> <p>Treasury (2001): falling transportation costs may allow some businesses to move to lower growth regions, as this enables firms to outsource and take advantage of lower production costs in peripheral, low-wage regions.</p> <p>Treasury (2001): large-scale investments in transport infrastructure, e.g. Sicily and Mezzogiorno in Italy have failed to <i>stimulate</i> economic growth in the long run and have resulted in underutilisation of resources. However, when infrastructure is used to <i>support existing growth</i> it can be an effective catalyst for development, e.g. airports in Crete to support the growing tourist industry, inter-regional motorways in Abruzzo (Italy) to improve market access to local industry. Hence, transport is, not surprisingly, not a sufficient condition for development, but it is unclear what level of transport infrastructure and services is a necessary condition for different forms of development and business.</p> <p>ECOTEC (1999): attention must be given to where firms would relocate from and where their competitors and markets are located.</p> <p>Goodwin (2003) An investment in transport infrastructure in a region or local area may lead to a displacement of growth <i>away</i> from that area, depending on the market characteristics of that area.</p>	<p>The balance between the growth and the redistribution effects of different forms of transport investment.</p>
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7.2.7 Land Use, Location And Transport (Chapter 5)

Key evidence

- Policies in the 1980s of encouraging out of town developments has lead to increased traffic and reduced accessibility for many.
- Transport policy can be used to reverse some of the negative aspects of this.
- While transport investment can be used as a stand-alone tool to help influence business to locate in accessible areas, for example by providing better bus services to city centres, it is most effective when used in partnership with other policies, such as labour market, inclusion and land-use planning.
- Ideally, transport planning should be *integrated within* land-use planning to ensure that both are effective in meeting objectives.

Policy questions and gaps in knowledge

Do planning decisions influence business competitiveness?	
Evidence	Gaps
ECOTEC (1999): Attention must be given to where firms would relocate from and where their competitors and markets are located.	What is the relative importance of planning compared to other factors on business location at a local level?
Scottish Executive (2000): many small local businesses in Edinburgh blame new style bus lanes for a decrease in	Hard data on the influence of planning regulations on business location.

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<p>turnover, mainly due to parking restrictions. Similar concerns have also been raised regarding congestion charging.</p> <p>Blackburn and Clay (1991): while the bypass of a town centre often removes the undesirable traffic congestion, truck traffic and reduces the number of traffic accidents in the town, the economic viability of many businesses located along the old route is often dependent upon the flow of traffic.</p> <p>Gerrard <i>et al.</i>, (2002): survey of business attitudes indicates that road user pricing and workplace parking levies will reduce profitability.</p> <p>DTLR (2002): proposal to create relaxed 'Business Planning Zones' met with mixed response. CBI stated they would encourage business development, some other consultees that they would encourage low quality and car-based developments.</p> <p>DETR (2000): There is little evidence that planning controls are restricting technology-based development. Research shows that there were few examples where council planning controls had constrained development</p> <p>Weisbrod (2001): road bypasses neither drastically reduce nor add to use of commercial premises in affected towns and cities. Shift in traffic throughput can correlate to business relocation, although data are not apparent on the extent of this relocation. Conversely, established city centres appear to benefit from the diversion of through traffic away from the area.</p> <p>Handy <i>et al.</i> (2001, 2002): Bypasses may have both positive and negative impacts on small communities. Communities benefit from a reduction in traffic externalities through the heart of the area. However, the reduction in through traffic may also have negative impacts on businesses in the community, particularly highway-oriented businesses located along the old route. At the same time, new development may occur along the relief route corridor. Empirical evidence on this is inconclusive.</p>	<p>regulations on business location.</p> <p>Does the growth resulting from urban LRT implementation impact on the longer-term viability of centrally located businesses?</p>
Development of key services and employment in accessible centralised locations	
Evidence	Gaps
<p>Kawamara (2001): distinct differences between the transport and logistics needs of the city centre and suburban business.</p> <p>Kawamara (2001): typically mass retailing has seen a move away from city centres where access for private vehicles may be restricted to peripheral locations where access is increased for private motorists.</p> <p>Felsenstein (2002): the tendency for high-tech industries to locate in outer suburban areas causes more urban sprawl</p>	<p>What is the impact of new transport management policies, including congestion pricing?</p>

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<p>and greater potential accessibility problems that the same industry in an urban location <i>or</i> a number of alternative industries in the outer location.</p> <p>Knowles (1996): urban LRT in Manchester increased cross-city accessibility and the attractiveness of city central locations to users from the south of the city. The link increased the accessibility of central businesses most where existing infrastructure was weakest.</p> <p>Banister and Berechman (2000): additional rail investment where transport infrastructure is well-developed has little effect on accessibility.</p> <p>DfT (2002a): 1980s planning policies resulted in much major new development moving to out-of-town locations, often readily accessible only by car. This had the effect of increasing traffic, reducing access and choice - particularly for those without use of a car -and starting a spiral of decline in many of our town centres.</p> <p>ODPM (2003a): tackling accessibility problems involves planning the location of key services and centres employment where they are most accessible to those on low incomes. Transport provision alone is not the answer.</p> <p>Banister (2000): in Japan, rail infrastructure and high population density contribute to centralised patterns of development.</p> <p>Ryuzo (2000): identified that investment in road infrastructure in Japan is reducing economic activity clustered around stations as businesses relocate out of town.</p> <p>Walmsley and Perret, (1992) The development of the Tyne and Wear Metro had minimal impact on business location demand in specific local areas.</p> <p>Gerrard <i>et al.</i> (2002): road user and workplace parking charges in urban areas may encourage suburbanisation of business activity.</p> <p>Scottish Executive (2003): new development adjacent to existing community facilities can reduce the need for travel in general, particularly car journeys.</p>	
Linking transport and planning policies	
Evidence	Gaps
<p>Lawless and Gore (1999): the desire to link public transport investment to city development has not proved entirely successful - despite strong commitment to transport investment, regeneration has not been strong.</p> <p>Lawless (1999): Sheffield tram system - there is a problem of lack of integration between regeneration and transport providers that hinders the benefits of public transport investment.</p>	<p>A key concern is how might more effective co-ordination between and within bodies and agencies be achieved?</p> <p>Does the growth resulting from urban LRT implementation impact on the longer-term viability of centrally located businesses?</p>

<p>Knowles (1996): study of Manchester LRT tram link makes reference to interaction between transport and business location policies, specifically those intended to reduce or prevent urban decentralisation. Draws a correlation between policy in place, and the effectiveness of LRT schemes to impact on central development.</p> <p>DfT (2002a): transport has an important role in shaping and supporting new development. The planning system also needs to be able to respond to the need for new transport infrastructure. Spatial planning and transport planning therefore need to be closely co-ordinated.</p> <p>Goodwin (2003): the success of urban initiatives such as pedestrianisation schemes is dependant on policies being in place. e.g. pedestrianisation in conjunction with a light rail scheme, although the direction of causality is not proven.</p> <p>Bulkeley and Rayner (2001): transport strategies have been less effective if too focused upon accommodating existing transport demand through additional infrastructure and modal shift, rather than reducing travel demand via land use planning and other demand management policy.</p> <p>Priemus (1999): to improve interaction between land-use and transport planning it is necessary to give public transport a competitive edge through measures such as road user pricing. This would push public transport up the policy agenda.</p>	<p>What types of firms take up travel plans in new developments? Can we generalise this? Is take up linked to planning consent?</p> <p>Businesses investing in new developments can be unwilling to fund transport investments because of uncertainty over future land prices. Where can advance funding for transport investment come from?</p> <p>Does transport enhance urban policy objectives, or vice-versa, or is there two-way causality?</p>
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7.2.8 Methodological Issues And Appraisal (Chapter 6)

Key evidence

- LUTI models are useful in modelling the economic effects of transport on business activity, but have a number of limitations.
- LUTI models are likely to be most effective when integrated with other policy planning tools.
- When considering the impact of transport investment it is important to look beyond the Transport Economic Efficiency (TEE) impacts on traffic and transport, and include other costs and benefits.
- The wider Economic Activity and Location Impacts (EALIs) need to be considered in impact studies.
- There is a need for more *ex-post* analysis of transport impact studies.
- Given the variety of factors influencing the role of transport, there is a need for greater use of multidisciplinary, micro-focused studies looking at specific issues, and an improvement of the associated research tools.
- New modelling paradigms and procedures are necessary if reliability, rather than travel time, is the most important factor in business location.

Policy questions and gaps in knowledge

Land Use Transport Models and Data Measuring Issues	
Evidence	Gaps
<p>SACTRA (1999): current LUTI models are useful in modelling the economic effects of transport on business activity, but have a number of limitations.</p> <p>Smyth (2003) LUTI models are likely to be most effective when integrated with other policy planning tools.</p>	<p>Whether current land use elements of transport models could be extended or integrated to provide indications of impacts of industrial change?</p> <p>There is a need for models to account for the effect of the business cycle, e.g. development of short run tracking models to look at traffic growth and GDP.</p> <p>Current models do not allow accurate forecasting of land use and transport.</p> <p>Improved reliability modelling - forecasting improvements in reliability.</p> <p>Can a 'portfolio' model of transport needs by industry cluster be developed to assess potential reduction in transport movements?</p> <p>There is a need for more time-series data on the impact of transport on business location at a micro (firm) level.</p> <p>Need for data on the relative importance of transport for each sector at firm level.</p> <p>Current multiplier analysis of the impact of large-scale transport infrastructure investment is dated, alternative techniques need to be investigated - what?</p> <p>Need to measure the gains from transport infrastructure investment in terms of reduced costs.</p> <p>Need to employ a meta-analysis of previous studies and re-run data from these to test their validity.</p> <p>There is a need for reliable, comparable measures of congestion.</p>
Transport investment appraisal	
Evidence	Gaps
<p>Scottish Executive (2001): it is necessary to look beyond the immediate Transport Economic Efficiency (TEE) impacts on traffic and transport, into the wider economy</p>	<p>Evaluation of the wider economic impacts of transport investment.</p>

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<p>Economic Activity and Location Impacts (EALIs) in a variety of sectors, when considering economic impacts.</p> <p>OECD (2002): traditional cost-benefit approaches to appraisal measure only the direct user benefits such as travel time and cost, while ignoring the wider socio-economic impacts. These benefits might include increased accessibility, employment, business efficiency, social inclusion and environmental improvements.</p> <p>Hine and Mitchell (2001a) Transport policy often fails to include problems common across different groups of society: physical, temporal, economic, spatial and psychological. Transport policy appraisal should incorporate these social factors in cost-benefit analysis.</p>	<p>Current cost/benefit analyses underestimate economic productivity gains from public sector transport infrastructure investment.</p> <p>A need for further research into understanding the processes by which transport investments produce positive impacts, and the level of these impacts</p> <p>Most appraisal work has been done on passenger transport. There is a need for more research on freight.</p> <p>Need to perform more <i>ex-post</i> analysis of transport impact and appraisal studies.</p>
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Annex 1: Methods Used in Literature Review

Approach to Review

Methodology

We adopted a combined methodology incorporating extensive secondary research of existing work, and a focused phase of primary research designed to capture current practice and innovation.

This study differs from similar analyses principally by incorporating primary research methods throughout the process of the review. It was designed to combine the evidence presented from reviews of academic and other literature with discussion and comment from subject specialists and practitioners. The rationale behind the primary research was to: set a framework for analysis by identifying key issues in detail; to gather new material on theories and practice of the role of transport in business location and; to act as a 'sounding board' to confirm or otherwise interim findings of the secondary desk-based research. The methodology consisted of three key stages:

- The literature review
- Interviews held with key policy actors
- Two round tables -one with academics, the other with transport practitioners.

Secondary Research

Scope of Literature Review

The review examined academic literature, both UK and internationally sourced, and relevant literature from government and other public and private sector organisations. We organised the academic trawl by discipline focusing initially on transportation, economics, planning and management. The trawl of non-academic sources examined sources from local and regional government and LSCs/LECs, UK national government departments, EU and OECD sources, along with research by private consultancies. The trawl made use of electronic literature databases such as BIDS, Scirus, EconLit, the OECD TRANSPORT database, and individual university library catalogues. We also consulted international research through databases such as the EU's *Transport RTD Programme Knowledge Centre* - <http://www.europa.eu.int/comm/transport/extra/home.html> - and the American *Transportation Research Board (TRB-TRIS)* - <http://www3.nas.edu/rips>.

The tables below highlight the key academic journals covered in the trawl of literature.

Date Range Of Journals	
Journal Name	Date Ranges
Journal of Economic Literature (JEL)	Dec 1994 to September 2002 (direct access to JEL Web Site). 1998 -2002
Regional Studies	Journal first issued in 1967 From 1997
Urban Studies	Journal first issued in 1967 From 1995
Journal of Business Research	Journal first issued in 1974

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	From 1974
Journal of International Economics	Journal first issued in 1971 From 1971
Journal of Political Economy	Journal inception 1892
Journal of Public Economics	Journal first issued in 1972 From 1972
Journal of Transport Geography	Journal first issued in March 1993 From 1993
Regional Science and Urban Economics	Journal first issued in 1975 From 1975-1986 it was formerly known as Regional and Urban Economics. From 1975
Economic Development Quarterly	Journal first issued in 1970 by Sage From 1999
Journal of Economic Geography	From 1999
Oxford Review of Economic Policy	Journal first issued in 1985 From 1985
ITE Journal (Institute of Transport Engineers)	Journal first issued in 1972
Oxford Economic Papers	Journal first issued in 1947 From 1996
The Annals of Regional Science	1984 - Current From 1995

Journal	Date Range Searched
Standort	<i>1997 - 2003</i>
Environmental Planning	<i>1995 - 2003</i>
Environment and Planning (A)	<i>1990 - 2003</i>
Technovation	<i>1981 - 2003</i>
Urban Studies	<i>1995 - 2003</i>
Journal of Regional Science	<i>1997 - 2003</i>
European Urban and Regional Studies	<i>1999 - 2003</i>

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Growth and Change	1997 - 2003
German Politics	1998 - 2003
Journal of Transport Geography	1993 - 2003
Journal of Materials Processing Technology	1990 - 2003
International Journal of Production Economics	1991 - 2003
International Journal of Information Management	1986 - 2003
Jahrbuch für Wirtschaftswissenschaften	1995 - 2003
European Journal of Operational Research	1995 - 2003
Regional Science and Urban Economics	1975 - 2003
Journal of Political Economy	1982 - 2003
Economic Development Quarterly	1992 - 2003
The Annals of Regional Science	1995 - 2003
Regional Studies	1996 - 2003
Transportation Research Record	1982 - 2003
ITE Journal (Institute of Transport Engineers)	1994 - 2003
Progress in Human Geography	1997 - 2003
Oxford Review of Economic Policy	1985 - 2003
Journal of Economic Geography	2001 - 2003
Oxford Economic Papers	1996 - 2003
Journal of Applied Behavior Analysis	1968 - 2003
Journal of Socio-Economics	1991 - 2003
Recherche - Transports - Sécurité	1988 - 2003
Trends in Cognitive Sciences	1997 - 2003

Inclusion Criteria

The literature search developed a significant base of pertinent information relevant to the needs of the project. Much of the information has provided an input to the analysis. The following criteria have been adopted in order to identify evidence that is robust and directly relevant to current policy issues. Emphasis has also been placed upon more recent studies.

Article Overview

Keyword searches based on the overview and structure indicated in the research proposal provided a preliminary overview of journal articles and academic papers for further review. In addition, papers cited within identified articles were also included in the initial trawl.

Descriptive, Case Study and Analytical Base

Literature reviewed varied between studies and findings of an analytical or modelling nature, case study reviews, and descriptive analysis. This included a comparison against a detailed checklist (see below) including:

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- Matching Discipline
- Matching Keywords
- Stated Geographical Area
- Transport Mode(s)
- Presentation of Findings
- Methodological Description
- Data within publication
- Availability
- Related Publications
- Impacts of Transport on Business Location
- Geographical scale
- Impacts of Business Location on Travel
- Overview of the Role of Policy
- Overview of Gaps apparent from this article

A fine level review also included summarising and internal discussion of data fit and appropriateness. A detailed listing of literature included, together with tabulation of further papers reviewed but not included, is given in Annex 2.

Primary Research

The primary research consisted of interviews with key transport and planning policy makers in the DfT and ODPM, followed by two separate round table sessions, one with academics and one with practitioners.

Interviews

Interviews were held with key personnel at the two departments to obtain views on trends and policy direction. Specifically, we discussed the following points.

What are the current trends in business location

What in your opinion are the main factors driving the location decisions of business

(for example labour costs, transport, corporate centralisation)

How does the importance of transport influence location decisions made at a level? How has it changed/ how is it changing

How have the following changed the role of transport in location decisions

How does the importance of transport differ by type of business?

When are transport improvements most likely to lead to an increase of economic activity?

What is current Department/Government policy regarding the use of transport to influence business location

We interviewed the following people.

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Name	Division	Responsibility
Helen Bullock	Transport Research Unit, DfT	Head of Branch undertaking cross-cutting research in DfT
Kenneth Cameron	Planning Policies Division, ODPM	Developing planning obligations policies in transport and land use planning
Sarah Fielder	Urban Policy Unit, ODPM	Responsible for the analytical support to the Urban Policy Unit.
Liz Ketch	Planning Policies Division, ODPM	Head of Branch developing transport and land use planning policies
Paul Martin	Planning Policies Division, ODPM	Developing transport and land use planning policies
Jason Teal	Transport Research Unit, DfT	Undertaking research into cross-cutting issues in the DfT
Jeff Thompson	Economics, Aviation, Maritime and International Division, DfT	Appraisal methodology for airports, production of air transport forecasts at UK airports and airports allocation model.
Mike Walsh	Economics Local Transport and General Division	Head of division offering economic advice on transport appraisal techniques and project appraisal for local transport schemes and Local Transport Plans
Tom Worsley	Integrated Transport Economics and Appraisal	Head of division responsible for developing the National Transport Model. The division also provides advice on projects / scheme appraisal and on traffic and transport modelling

Round Tables

The round tables were designed to bring together experts within the fields of transport and business development and allow a more varied discussion and cross-fertilisation of ideas than would have been possible in a one-to-one interview situation. The academic round table acted as a forum for exchange of ideas and comments on findings from the first phase of research, The practitioner round table was held at a later date and was a more confirmatory session, designed to test if the findings from the report to date were in line with their experiences as professionals in the field.

The round table works as a group discussion, but in a more structured format, with the initial discussion allowing each member of the group a set time to speak about the topic. The advantages of this over a general group discussion are to allow equal participation by all round table members, avoid intimidation by dominant personalities, and assure that the full range of all possible ideas is revealed. This is followed by a more open group discussion designed to explore in depth the issues that have been highlighted as particularly important in the first stage.

Academic Round Table

Participants were selected to reflect a wide range of subject specialisms in transport, logistics and urban policy. This effectively covered all the bases in the process of planning and understanding business location. We selected people who we either knew could make a meaningful contribution or whose work we knew, implying that they would be able to make a contribution. Participants brought experience from the UK, Europe and the USA, and were briefed in advance to consider:

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- the relative importance of transport in business location decisions;
- the relationship between land use planning and transport;
- the impact of changing technology on the role of transport in business location;
- other issues arising.

Attendees for the academic roundtable on 13 March 2003 were:

Name		Organisation	Responsibility
David	Banister	University College London, UK	Transport Planning
Alan	Brown	ODPM	Urban policy
Kenneth	Button	George Mason University, USA	Transport and public policy, air transport
Graham	Gudgin	Freelance consultant, UK	Industrial location, geography of employment
Alan	McKinnon	Heriot Watt University, UK	Logistics
Eddy	Van de Voorde	UFSIA, Belgium	Logistics and maritime economics

In addition to the above, we invited a number of people who were unfortunately unable to attend, although we anticipated some drop out when deciding on numbers to invite as is usual for such events. Those unable to attend included the following specialisms.

- Transport infrastructure and regional development
- Economic impacts of transport and transport appraisal.
- Regional and spatial economics
- Planning policy
- Effects of transport on industrial location and labour mobility, logistics.
- Transport modelling

Practitioner Round Table

Participants were selected to represent practical expertise in the transport, business location and economic development fields in both the UK and Europe. We selected people to represent a wide range of subject areas to ensure that input was given on as many sections of the report as possible. Participants were given the same advance brief as for the academic round table.

Attendees for the practitioner roundtable on 20 March 2003 were:

Name		Organisation	Responsibility
Mario	Aymerich	European Investment Bank	Projects Directorate
Rachel	Burns	British Retail Consortium	Environment & Transport Policy Executive
Randall	Faulkner	NITL, Dublin	Director

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Gareth	Leigh	DTI	Director for Innovation Research and Technology Policy
Mary	MacLaughlin	Scottish Enterprise	Head of Transport Team
Robin	Shore	National Assembly for Wales, Welsh Assembly Government	Transport Director
Ursula	Huws	Institute for Employment Studies / EU EMERGENCE project	SUSTEL Project, teleworking and commuting. EMERGENCE - technology and employment location.
Richard	Elliott	Manchester City Council	Transport Policy
Nigel	Dotchin	DfT	Strategic lead on planning and regional aspects of the 10 Year Plan Review
Sarah	Fielder	ODPM	Responsible for the analytical support to the Urban Policy Unit

Additionally, we invited people from the following organisations, who were unfortunately unable to attend.

- Manchester Airport
- Teesland Regeneration
- Freight Transport Association
- CBI
- Invest UK
- English Regional Development Agencies
- Scottish, Welsh and Northern Irish Executive/Assemblies

Assessment of Round Table Methodology

Overall, we were pleased with the outcome of the round tables and felt that they contributed usefully to the study. We would highlight the following specific issues.

- What worked well:
 - Balanced discussion in both sessions with every participant making a useful contribution;
 - Every subject raised at the academic session was discussed in a useful level of detail;
 - Gaps in research highlighted at the academic session;
 - The issues felt to be of most importance were picked up at both sessions.
 - The two separate sessions were necessary in terms of participants and focus of discussion.
- What worked less well:
 - Some areas that we would like to have discussed at the academic session were not covered due to the limited number of participants and lack of time;

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- Likewise, the number of topics and depth at the practitioner session was slightly limited due to time constraints.
- What we would do differently next time:
 - Invite slightly more participants to the academic round table, although we would want to keep this to fewer than 10;
 - Invite slightly fewer participants to the practitioner session, or extend the time available for discussion;

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