FREIGHT TRANSPORTATION BETWEEN THE UNITED KINGDOM AND WESTERN RUSSIA – MODAL CHOICE

by

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ABSTRACT

This study investigated modal choice and why shippers confronted with explicit favourable data do not automatically select more environmentally acceptable and, potentially, cheaper modes of freight transport, namely sea and rail. The experiment was carried out in the context of the trade between the UK and Western Russia. The decision-maker's typology was proposed as the principal differentiating variable. Corresponding cognitive strategies, such as maximizing, satisficing, and the application of decision-making heuristics (availability, confirming, conjunctive, representitiveness, risk attitude and vividness), were considered. The phases of the decision-making process were explored, including the stimulus for change (trigger), buy-class, predecisional information gathering, ranking of options according to determinants of choice, and the ultimate modal choice decision. A Web-based questionnaire was used to elicit preferences from the respondents, applying a combination of techniques including adaptive stated preference and psychometric testing. The study concluded that buy class, information gathering strategies and resistance to change are governed by the decision-maker's typology. A significant association was found between determinants of choice and those of dissatisfaction, indicating the importance of context. It was not possible to predict the modal choice decision based on particular typologies but it was noted that even when the service attributes favour sea or rail, road transport is often preferred, especially for one-off shipments.

ACKNOWLEDGEMENTS

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Chapter 1

Freight Transportation between the United Kingdom and Western Russia – Modal Choice

1   CHAPTER 1 - INTRODUCTION

1.1   Background

The efficiency of the transportation sector has been identified as crucial to the successful development of the new Russian economy (Holt, 1993). Since 1993 numerous studies have focused on improving the different elements of the transport infrastructure, particularly the road and rail network (Government of the Russian Federation, 1999). Work has been carried out on the freight interchange points such as ports (Transportation Research Group, 1995) and inland depots, and transportation units including ships, rolling stock and road vehicles.

The demands imposed on the transport infrastructure by a free market economy are vastly different from those dictated by an autarkic command economy (Shaw, 1999) such as the Former Soviet Union. The transport network of an autarkic economy is designed to facilitate domestic rather than international freight movements. At best the external links of an autarkic economy are driven by political allegiances rather than geographic and economic drivers. In a command economy, freight transport tends to form part of a more comprehensive economic strategy (e.g. Gosplan) and, in consequence, the shape of the network and traffic densities may not necessarily be explicable in their own right. Energy costs may be heavily subsidised (or reflect internal rather than international market prices) and the capital costs of the permanent way justified by military expediency, rather than normal traffic flows (Banerjee, 1995). Consignment sizes in a command economy tend to be significantly larger than those determined by the more volatile demand characteristics of a market driven supply chain.

In the 1990s the accepted wisdom was to allow the natural dynamics of supply and demand to determine the development of both the market, and its supply chain (Goldman, 2003). More recently this strategy, when applied to

transport, has been seen to be gravely flawed (because the actual costs of some of the elements are not properly attributed). The classic example of this in the United Kingdom is the cost of road provision and, more importantly, road maintenance being disproportionately borne by the domestic motorist and taxpayer, rather than the freight transporter (Button, 1982).

Contemporary thinking (or, at least, the stated policies of governments) is to encourage, as far as possible, freight to be carried in ways that are both energy efficient and considerate of the environment. Generally this means favouring waterborne or rail transportation over road direct (door to door) movements or, where this is not possible, the proportion of the lower cost element is sufficiently high in order to justify a multi-modal solution. Considering the work done by Hayuth (1987) on convexity ratio theory, Beresford and Dubey's (1990) modal mix model and Banomyong and Beresford (2001) on routing alternatives, it is generally thought that the most cost-effective and environmentally friendly transport route for freight from the United Kingdom into western Russia maximises the available maritime component.

Despite the compelling economic and environmental advantages, and an opportunity for governments to influence a rational strategy, a large proportion of freight carried between Europe and western Russia now moves by road (EBRD, 1993). Thus, given that the choice has been left to the consumer, it is important to understand the selection process whereby some shippers make what appears to be an irrational choice. In justification of this dichotomy, Brooks (1983) in her doctoral research found that the cost to the shipper is not necessarily the key determinant of transport choice, and that attributes such as speed, dependability and reliability are often more important than rates.

The poor performance of the transport sector in many of the centrally planned economies has been blamed for contributing to their overall economic failure (Bergson, 1954). Given the importance of the transport sector for the development of an emergent market driven economy, and conversely, the potential

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adverse impact on the environment of large amounts of freight being carried across Eastern Europe by road, there is very little, if any research on the subject[1].

1.2 Objectives of the study

The primary objective of this study is to examine modal choice and, specifically, the reasons why a significant proportion of exporters appear to behave irrationally, moving freight from the United Kingdom to western Russia choosing the typically more expensive road transport option in preference to maritime transport. The study seeks to explore this apparent aberration and, from the results, draw conclusions about the freight product offering and how it is packaged.

This study is intended to explore modal choice between the United Kingdom and Russia. It is not intended to evaluate the choice between individual carriers or routes. However, some of the factors that are taken into consideration, particularly in a behavioural model, do relate to carrier and route characteristics. This is especially true where the perceived risk level may be associated with a particular route or node (e.g. St Petersburg). Even so, despite the taxonomies and background literature used, this is definitely a modal choice study, albeit one that is intended to reflect the real world.

The originality of this work lies in an investigation into whether modal choice is influenced to a large extent by the decision-maker's psychological typology. Although the influence of cost and service are taken into account in terms of the determinants of choice, it is the interaction of these determinants with the decision-maker's preferences measured on the Jungian bi-polar scales that are examined in detail. It is proposed that these preferences, such as intuition, sensing, thinking and feeling, actually determine the way that the separate elements of the decision-making process are addressed and, ultimately, the eventual modal choice.

Other objectives of the study include:

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[1] See Turró, (1999), pp. 57-58; provides a summary of the recent research on planning transport networks in Europe and links with Eastern Europe and Russia.

1. To assess the impact of the findings on the decision process and, consequently, the most likely outcomes in terms of preference for particular modal choice.

2. To evaluate the implication this has for the freight market, and how suppliers (carriers and other players in the supply chain) should design and package their product to appeal to particular types of decision-maker.

3. To suggest areas of further research, within the framework of the study itself and in a wider context.

1.3 Structure of the study

Source: Author
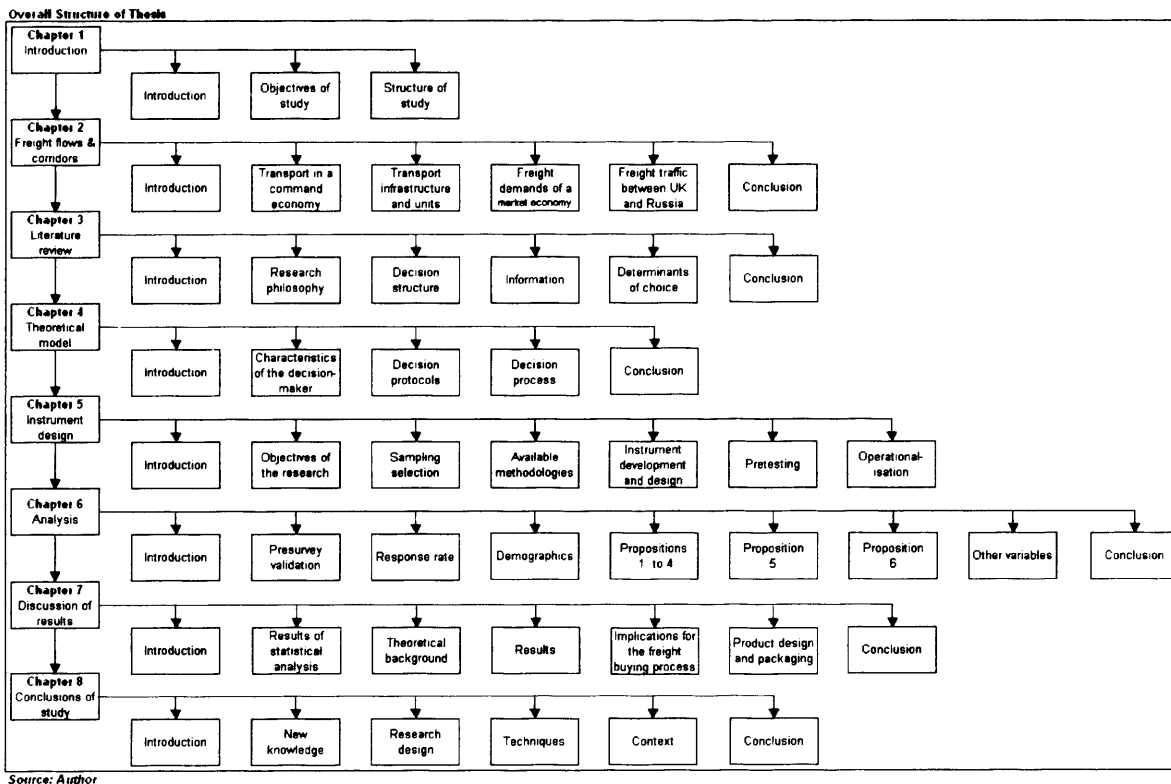
Figure 1.1 – Overall structure of thesis

The thesis is organised and divided into eight chapters.

Chapter One is an introductory chapter that provides a background to the study, states the objectives and sets out how the investigation is carried out.

Chapter Two outlines the existing freight flows to and from Russia, and how the economic circumstances and the resulting demand for freight movements have changed from the Soviet era. The freight structure and the corridors between the United Kingdom and Russia are examined in the context of how they integrate with Russia's international trade.

Chapter Three reviews existing research on which the current study is based with particular reference to the research philosophy, decision structure, psychometric instruments, existing taxonomies, information gathering and determinants of choice.

Chapter Four describes the construction of the model used to explore the decision-making process with regard to modal choice. Six propositions are used to define the process and these propositions form the basis for the constructs by which the variables are defined.

Chapter Five explains the research methodology and instrument design used in the study to measure the variables.

Chapter Six presents the general findings resulting from an analysis of the data, and the statistical analysis used to explore the propositions.

Chapter Seven discusses the general findings and the implications of the results of the statistical analysis on both the service offering and modal choice strategies.

Chapter Eight summarises the main conclusions of the study.

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Chapter 2

CHAPTER 2 – FREIGHT FLOWS AND CORRIDORS

2.1   Introduction

Chapter Two outlines the existing freight flows to and from Russia, and how the economic circumstances and the resulting demand for freight movements have changed from the Soviet era. The development of trade with Russia is put into the context of transportation in Europe in general before examining the freight structure and corridors between the United Kingdom and Western Russia.

The chapter is set out as shown in Figure 2.1.

Structure of Chapter 2 - Freight flows and corridors
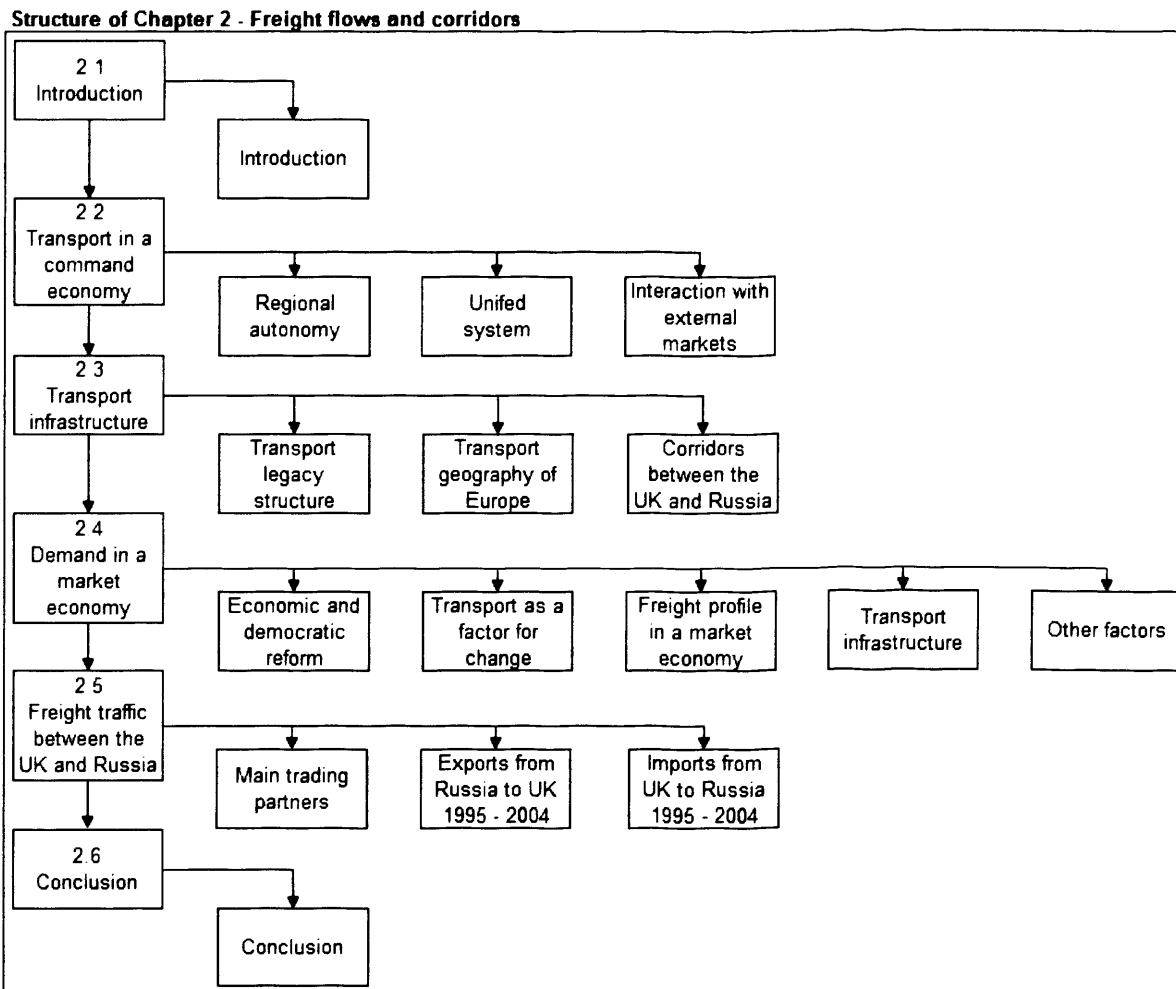
Source: Author

Figure 2.1 – Structure of Chapter 2 – Freight flows and corridors

Towards the last part of the nineteenth and early part of the twentieth century, tsarist Russia provided almost half the world production of grain, as

well as a significant amount of cotton (Spulber, 2003). This, combined with the industrialization of Russia, created substantial export and import flows. The resultant demand for a robust, externally orientated freight transport system coincided with the development of the rail and road networks and determined many of the major underlying features of Russia's transport system (Gros and Steinherr, 2004).

The October revolution of 1917 began the Russian communist era. One of the key characteristics of communist economics is central planning where government attempts to optimise economic output through various regulatory and control instruments (Davies, 1998). The more insular nature of the command economy greatly influenced the transport infrastructure of the Soviet Socialist Republics right up until the late 1980s. By this time the principles of communist economics were seen to be flawed in practice and many of the world's socialist regimes were moving towards free market strategies (Newton, 2004).
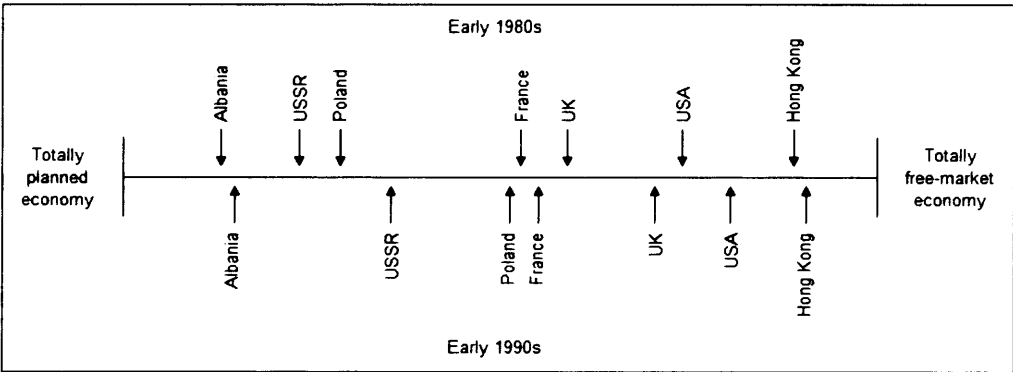
Source: Economics, Sloman J, 1991

Figure 2.2 – Positioning of planned and market economies

In the last eleven years, between 1995 and 2006 Russia has gone a long way towards making the transition from a command to a free market economy. This change in economic philosophies has placed completely different demands on the transport infrastructure (Estache, 2000). The purpose of this chapter is to examine Russia's current international trade, the resultant demand for freight movements, and how a transport system which evolved in a command economy can be used or modified to meet the new requirements placed upon it by the free market.

The chapter is organised into five further sections:

- Organisation of transport in a command economy;
- Political influence on Russia's external trade during the Soviet era;
- Transport infrastructure and existing freight corridors;
- Freight demands of the market economy;
- Freight traffic between the UK and Russia.

2.2   Organisation of transport in a command economy

Communist philosophy is based on the principle that the means of production and transport are the property of the population and that both should be organised to optimise the common good (Solts, 1922). From this philosophy arose the Soviet planning instrument known as "Gosplan". Structured into five-year plans, Gosplan regulated everything in the Soviet economy from agriculture to industrial output, and from housing to transport (Sootla, 2002).

Two aspects of this economic system are relevant to the development of the transport infrastructure in the Soviet Union and thus Russia. The first principle that the communist regime tried to apply was that each region should, as far as possible, be self-sufficient (Wehrheim, 2003). The second principle relates directly to the transport itself. One of the main tenets of communist dogma is that an economy that is planned must be more efficient than one that is driven by "selfish" capitalist principles. Thus transport in a command economy is organised into one unified system optimizing the use of both the means of transport and the infrastructure.

The differences between the planned and market approach (seen from a communist perspective) are exposed by Lavrishchev (1968) in his "Economic Geography of the USSR".

> 'Under the capitalist system of economy the irrational distribution of production accounts for the irrational distribution of the means of transport. The sharp division of the capitalist countries into industrial and agrarian, economically highly developed and backward, the uneven distribution of production

within individual capitalist countries, and the isolation of industrial and agricultural production from the areas of consumption lead to irrational transportation of raw materials and fuel, half finished and finished products, and in the end results in an enormous waste of public wealth and reduces the productivity of social labour. In many capitalist countries the transport is owned by large monopolies. The capitalist transport is characterised by competition among the different private transport companies – railways, shipping lines, bus and truck lines, airlines – which redoubles the irrational work of the transport in a capitalist world.'

Against this Lavrishchev extols the virtues and benefits of the organisation of transport in a socialist world:

'In socialist society the transport is the common property of the people and is a constituent part of the single socialist system of economy. The systematic, proportional development of socialist economy conditions the rational development and distribution of transport over the territory of the country. The distribution of transport in its turn fosters systematic distribution of production all over the country.... Unlike the elemental and anarchic development of the means of transport in a capitalist country, the railways, waterways, automobile and air transport have developed in the USSR as a single system of transportation which systematically combines all forms of transport and works in accordance with a plan established by the state. One of the most important differences between the socialist transport of the USSR and the transport of capitalist countries is that the former develops without any crisis and its freight turnover is continuously increasing.'

Transport in a socialist economy is seen as a unitary whole, operating efficiently within the framework of the production cycle. Like many aspects of socialist philosophy the aspirations may be considered laudable, and the principles, taken on face value, quite sound. Unfortunately the strategy ignores several important practical constraints. Regional autonomy is almost impossible, especially in Russia, because of the dispersal of raw materials, climate, agricultural assets, population distribution, and availability of energy. The underlying transport infrastructure, whether natural such as waterways, or imposed such as the railways, are given factors, or a legacy of the demands of an earlier economic regime.

The early communist government attempted to correct the perceived failings of the networks it inherited from the tsars, by developing full industrial

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infrastructures in each of the planning regions, and even resorting to relocating whole populations (Holt Ruffin, & Waugh, 1999). Ultimately transport economy could only be achieved by moving industry towards its raw materials and sources of energy. This meant that vast industrial complexes were built that became transport nodes for highly concentrated transport on trunk routes.

As the planned economy became more complex, regional specialisation was inevitable with the attendant need for inefficient low density cross haul routes. In addition, the priority given to industrial development meant that the tsarist transport system, intended to meet the demands of an agrarian exporting economy, had to be reoriented from one that was essentially north-south, externally open (linking the agricultural areas to the ports) to east-west, and internally focused (linking raw materials, energy and industrial assets) (Shearer, 1996).

The concept of regional autonomy also influenced transport links outside the Soviet Union. Quite apart from the physical constraints of distance, climate and topography, or even political isolation, the pure socialist model militated against establishing links to external markets unless these were absolutely essential. For the most part, in theory at least, such links were not necessary as (viewed as a whole) the Soviet Union could be completely self-sufficient. This philosophy conveniently ignored the reality that in some instances external links would have provided greater transport economy than self-reliance. For example, it may make economic sense to supply the Russian Far East with grain carried by sea from Canada rather than grain shipped roughly the same distance by rail from the Ukraine (Shershniov, 1985).

It is argued that the socialist ideal of a unified transport system can only exist in isolation from market driven economic factors. While a unified transport system may optimise the use of transport assets within a closed environment, given the application of internal "pricing" structures, any exposure to world commodity and fuel prices only serves to highlight the inefficiencies of internal, high-cost producers and subsidized transport (based on below market price energy costs). Thus, the perceived transport efficiency of a command economy

relies on operating within an autarkic regime, and the moment the boundaries of this regime break down it becomes untenable.

This has been the case in Russia for some time, even before the reforms of the 1990s. Although the transport system was planned to serve the needs of a command economy, the effects of war, the inability to impose regional autonomy, the failure of Gosplan to deliver overall self sufficiency, the eventual enforced interaction with external markets (because of internal shortfalls in production) and the pure geography of the country meant that, the ideal of a unified transport system was never really achieved. Even so, the legacy structure, though not completely characteristic of a purely unified system of a command economy, then had characteristics that were not suitable for the requirements of a market driven system (Shaw, 2003).

- The introvert nature of the economy and a marked dependence on land-based media meant that operating distances were far greater than those normally regarded as optimal for a particular medium of transport in a market economy (Byung Hyun, 1987);

- There were few external links and, where these existed the facilities were not totally compatible with western orientated media (rail gauge, freight technology, transportation units and the amenities for handling containers – eight foot six inch ISO containers rather than the original eight foot) (Mattelart, 2000);

- The priority accorded to bulk freight such as coal, petroleum and timber, established on major trunk routes rather than lower density, geographically diverse traffic occasioned by consumer supply and demand, influenced both the development of the network and the design of the transportation units and transfer points (Barnard, 2004);

- Organisation, management and control based on common ownership of assets across the whole of the USSR (including freight containers, rolling stock and even locomotives) is vastly different from a system where the infrastructure and transportation assets are owned by a wide variety of legal entities and organisational types (Lieberman, et al., 1995).

2.3 Transport infrastructure and units

2.3.1 Transport legacy

Transport corridors, especially on land, develop over substantial periods of time and often evolve as a legacy of a completely different era. Footpaths may follow the line of earlier animal runs which themselves have been dictated by topography and climate. Cart tracks and then roadways using almost the same line as the original animal run may later replace the paths. Even the line of modern Motorways, Autobahns and Freeways, are influenced by the towns and cities established along the transport routes of an earlier age.

Contemporary changes to a transport infrastructure tend to be marginal. This is because any significant innovation will be high profile, have to comply with modern regulatory regimes (protecting the rights of others and the environment), will require some form of enquiry and be capital intensive. Where a change is proposed, it will normally have to demonstrate that there are significant benefits over existing links or that the existing links have become severely congested. White and Senior (1983) observe:

> "It is an obvious mistake to think that the slate can be wiped clean and a completely fresh start made with a transport system. Continual marginal changes can be made, but to change direction is more difficult. Thus the shape of a railway system is a legacy from the past."

The transport infrastructure in Russia has been modelled and remodelled by many different factors including:

- Climate;
- Conflict;
- Geography;
- Industrial development;
- Migration;
- Natural resources and energy;
- Political ideology;
- Technological isolation;

–   Trade (regional specialisation).

There are significant physical barriers to transportation in Russia such as mountains, rivers and swamps. Major rivers provided early travellers and traders with effective transport routes to the interior but in Russia, these tend to be orientated from north to south (see Map 2.1). The same rivers effectively impede travel from east to west. Before the development of the rail and road system (requiring permanent or semi-permanent river crossings), transport was often more easily accomplished in the winter by sledge (March, 1996).

Map of Russia and the surrounding areas

Source: Author (based on various sources)

Map 2.1 – Russia and the surrounding areas

Short to medium term demand for freight transport is determined by two main drivers; trade, caused by regional specialisation, and conflict. Trade routes are generally developed in an orderly manner along new or established transport corridors; however, the requirements of war are less predictable. More often than not the determinants have been generated by the aggressor specifically to exploit any weaknesses in the defender's supply chain. Hence, conflict often establishes new (and, possibly, irrational) transport corridors that would otherwise not exist, e.g. Arctic convoys to Murmansk in World War II. In turn these corridors may, themselves, stimulate new trading routes and regional specialisation (Miller et al., 1952).

Much of Russia's modern transportation system was determined by trading patterns of the late nineteenth and early twentieth century. In the second half of the nineteenth century, when railway development first began, Western Russia's

main export market was Europe comprising cotton and grain. As Russia began to industrialise at the end of the eighteenth century and beginning of the nineteenth, large quantities of the new machinery and equipment were imported from Europe, particularly Great Britain. As the new industrial complexes came on stream, railways were built to link these with sources of raw materials and energy (Westwood, 1964).

Although the development of the railways in Russia (given the terrain and climatic conditions) was already impressive, ultimately it was conflict that accelerated the expansion. The Russians blamed the defeat in the Crimea in 1856 on inadequate supply lines (Symons & White, 1975 and Murray, Bernstein & Knox, 1999). In the fourteen years following the Crimean War no fewer than nine railway systems were built.

The development of the Trans Siberian Railroad by Nicolas II (1892-1901) was largely designed to support the garrison in Russia's Far East (Cohen, 1996). By military standards, it was unsuccessful in its delivery for this purpose, as it lacked the facilities necessary to reinforce the forces in Manchuria at the time of the Russo-Japanese war. It did, however, have the effect of opening up Siberia in terms of trade. Almost a century later, the Trans Siberian Railroad (TSR) provided an alternative to the waterborne container service of the Far East Freight Conference in the 1970s. Even now, there are initiatives (Maersk/Sea-Land) to develop the TSR as a major freight corridor again (Helmer, 2000).

Conflict has also had a negative impact on the transport infrastructure. The invasion of Russia by Nazi Germany in 1941 had persistent implications for the pattern of trade, domestic and external. As the Germans marched on Russia from the west, Stalin withdrew the major industrial assets east, beyond the Ural Mountains to avoid them falling into the hands of the occupying forces (Knight, 1993). This had the effect of further concentrating industry in the centre of Russia and isolating it from external markets and influences.

Even when the political climate mandates international trade, Russia is geographically disadvantaged with regard to external links to the transport

network. The country is vast, measuring 4,500km north to south and 16,000km east to west (Kaminiski, 1996) so that for some parts of Russia the distance to the nearest border crossing can be huge. The land borders to the south comprise either desert or mountainous regions with few viable border crossings. To the North Russia is bounded by sea. Most of the northern ports are within the Arctic Circle and are icebound for much of the year. Even Russia's ports in the Baltic and the Black Sea are icebound for part of the year and can only be accessed with icebreaker assistance (Terterov, 2002). Moreover, the size of vessels plying to these areas is restricted by the need to transit the Denmark Straits (De Geus, 2002, Admiralty, 2005 and Wessel, 2004) and Bosphorus respectively.

Hence, the design of Russian ships is quite particular. They are normally of high ice class, sometimes with icebreaker bows, have relatively powerful engines for their tonnage and are size limited. Technically, they are generally considered inferior to western vessels with higher fuel consumption, higher manning scales and severe cargo carrying constraints (due to tonnage rules, deadweight constraints or ISO freight container compatibility) (Greenway & Curtis, 1981).

The Soviet merchant marine, itself, was organised into various shipping companies according partly to specialisation and region. Most of these companies were designed to carry mainly domestic traffic but some were allowed to develop fleets orientated towards international trade, whether Soviet or third party cargoes (cross-trades). The main companies involved in such traffic were Baltic Shipping Company (BSC), Black Sea Shipping Company (BLASCO) and Far East Shipping Company (FESCO) (Bergstrand & Doganis 1987).

Baltic Shipping, based in Leningrad (St Petersburg), participated in a number of trades, independently, or as part of joint ventures with such carriers as Polish Ocean Lines. Externally Baltic Shipping progressed from being regarded by the Conference lines as "non-commercial competition" to "tolerated outsider" and eventually to full conference membership in some trades. Prior to the break-up of the Soviet Union, Baltic Shipping participated in the following trades:

- Balt Australia (Leningrad/Europe/Australia);

- Balt Orient   (Leningrad/Europe/Far East);
- Balt America   (Europe/South America);
- Balt Canada   (Leningrad/Europe/Canada);
- Cobalt Line   (Europe/Central America – Pacific);
- Baltgulf   (Europe/US Gulf);
- Balt Cuba   (Leningrad/Cuba);
- Balt Pacific   (Europe/West Coast South America);
- Balt USA   (Leningrad/East Coast USA);
- Besta   (North Europe/East Africa);
- Rinela Line   (Riga/Europe/Near East).

As the republics making up the Soviet Union were devolved, the various shipping companies were ceded to the new nation states. Some have survived (e.g. Northern Shipping Company) whilst others have not (e.g. Baltic Shipping Company). For a short period after the break-up, determined by the economic life of the ships, a lot of the former Soviet tonnage became available on the international charter market (at low charter rates reflecting the smaller unit size, higher manning and fuel costs) or even transferred into Western ownership (same ships, same board of directors).

Overland routes to Russia are not without problems. Russia has land borders to the west and south. The links to the west are quite viable insofar as there are no real physical constraints to transportation. To the south Russia is bordered by either deserts or almost impenetrable mountain ranges. Consequently, the land routes to the south are quite limited.

For the purpose of this study it is the routes to the west that are of interest. Links with Western Europe are through either the Baltic States or Belarus and Poland. Road transport is restricted to a certain extent by the poor state of the carriageways in Russia itself and the transit countries (ECMT, 1998). Although this is improving, in Poland, for example, freight haulage is sometimes prohibited during the daytime because the poor quality tar used to bind the wearing surface tends to melt (CEEBIC, 2003). Conversely, the extreme cold in

winter damages the road surface and maintenance is a continuous problem (ECMT, 2000).

Russia has a low density of metalled roads and, where they exist, they tend to be extensions of the railroad rather than trunk routes in their own right (Mau, 2004). Western Russia is better served than the other regions, so that road links with locations to the west of Moscow are generally viable whereas links to anywhere east of Moscow depend on the precise destination. There are numerous road transport operators available, dominated by eastern European hauliers, mainly Polish. Russian companies are beginning to contest the routes.

Through rail transport from countries bordering the Former Soviet Union is complicated by the different rail gauge requiring change of gauge transhipment. As far as trade with western Russia is concerned, this can only take place at Brest in Belarus, Chop in the Ukraine and Ungheni in Moldova (VTT, 2004). Finland and the Baltic States have the same rail gauge as Russia so that the modal change at ports in these countries gives direct access to the Russian rail network. On the other hand, rail gauge transhipment is necessary between Lithuania, for example, and Poland.

The Russian railway system is being reorganised along western lines with the similar arguments regarding administration of the permanent way, as in the UK, and letting of regional franchises and passenger and freight train operations. At the time of writing these matters have not been finally resolved.

As far as the current situation is concerned, the availability of suitable rolling stock is possibly the most critical factor preventing the use of the rail network from providing external links (Vigdorchik, 2004). By definition the mixed and less orderly requirements of market driven demand inherently require a greater number of transport units. It also requires a different type of management and control of the transport assets (Pittman, 2004). The rolling stock required for the bulk movements, discussed above as characteristic of a command economy, is generally of a different nature than that required for smaller, market driven, consignments. The less well-matched freight flows, or

inability to triangulate to the same extent as in a command driven system, means that large numbers of wagons have to be dead-legged empty which is alien to the Russian psyche.

The difficulties that beset surface transport in Russia stimulated the growth of a significant air transport sector for passengers and freight. Because of the terrain, air transport of domestic freight and passenger movements on a mass scale was probably more important in the Soviet Union than anywhere else in the world. Developed exclusively during the communist era, the route network reflects accurately the needs of a command economy. Thick trunk routes connect main population and industrial centres whilst long thin routes extend to the more isolated settlements. Air transport networks are easier to modify than any other mode because the ground based facilities, especially for freight, are readily established or transferred and aircraft can be reassigned. Hence, air transport quickly adapted to the new requirements.

After the dissolution of the Soviet Union, Aeroflot, originally established in 1932, was broken up and the various parts ceded back to the home nations. Some retained national carrier status, whilst others, e.g. Arkhangelesk Airlines and Baikail Airlines, became regional carriers. Russia still uses the name Aeroflot to designate its national carrier[2]. Many of the new airlines have modernised their fleets releasing a lot of the former Aeroflot aircraft (Duffy, 2004), especially the large freight transporters, such as the Antonov AN24 and Ilyushin IL76, onto the international air charter market. As well as being used externally (Hellenic, 2004), they provided western investors (primarily in the oil industry) with a means of moving large consignments long distances into the remoter areas of the Former Soviet Union.

The transport infrastructure of Russia and the Former Soviet Union is inherently well developed. It has some shortcomings because it was designed and managed as a unified transport system to meet the demands of a command economy, and those requirements have changed. The demands of a market

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[2] Not only has the name of Aeroflot been retained but the "hammer and sickle" is still used as part of the logo and on some of the advertising (BBC, 2003).

economy in Russia now require a developed, flexible and economic transport infrastructure that has reliable and persistent external links. In due course, no doubt, the Russian transport infrastructure will fully integrate with those of its neighbours, with economic benefits to Russia and its trading partners.

In the meantime, the freight corridors that are available at present are discussed below.

2.3.2 Transport geography of Europe

The transport infrastructure of Europe has also been moulded by trade (e.g. super containers ports in the Northwest Continental port range), conflict (e.g. the "Cold War"), political developments (e.g. establishment and enlargement of the European Union) and technical innovation (e.g. Channel Tunnel link).

As trade between Europe and the Former Soviet Union has increased, so have the transportation links, both land-based and maritime. Eastern European trucking companies have contested the freight markets, both international and domestic. New short-sea shipping lines have been launched (e.g. Euro-Baltic) and feeder services established to link the super ports with smaller satellites.

The trade between mainland Europe and Russia is far more complex than that between the United Kingdom and Russia. The competition for road transport is more intense, the proximity of many European countries to the land borders of Russia favours road or rail solutions, and even the maritime routes can be operated economically by river vessels (via the Kiel Canal) in the summer. Moreover, Continental shippers are slightly more disposed towards rail transport than their UK counterparts. Many of the disadvantages of using road and rail from Europe to Russia, such as customs formalities have eased in recent years.

This means that the European trade with Russia naturally, but not exclusively, falls into the following categories:

- Road and rail – cargo emanating from outside the immediate hinterland of connected ports (e.g. Antwerp, Rotterdam, Bremerhaven and Hamburg);

- Short-sea shipping services to Russia – cargo from the immediate hinterland of connected ports plus feeder cargo from mainline vessels;

- Feeder services – cargo from mainline vessels.

Hence, exploring modal choice between Continental Europe and Western Russia would entail taking account of more diverse geographic variables. For example, the implication of port proximity for freight emanating from, Mannheim or Botlek is likely to be more influential than a similar comparison between Birmingham and Hull. It is possible that the freight flows between Europe and Russia influence those between the UK and Russia, insofar as, the links, competitive rates and backload potential are established on the basis of these flows. However, the affects would be of more interest in a macro-economic study and are not explored in detail here.

2.3.3   Surface freight corridors between the UK and Western Russia

Freight corridors between the UK and Western Russia

Source: Author

Map 2.2 – Surface freight corridors between the UK and Western Russia

Although the transport legacy of Russia has been discussed as a whole, only a limited number of freight corridors are relevant to this study. The

following corridors between the UK and Western Russia are examined in more detail:

- Rail via Folkestone, Calais and Brest;
- Road via Dover, Calais and Brest;
- Sea via UK east coast port to St Petersburg;
- Sea via UK east coast port to one of the Baltic State ports;
- Sea via UK east coast port to Finnish ports;
- Sea via UK east coast port to Kaliningrad;
- Sea via UK east coast port to Murmansk/Arkangel.
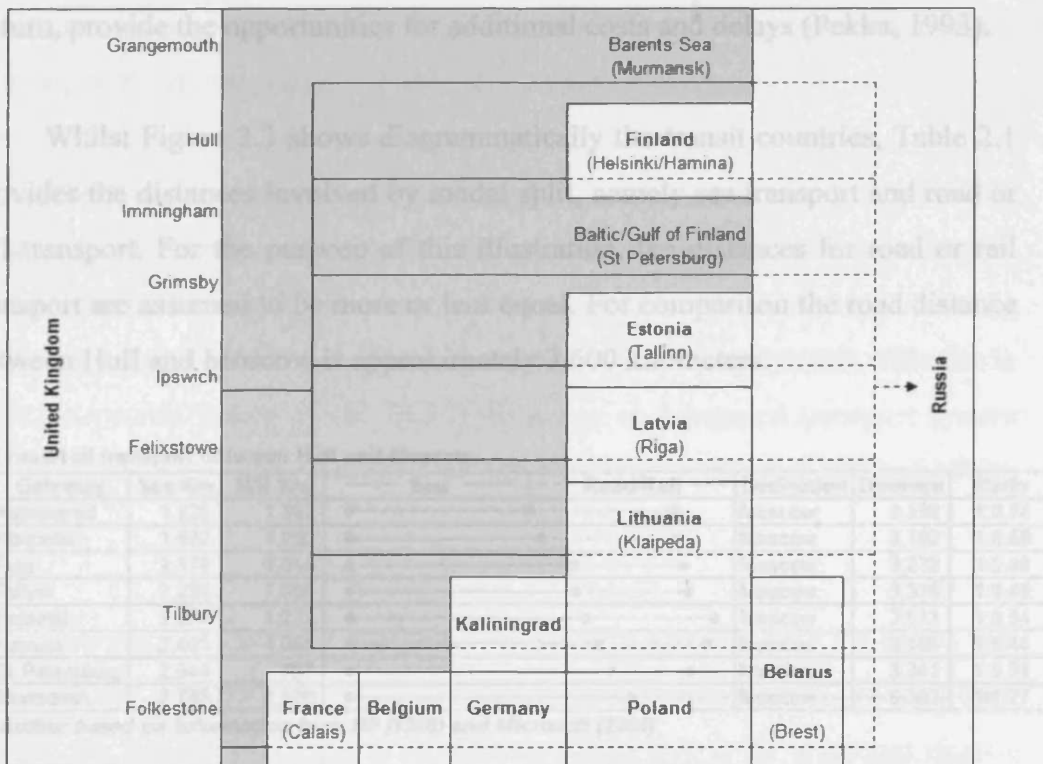
Source: Author

Figure 2.3 – Diagram showing freight corridors and transit countries

From Map 2.2 it can be seen that some of the corridors are shorter than others and utilize different transport modes, namely road, rail and sea, as well as combinations of two or more of these. Some corridors provide direct seaborne access to Russia (Murmansk/Arkangel and St Petersburg), whilst others involve transiting a third nation state, as in the case of Finnish ports, and Tallinn, Riga and Klaipeda. Kaliningrad is interesting because, through historical accident,

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although it is part of the Russian Federation, surface freight landed at this port and destined for Western Russia still has to transit both Lithuania and Belarus.

Road transport from any United Kingdom origin will generally be shipped by one of the Channel crossings (for example, Dover/Calais or Folkestone/Calais) to France. Similarly, rail traffic will use the Channel Tunnel link to France. Whether road or rail freight, this traffic then has to transit Belgium, Germany, Poland and Belarus before arriving in Russia. These corridors are shown schematically in Figure 2.3. Apart from the distance involved (see Table 2.1), each border crossing involves Customs formalities that, in turn, provide the opportunities for additional costs and delays (Pekka, 1993).

Whilst Figure 2.3 shows diagrammatically the transit countries, Table 2.1 provides the distances involved by modal split, namely sea transport and road or rail transport. For the purpose of this illustration, the distances for road or rail transport are assumed to be more or less equal. For comparison the road distance between Hull and Moscow is approximately 3,600 kilometers.

Sea and road/rail transport between Hull and Moscow

Origin	Gateway	Sea Km	R/R Km	—— Sea ——	--- Road/Rail ---	Desination	Distance	Ratio
Hull	Kaliningrad	1 828	1 362			Moscow	3 190	1 0 74
Hull	Klaipeda	1 892	1 290			Moscow	3 182	1 0 68
Hull	Riga	2 178	1 054			Moscow	3 232	1 0 48
Hull	Tallinn	2 226	1 090			Moscow	3 316	1 0 49
Hull	Helsinki	2 274	1 237			Moscow	3 511	1 0 54
Hull	Hamina	2 401	1 064			Moscow	3 465	1 0 44
Hull	St Petersburg	2 544	797			Moscow	3 341	1 0 31
Hull	Murmansk	2 782	3 520			Moscow	6 303	1 27

Source: Author based on information from BP (1958) and Microsoft (2004)

Table 2.1 – Sea and road/rail transport between Hull and Moscow

In general, rail transport can provide economic advantages over road transport where the rail sector is sufficiently long and the origin and destination points are close to a railhead. Transfesa (2005) in its evidence to the European Union Committee of the House of Lords, estimated rail transport costs to be in the order of €0.45 per kilometer per container for rail freight against €0.65 for road transport. Rail can also provide a viable alternative to sea transport if there is sufficient convexity, i.e. the sea route is much longer (taking into account any oncarriage) than the land route.

Since the Channel Tunnel opened in 1994, in theory at least, a direct physical rail link has been established between the rail network in the UK and that of Russia. The permanent way exists and, since 15th March 2003 operators with the necessary licence have access to the Trans European Freight Network (TERFN). Change of gauge transhipment is required at Brest (if using the route through Poland and Belarus) which is normal. As far as European freight is concerned, delays amounting to several days can occur due to the shortage of rolling stock. There can also be problems with documentation and most carriers have agents appointed in Brest to deal with formalities and expedite shipments. Most rail services from Brest go on to Moscow from where cargo is distributed by road, or the rail wagons are shunted for onward movement.

There are many changes taking place as far as the organisation and structure of the Russian rail network. Although these changes are not finalised, it is likely that the eventual outcome will be separation into competing vertically integrated operators with non-discriminatory access. (Pittman, 2004). This fits in with the general policy of the ECMT to create an integrated transport system throughout Europe, and to build a bridge between Europe and the rest of the continent.

There is a danger in a study of this nature to consider only the issues that relate to the transport infrastructure of the developing country, in this case Russia. As far as rail freight is concerned, whilst this is an important aspect, where consideration is being given to the viability of a corridor between the United Kingdom and Russia, the connectivity of the former (United Kingdom) to the network is as important as the latter (Russia). In this context, the United Kingdom link with the network, the Channel Tunnel, was originally forecast to carry between 6 and 8 million tonnes of rail freight per annum. The most it has ever carried is 3 million tonnes and in 2003-4 this fell to 2 million tonnes. This represents about 3 per cent of the total cross channel market (Transfesa, 2005).

An important factor determining route and modal choice is the perception of a service at the point of origin. It can be seen that the United Kingdom freight

market is not well orientated towards the use of rail. Only about 10% of the United Kingdom's freight traffic is carried by rail compared with 20% in France (Eurostat, 2004). It may be that in this case, there is only a marginal cost advantage using the rail corridor between the UK and western-Russia and that any economic advantage is outweighed by the inconvenience of the rail gauge transhipment. On the other hand, it may simply be that the UK freight transport system does not integrate well even with the European rail network, so that the fact that the cargo would ultimately be consigned to Russia is largely irrelevant. In any event, the number of forwarders prepared to offer this mode and routing appears to be extremely limited.

Road transport does not, under normal circumstances, compare favourably with rail and sea transport over longer distances. Even so, road transport directly to Russia appears to have become a popular mode amongst shippers and forwarders. Although it takes about two/three weeks for a round trip, it has the advantage of being door to door and under the control of one person – the driver. There have been problems with security and, in Eastern Europe and Russia, drivers are advised to stop only in secure compounds, especially when they are carrying higher value consignments.

There are some restrictions on the movement of freight vehicles on the roads in Poland during the day, and one day is normally allowed for delays and formalities at the borders. Some time can be saved by using a TIR Carnet (Silva and Handy, 1997). The state of the roads in Belarus and Russia are also poor which restricts the speed of vehicles but this, in itself, despite the distance, does not seriously impact on the overall transit time (1,000 km at 60kph only takes just over four hours longer than at 80kph).

There are a number of forwarding companies and hauliers offering this route, many of the latter based in Poland, Belarus or Russia. Whilst there are numerous UK based freight forwarders offering road services to Russia these rely on East European transport operators rather than UK hauliers. The UK hauliers have either had to exit the market (Lesto, 2005), as they are unable to compete on costs, or have diversified into other areas. The forwarders offering

regular shipments to Russia generally employ at least one Russian speaker in order to expedite any movements that are delayed.

The most cost effective multimodal operations maximise the lowest cost elements and minimize the higher cost elements and number of transfers. In terms of freight transport from the UK to western Russia the lowest cost route would be a direct shipping service from a shipper based at a UK east coast port to a consignee in a Russian port. However, in practical terms there will normally be a road or rail movement to the loading port, and a road or rail movement from the destination port (gateway) to the consignee's premises.

Ignoring issues such as ice navigation, port congestion and discriminatory access to rail and road networks, the optimum is achieved by selecting ports that are closest to the shipper and consignee respectively. Hence, the most appropriate maritime gateway for Western Russia, on face value, is the Port of St Petersburg. The port is Russian; there are no borders to cross (as with Kaliningrad, the Baltic States and Finland); the sea distance against the inland element is maximised; there are good connections to the inland network, whether waterway, road or rail; and the port has facilities for handling conventional as well as container ships.

Services between UK East Coast Ports and St Petersburg

Seq	Port	Frequency	Rotation
NW Shipping	Felixstowe	Once every two weeks	Felixstowe-St Petersburg-Felixstowe
OOCL	Grangemouth	One sailing per week - fixed day	Grangemouth-Antwerp-Rotterdam-Tallinn-Hamburg-Gdansk-St Petersburg-Hamburg-Grangemouth
Samskip 2	Hull	One sailing per week - fixed day	Hull-Antwerp-Rotterdam-Bremerhaven-Hamburg-St Petersburg-Hull

Source Author - based on Containensation International Yearbook - 2004

Table 2.2 – Services between UK East Coast Ports and St Petersburg

In practical terms, the main disadvantage for using St Petersburg all year round is that it is icebound for up to five months out of twelve. The port is located at the eastern end of the Gulf of Finland where, because of the outflow from numerous rivers, the water is extremely cold and the salinity very low. Ice forms easily in the Gulf and is blown by the prevailing southwesterly winds directly towards St Petersburg, where it forms pack ice (Pinardi and Woods,

1965). Entry to the port is only possible with special ice strengthened ships, and in January, February and March (depending on the severity of the winter and prevailing winds), only with icebreaker assistance.

As well as the climatic disincentives for using St Petersburg, the port has from time to time had a poor reputation for both delays and corruption (Yegorov, 2003). The result is that of the nine shipping lines, comprising nineteen services, operating to gateway ports for Russia out of the UK, only three of them call at St Petersburg (see Table 2.2).

Since the break up of the FSU, the Baltic States have been keen to develop their facilities as gateway ports for Russia. As part of the Soviet Union's planned economy they were, in any event, part of the framework of administrative directives that secured particular types of cargo to certain transit ports (Brodin, 2000). From the dissolution of the FSU, the Baltic States have not only had to compete for the cargo volumes from Russia's own ports but also with other gateways, such as Finland, and land based corridors.

Services between UK East Coast Ports and the Baltic State Ports

Seq	Port	Frequency	Rotation
Kursiu Linja 1	Ipswich	Every six days	Kaliningrad-Riga-Klaipeda-Ipswich-Rotterdam-Immingham-Riga-Klaipeda-Kaliningrad
Kursiu Linja 2	Immingham	Every six days	Kaliningrad-Riga-Klaipeda-Ipswich-Rotterdam-Immingham-Riga-Klaipeda-Kaliningrad
OOCL	Grangemouth	One sailing per week - fixed day	Grangemouth-Antwerp-Rotterdam-Tallinn-Hamburg-Gdansk-St Petersburg-Hamburg-Grangemouth
Rix 1	Hull	Every fourteen days	Klaipeda-Hull-Klaipeda
Rix 2	Hull	Every fourteen days	Riga-Hull-Riga
Rix 3	Ipswich	Every fourteen days	Tallinn-Riga-Klaipeda-Ipswich-Riga-Tallinn

Source Author - based on Containensation International Yearbook - 2004

Table 2.3 – Services between UK East Coast Ports and the Baltic State Ports

Geographically, the Baltic States are well positioned to attract Russian transit traffic (see Table 2.3). Tallinn, in Estonia, is just inside the Gulf of Finland, towards the western end, so is not so affected by ice (although in 2003 it did suffer from an exceptionally cold winter and lack of icebreakers) (EIU – Estonia, 2003, EIU – Latvia, 2003 and EIU – Lithuania, 2003). Riga in Latvia

and Klaipeda in Lithuania are outside the Gulf of Finland but still suffer from some degree of localised ice on occasions.

All the Baltic State ports offer similar facilities in terms of transit cargo to Russia. From the days of the Soviet Union they are well connected to the Russian rail and road networks. The distances to Moscow from St Petersburg, for example, are not dissimilar (150-200 kilometres more for Tallinn and Riga – Latgale Highway). Transit cargo plays an important role in the Latvian economy, especially oil cargoes from Russia (although Russia has boycotted the use of the Ventspils oil pipeline since 2002). As an indication of the importance of this business, Riga's transit traffic increased from 27% of the total cargo volume in 2001, to 45% in 2005 (EIU – Latvia, 2005).

Klaipeda is favoured as the main port of call in the Baltic by Kuršų Linija. A new container port was opened in 1999 with a view to handling a further 150,000 teu per annum (Baird, 2004).

Services between UK East Coast Ports and Finland

Seq	Port	Frequency	Rotation
Containerships 1	Teesport	Every seven days	Helsinki-Teesport-Rotterdam-Helsinki
Containerships 2	Tilbury	Every seven days - fixed day sailing	Helsinki-Tilbury-Teesport-Aarhus-Helsinki
Containerships 3	Teesport	Every seven days - fixed day sailing	Helsinki-Tilbury-Teesport-Aarhus-Helsinki
Finnlines 1	Hull	One sailing per week	Helsinki-Hamina-Hull-Helsinki
Finnlines 2	Hull	One sailing per week	Helsinki-Rauma-Hull-Helsinki
Finnlines 3	Felixstowe	One sailing per week	Helsinki-Kemi-Oulu-Felixstowe-Antwerp-Turku-Kemi-Oulu-Antwerp-Felixstowe-Copenhagen-Helsinki-Kemi
T&E ESCO	Felixstowe	One sailing per week	Heslinki-Muuga-Felixstowe-Antwerp-Stockholm-Muuga
Transfennica 2	Tilbury	One sailing per week	Tilbury-Hamina-Tilbury

Source: Author - based on Containerisation International Yearbook - 2004

Table 2.4 – Services between UK East Coast Ports and Finland

Despite the stated intention of the Russian Ministry of Transport to force certain Russian exports, such as non-ferrous metals, through Russian ports this has largely proved unsuccessful in a market driven environment. More than half Russia's exports of non-ferrous metals in 2000 were shipped through Baltic State ports (STI, 2000). This is not surprising given the underlying port capacities/utilizations but there is also another factor. Major Russian exporting

companies, such as Yukos and Gazprom, are actively investing in the transport infrastructure of neighbouring countries in order to secure reliable transit routes (Yukos, 2004).

Finland has always proved very competitive in terms of acting as a gateway to Russia (see Table 2.4). The port of Kotka is only twenty miles from the Russian border, and Helsinki is just over one hundred miles. The rail gauge in Finland is the same as in Russia, and Finland has tended to be more consistently successful keeping its ports open in winter by providing icebreaker assistance when this has been necessary (on occasions even supplying icebreakers to St Petersburg). Finland has been in the EU since 1995 (as now are the Baltic States) that makes customs formalities for export cargo from Russia through these countries much easier.

One of the important criteria qualifying a port for either transhipment cargo, or as a gateway for entrepôt cargo, is the ability of the immediate hinterland to generate a substantial inward or outward cargo flow of its own. Major shipping lines do not then have to deviate from their normal schedules speculatively, but can add cargo for transhipment at a main port at marginal cost. This is the case with Helsinki, as Finland's economy is such that domestic cargo flows already exist with many of Russia's own trading partners. This is amply illustrated by the fact that transit cargoes account for only 7 per cent (2002) of the turnover of Finnish ports, compared with 71 per cent of the Baltic State ports (2001) (Brodin, 2000 & Port of Helsinki, 2004).

On the negative side, as with the Baltic States, Russia is not keen to promote the shipment of Russian cargo through non-Russian ports and has on occasions imposed taxes and tariffs on, for example, the Finnish railways to discourage the use of this route. Finland has also been able to pressurise Russia from time to time, and so the situation (and, thus, cargo flows) has tended to fluctuate. As the authorities in Russia and Finland have established closer cooperation, these problems are supposed to be easing, but there are still occasional disputes between Russian truckers and the Finnish authorities (BOFIT, 2003).

The Finnish State Railway (VR) has the same track gauge as the Russian Railways, so operationally can compete on an equal footing with St Petersburg and the Baltic State Ports. However, the tariffs at the port and on the railway are considerably higher. Overall, the costs of shipping through Finland to Russia are reported to be far higher than through the port of St Petersburg. Brodin (2000) gives the cost for a forty-foot container from Europe to Moscow to be USD1,890 via a Finnish port, against USD1,520 through St Petersburg. Thus, the general trend is for shippers to use Finland for higher value shipments.

The oblast of Kaliningrad is a Russian enclave situated at the lower end of the Baltic between Lithuania and Poland. It is separated from the rest of Russia by Lithuania and Belarus. Kaliningrad is an anomaly arising from the First World War where as Königsberg it originally formed part of Eastern Prussia. Its position as part of Russia was consolidated at the Potsdam and Yalta Conferences (where it was erroneously deemed a "warm water port") at the end of the Second World War. Although geographically aligned with the Baltic States, because of its strategic military importance during the Cold War, the majority of the population is either Russian or Ukrainian and thus culturally it is inclined towards Russia. Hence, when the Soviet Union was dissolved, it was not a viable option to give Kaliningrad independent status or for it to be absorbed it into Lithuania.

Services between UK East Coast Ports and Kaliningrad

Seq	Port	Frequency	Rotation
Kursiu Linja 1	Ipswich	Every six days	Kaliningrad-Riga-Klaipeda-Ipswich-Rotterdam-Immingham-Riga-Klaipeda-Kaliningrad
Kursiu Linja 2	Immingham	Every six days	Kaliningrad-Riga-Klaipeda-Ipswich-Rotterdam-Immingham-Riga-Klaipeda-Kaliningrad

Source: Author - based on Containerisation International Yearbook - 2004

Table 2.5 – Services between UK East Coast Ports and Kaliningrad

As a part of Russia, Kaliningrad would appear to be a natural gateway, providing a shorter sea route from Europe than the Baltic States with similar oncarriage to Klaipeda, for example (see Table 2.5). Unfortunately, as far as rail freight is concerned, Lithuania and Belarus apply separate rail tariffs that, when

consolidated, make Kaliningrad uncompetitive. Based on the 2002 Lithuanian Rail Tariff, the cost per ton per kilometer is almost twice as much for cargo to Kaliningrad as for the same cargo to Klaipeda.

Although Archangel and Murmansk are possible gateway ports for Northwestern Russia (see Table 2.6), they are not viable for imports to the Moscow region. For Murmansk, the immediate hinterland does generate raw materials that are exported in an unrefined form. The port is also competitive for long-distance bulk cargoes such as coal, but the future of this will depend on railway pricing. There is some prospect of expanding mineral extraction on the Kola Peninsula and the possibility of oil exports from the Timan-Pechora fields.

Services between UK East Coast Ports and Murmansk

Seq	Port	Frequency	Rotation
Samskip 1	Grimsby	Every ten days	Rotterdam-Grimsby-Aalesund-Bodo-Tromso-Murmansk-Rotterdam

Source. Author - based on Containerisation International Yearbook - 2004

Table 2.6 – Services between UK East Coast Ports and Murmansk

Archangel, before transition, had a reasonable trade in processed wood – sawn timber. This trade has declined since the break up of the Soviet Union, and with it, the population. The port is quite shallow in parts, which limits the size of ships it is able to accommodate. In 2002 the Severnaya Dvina River was dredged in the port section, and the turnover of the port doubled due to the reinstatement of oil handling. Northern Shipping, based in the port, have, from time to time offered services between the UK and Archangel, but this has been on an itinerant basis when the ships are not required for the summer timber trade. In terms of being a gateway for Northwestern Russia, the prospects are very limited. Now this region of Russia is served only by Samskip through the Port of Murmansk.

It can be seen from Table 2.7 that there are a number of shipping opportunities from the East Coast ports of the United Kingdom into Western Russia. Some of these also provide feeder services for the deep-sea operators (e.g. OOCL) although the majority of liner transhipment takes place at mainland Continental European ports. Even so, there are sufficient services, that rates are highly competitive. Although the most convenient port, in terms of geography, is

St Petersburg, both the Baltic State ports and the Finnish ports manage to attract a significant proportion of the cargo destined to and (not to quite the same extent) from Russia.

Service	Felixstowe	Grangemouth	Grimsby	Hull	Immingham	Ipswich	Teesport	Tilbury	Hamina	Hanko	Helsinki	Klaipeda	Murmansk	Rauma	St Petersburg	Riga	Tallinn
Containerships 1							X				X						
Containerships 2							X	X			X						
Containerships 3							X	X			X						
Finlines 1					X				X		X						
Finlines 2									X		X						
Finlines 3	X										X						
Kursiu Linija 1					X							X				X	
Kursiu Linija 2					X	X						X				X	
NW Shipping	X														X		
OOCL - SBX1		X													X		X
Rix - 1					X							X					
Rix - 2					X											X	
Rix - 3						X						X				X	X
Samskip 1			X										X				
Samskip 2			X												X		
T&E ESCO	X										X						
Transfennica 1																	
Transfennica 2							X	X									
Transfennica 3								X		X					X		

Source: Author - Analysed from Containerisation International Yearbook - 2004

Table 2.7 – Summary of services between the UK and Western Russia

2.4 Freight demands of a market economy

This section looks at the different demands placed upon a transport infrastructure by command and market economies. The section is in three parts:

- Transition from a command to a market economy;
- Changing requirements on the transport infrastructure;
- Practical implications.

In order to understand the different demands placed upon the transport infrastructure of Russia by a market, rather than a command economy, it is necessary to appreciate the process of transition. A number of organisations monitor the countries in transition. The EBRD (European Bank of Reconstruction and Development) has developed a Transition Index that allows

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the progress of particular economies to be measured. Although this study is primarily concerned with economic reform as it relates to Russia, it is useful to see Russia compared with other economies making the same transition.

According to the EBRD Report 2004 (EBRD, 2004), Russia is rated at 3.0 on a scale of one to five for economic policy reforms, and 2.1 for democratic freedoms on the same scale. In terms of economic policy, this compares favourably with the Eurasian countries, with which it is aggregated, and about in the middle of the Southern Tier CEE (Central and Eastern European) countries. Russia lags well behind the Northern Tier grouping, which includes the Baltic States in terms of economic reform and, even more so, in terms of democratic reform (see Figure 2.4).
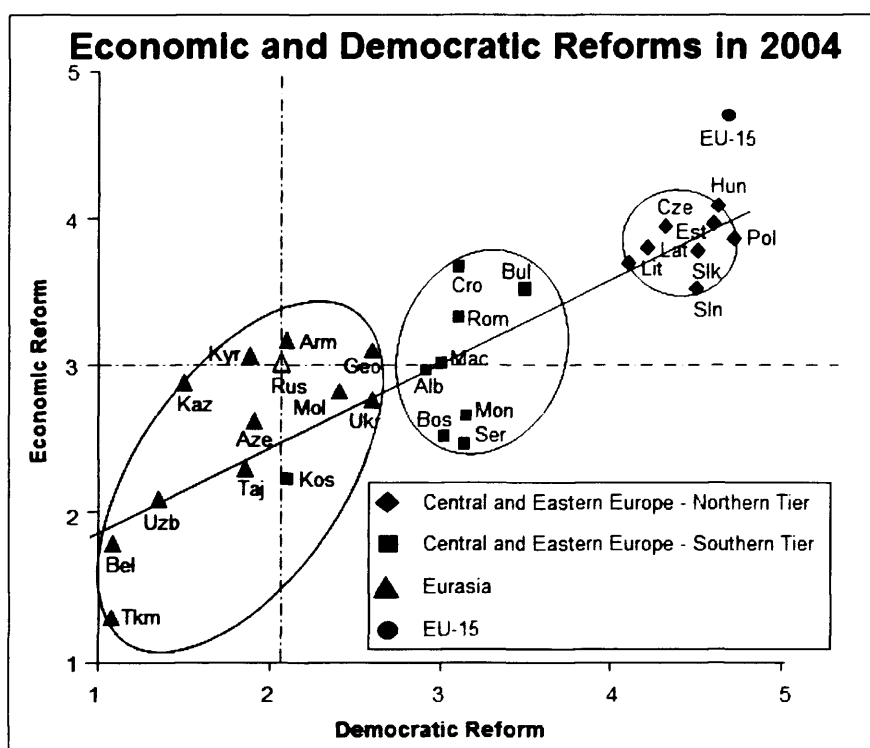
Source: Adapted from USAID, "Nations in Transit 2004", and EBRD Transition Report, November 2004

Figure 2.4 – Economic and Democratic Reforms in 2004

Economic Reform is classified by the EBRD Transition Indicators in two stages, first and second stage (Figure 2.5). The first stage reforms include small-scale privatisation, price liberalization trade and foreign exchange systems. The second stage comprises, large-scale privatisation, governance and enterprise restructuring, competition policy, banking and institutional reform, and

infrastructure. The latter includes transport in the form of roads and railways.

Russia is still in the process of transition. Comparing 1999 with 2004 gives an indication of the pace of reform, and the level achieved by 2004. Both small-scale and large-scale privatisation leveled out at 4.0 in 1999 indicating that by then, all small companies and 50 per cent of state owned enterprises and farm assets had been transferred into private ownership. Enterprise Reform had moved from 1.3, indicating weak corporate governance, to 2.3 where much tighter control of enterprises is exercised (see Figure 2.5).
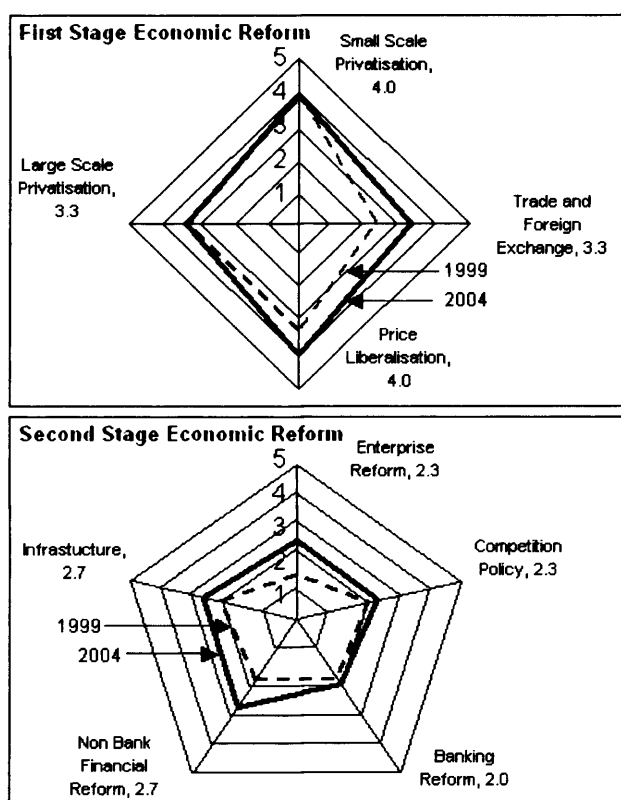
Source: Adapted from USAID. "Nations in Transit". 2004 and EBRD Transition Report. November 2004

Figure 2.5 – First and Second Stage Economic Reform

Price liberalization moved from a fairly high degree of state intervention in commodity prices in 1999 (3.3) to a situation where the majority of price controls had been phased out in 2004 (4.0). Some competition policy legislation had been introduced by 1999, but by 2004 it was still not rigorously enforced. In the banking sector, interest rates had been liberalized and credit facilities regulated (2.0). There is no framework for supervision and regulation of the banks (3.0), which have not achieved the BIS Standard (Bank for International

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Settlements – Basle). Non-banking reform is a little better at 2.7, indicating that there are mechanisms in place for trading shares in private enterprises with some degree of protection for minority shareholders.

As far as the infrastructure is concerned, road transport is ahead of rail. The roads are moving towards a fairly large degree of decentralisation and maintenance is separate from administration. There are laws passed providing for the provision of roads and road transport by private enterprises. At this stage, however, there is little public consultation or participation in the preparation of road projects.

Based on an aggregate infrastructure scoring, the transition index of 2.7 indicates there are laws passed that distance railway operations from the State. Commercial objectives are weak but are being developed. There are business plans for restructuring the railways but funding has not been secured. Organisational structures tend to be based on geographical area. It can be seen that although privatisation is well advanced, the transition indices show quite clearly, that many of the features that inspire confidence in an economy by outside investors, are simply not in place. This is a problem for the transport sector as, in order to modify and improve the freight facilities to satisfy demand, investment by the private sector, especially external investors, is essential.

Transportation is one of the major factors of change between a command and market economy and, if not addressed properly, can inhibit transition. Under the command economy of the FSU, most freight was hauled by trains over main routes to large cities for distribution in bulk by huge government procurement agencies. Free market conditions mean that literally millions of small producers and consumers are free to buy and sell wherever the price is most attractive. This requires a highly flexible and responsive freight transportation system that the existing infrastructure cannot deliver immediately.

Research has shown that command economies have higher transport intensities (ratio between tonne-kilometers and GDP – inland modes) than market economies. A study by the World Bank in 1992 showed that, whereas the

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demand for road freight is closely associated with GDP, the demand for rail freight correlates more closely with the area of the country (Bennathan, Fraser & Thompson, 1992). The study found the relationship to be the same for both developed and developing economies, but the elasticity of demand for road tonne kilometers related to GDP, differed. The norm for developing economies was 1.25 whereas it was close to unity for high-income countries. Thus, elasticity is positive in both cases meaning that a rise in the determinant (GDP) causes a disproportionately larger rise in road transport intensity, but this disproportional rise is greater for developing economies.

Real GDP as a Percentage of 1989 GDP
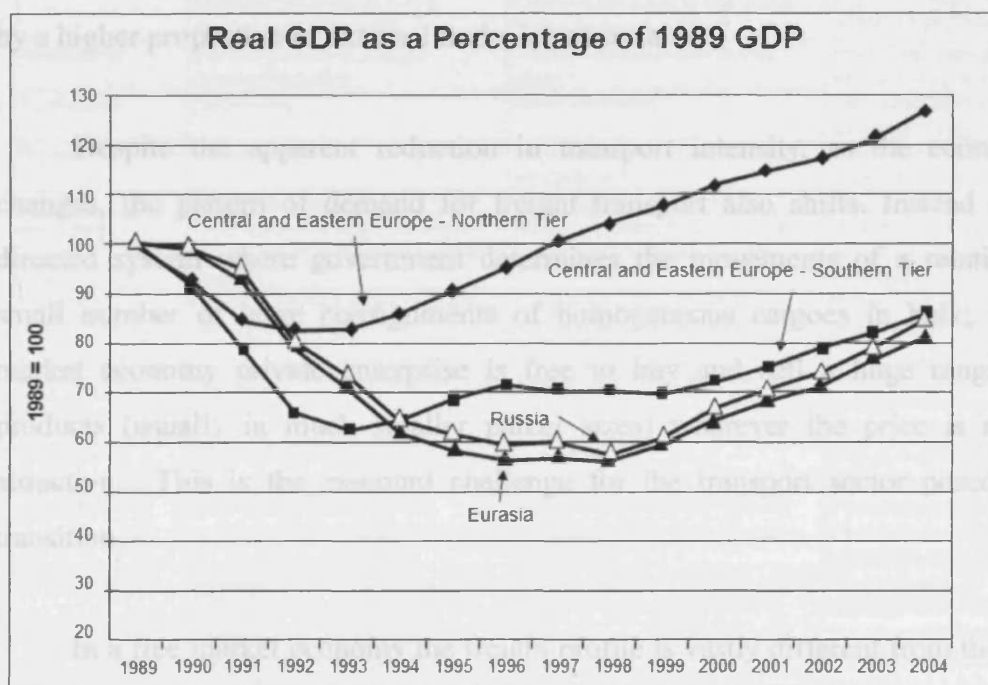
Source: Adapted from EBRD Transition Report, November 2004

Figure 2.6 – Real GDP as a percentage of 1989 GDP

Putting this into the context of Russia (which was not included in the original study), if GDP increases, the transport intensity of road transport should increase and that for rail transport should remain the same. In fact, between 1989 and 1998 GDP in Russia fell (see Figure 2.6), but since then has continued to increase. Although it may be dangerous to extrapolate the findings of previous studies and apply them to Russia (because of the size of the country and the uniqueness of both the transport infrastructure and the freight mix) these trends provide some explanatory background. Russia's trade exports are heavily

concentrated in the energy and raw materials sectors, both of which contribute significantly to the GDP but tend to move by rail or pipeline. In terms of imports, GDP should also have a direct relationship with transport intensity due to the movement of industrial goods, such as oil field equipment, and the generally increased affluence of society creating a demand for consumer products.

However, according to the World Bank (Eijbergen et al, 2004) the transport intensity in Russia has halved since the break up of the Soviet Union. Whether this is entirely due to the overall fall in GDP or whether there are other contributing factors, such as increased efficiency and shorter hauls brought about by a higher proportion of external trade, is not certain.

Despite the apparent reduction in transport intensity, as the economy changes, the pattern of demand for freight transport also shifts. Instead of a directed system where government determines the movements of a relatively small number of large consignments of homogeneous cargoes in bulk; in a market economy private enterprise is free to buy and sell a huge range of products (usually in much smaller parcel sizes) wherever the price is most attractive. This is the essential challenge for the transport sector posed by transition.

In a free market economy the freight profile is vastly different from that of a command economy. In a command economy there tend to be huge production plants requiring large quantities of raw materials in bulk. Agricultural output is consolidated and then transported in bulk to the main population centres for distribution. Freight flows in a command economy tend to be large and predictable, trunk routes are well established, and resources can be planned easily.

In a market economy, large numbers of buyers and sellers are free to buy and sell their products wherever the price is most attractive. Thus, freight flows can be volatile, according to all sorts of macro and micro economic factors that can change overnight. Sellers will try to increase their added value (elaborated goods) where possible and so average consignment values tend to be higher. As a

result, consignment size is generally much smaller and the number of transport routes and modes more diverse. Table 2.8 shows the various factors involved and how, based on the previous discussion, the author determines how they impact on the structure and organisation of the transportation system.

Transport Infrastructure - Differences between Command and Market Economies

	Element	Planned economy	Free market	Impact
Challenge	Freight demand	Majority of freight hauled by trains over main routes to large cities for distribution in bulk by government	Large number of small producers and consumers free to buy and sell wherever the price is most attractive.	Requires a flexible, highly responsive (market driven) freight transport system.
Theoretical implications	Transport intensity	Higher.	Lower.	Demand for road freight will increase as GDP increases - which it should under market conditions. Short term, rail freight will decrease (if transportation intensity remains the same) and, in the long run, will fall (in relative terms) as the economy moves towards a free market.
	Demand for road freight	Strong correlation with GDP.	Strong correlation with GDP.	
	Demand for rail	Strong correlation with country's area.	Strong correlation with country's area.	
	Elasticity	Elasticity of demand for road ton-kilometres with regard to GDP in developing countries = 1.25.	Elasticity of demand for road ton-kilometres with regard to GDP in high income countries = 1.00.	
Regulatory framework	Freight policy	Planning instruments, laws and directives (Gosplan).	Taxes and incentives such as road pricing.	As regulation becomes less oppressive and discriminatory free market environment will increase investment and transport opportunities.
	Competition	Discrimatory.	Non discriminatory.	
	Customs	Protectionist.	More liberal as Russia moves towards entry to the WTO.	Improvement in Customs formalities as Russia aligns with trading partners.
Investment strategies	Horizon	Public sector focus 10 years or more.	Private sector focus about 5 years.	Investment will be more responsive to requirements of the market. Strategic investment by government will encourage outside investment.
	Investment	Public investment only. Often wasteful to compensate for inefficient production methods.	Private investment. Public investment as a catalyst for private investment.	
	Priorities	Investment strategies based on political ideology and military necessity.	Management and pricing strategies implemented first to reduce capital investment requirements.	Management and pricing strategies will prevent unnecessary capital investment.
Freight profile	Manufacturing process	Few multi-process state controlled enterprises.	Huge diversity of competing suppliers and sub-suppliers.	Better management and control required to look after the larger number of consignments and overall higher values.
	Shippers	Few goods and transport buyers/sellers.	More goods and transport buyers/sellers	Better management and control required to look after the larger number of consignments and overall higher values. Choice of enterprise determined by meeting these requirements.
	Trading terms	Directed. Transport arranged by consignee (state or state monopoly).	Flexible - empowerment of shipper or consignee to agree terms and arrange transportation.	
	Road freight	Little outward difference between a market and command economy.	More opportunities for small to medium enterprises and outside investment.	Choice of mode and carrier is price and efficiency driven. Mix and consignment size suits road transport better than rail in many cases. Highly contestable.
	Rail freight	Large consignments on regular trunk routes.	Smaller, diverse consignments on variety of routes.	
	Value	Lower value raw materials.	Higher value elaborated goods.	
Transport assets	Freight market contestability	Limited market for small consignment size transport.	Large market for small consignment size transport.	Low barriers to entry into the freight market. Highly contestable by organisations of all sizes - domestic and international.
	Organisations	Large freight monopolies.	Mixture of large and small, domestic and international transport suppliers.	
	Terminals	Low utilisation.	High utilisation.	Better turnaround times achieved.
	Equipment	Common ownership.	Single ownership.	Requires better control/interchange.
	Technology	Stagnant. Responsive only to necessity.	Innovative and creative use of the transport infrastructure.	Improved efficiency, interoperability and performance.

Source: Author

Table 2.8 – Transport infrastructure in command and market economies

Handling facilities and equipment have to be able to respond to the market demand. The smaller consignment size and the number and diversity of the routes and interchange points make the freight market, especially in respect of road transport, highly contestable by small enterprises. Thus, in a free market, and especially an emerging free market, there tends to be a modal shift away

from larger transport units (ships and railways) towards the smaller units characteristic of road transport. This creates both opportunities and challenges. Whereas in a command economy, freight facilities are generally planned to have slightly greater capacity than necessary, in a market driven system pure economics dictate high utilization levels in order to reduce the unit cost. This, in turn demands higher levels of efficiency and less room for error and may cause problems, particularly when staff are unfamiliar with operating under such conditions. The resulting delays and bottlenecks will tend to manifest themselves where freight concentrations are highest, e.g. in the ports and other interchange points.

Although there are significant changes in the way that freight is handled and managed inside Russia in the last part of the twentieth century, there have also been massive changes outside Russia. These include:

- Technological development such as unitization, containerization and, more recently, the development of super containerships and ports;
- Conceptual changes such as round the world services, hub and spoke operations (feedering), and intermodal transport;
- Commercial and legal improvements such as through Bills of Lading, Waybills (applied to surface transport), TIR carnets, etc.
- Information technology and information processing and sharing, i.e. EDI and Internet tracking;
- Structural changes in the supply chain such as Just in Time, virtual warehousing etc.
- Market expansion such as couriers, logistics service providers and NVOs (non-vessel operators).

To a certain extent, the autarkic policies of the Soviet Union insulated the transport sector, particularly the domestic arena, from many of these developments so that the challenge of matching the current systems in the western word is now even greater.

2.5   **Freight traffic between the UK and Russia**

Since the Muscovy Company was chartered in 1555 with a monopoly on the newly opened Russian trade, Britain has had strong trade links with the region. The pattern of trade has always been much the same with Russia exporting raw materials such as timber and grain and importing manufactured goods. Only the nature of manufactured goods has varied according to the demands of the age, from farm implements in the sixteenth century to railway materials in the nineteenth and oil field equipment and motor vehicles in the twenty-first.

Russian exports and imports by value

	Exports 2004/5			Imports 2004/5			Overall
	Billion US$	%	Rank	Billion US$	%	Rank	Rank
Germany	16.5	8%	2	12.3	14%	1	1
The Netherlands	19.5	9%	1	2.4	3%	7	2
Italy	15.1	7%	3	4.2	5%	2	3
USA	6.6	3%	7	3.8	4%	3	4
UK	7.4	3%	4	2.4	3%	7	5
Poland	7.2	3%	5	2.5	3%	6	6
Finland	6.8	3%	6	2.8	3%	5	7
France	5.3	2%	8	3.4	4%	4	8
Switzerland	0.9	0%	9	0.1	0%	9	9
Total main trading partners	85.3	40%		33.9	39%		
Total	215	100%		87	100%		

Source: NAG/Moscow Narodny Bank (2006)

Table 2.9 – Russian exports and imports by value

It can be seen from Table 2.9 that the most important trading partner of Russia is the Germany, with the Netherlands running second. Based on the figures for 2004/5, the UK ranks fifth comprising 3 per cent of Russian exports and 3 per cent of imports (NAG, 2006).

During the period 1995 to 2004 there has been a significant change in the make up of exports from Russia to the UK. It can be seen from Table 2.10 that petroleum and petroleum products have experienced a massive increase from £120 million in 1995 to £1,688 million in 2004, with most of the growth since 1999. Non-metallic mineral manufactures grew between 1995 and 1999 but fell back slightly to 2004. Most of this can be attributed to the re-export of enriched uranium hexafluoride – high value/low volume. Non-ferrous metals, mainly aluminium, are an important base cargo for shipping companies on this trade.

Coal, iron and steel, wood, chemicals and fertilizer tend to move in specialist ships and do not form part of the general cargo trade.

UK Trade with Russia 1995 to 2004 - Exports to the UK from Russia - £mn

SITC Division & Description	1995	1999	2004	1995 %	2004%
33 Petroleum petroleum products and related materials	120 4	162 5	1 688 0	12%	48%
66 Non-metallic mineral manufactures	2 4	431 5	407 4	0%	11%
68 Non-ferrous metals	310 2	309 7	338 6	32%	10%
32 Coal coke and briquettes	6 3	4 9	328 9	1%	9%
52 Inorganic chemicals	116 4	109 4	205 3	12%	6%
67 Iron and steel	45 8	29 2	182 3	5%	5%
24 Cork and wood	53 2	43 5	77 0	6%	2%
56 Fertilizers other than those of group 272	36 0	19 4	55 1	4%	2%
64 Paper paperboard and articles of paper pulp etc	20 8	23 8	44 3	2%	1%
51 Organic chemicals	45 7	7 4	33 9	5%	1%
79 Other transport equipment	1 7	62 5	23 9	0%	1%
28 Metalliferous ores and metal scrap	37 6	44 5	15 8	4%	0%
Other	169 3	118 7	145 0	18%	4%
Total trade	965 9	1 367 1	3 545 5	100%	100%
Growth	100%	142%	367%	100%	367%

Source: Compiled for Author by DTI Statistics from HM Revenue & Customs data

Table 2.10 – UK trade with Russia 1995 to 2004 – Exports to the UK[3]

The largest growth of imports from the UK to Russia since 1995 has been road vehicles[4], increasing from £22 million in 1995 to £311 million in 2004 – an increase of 1427 per cent. There has been a significant but more modest increase in other manufactured goods and office machinery (see Table 2.11). Most imports from the UK dipped as a result of the downturn in the Russian economy in 1998 but are now building back up again.

Despite these radical shifts in terms of commodity, the basic pattern of trade between the UK and Russia remains the same with raw materials exported and finished goods imported. This creates a challenge for the transport operator because the transportation unit used for raw materials is usually different from that used for higher value finished goods. This happens in a number of trades where, for example, frozen or chilled produce flows in one direction, and general cargoes in the other. More often than not, a compromise is engineered so that on one of the legs a less than optimal solution has to be found.

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[3] The UK Department of Trade provided data at the SITC 4 digit code level that has been consolidated and analysed by the Author.

[4] A large part of the trade in road vehicles can be attributed to second-hand cars. In 2001 Russia imported 160,000 used cars from Western Europe. However, the Russian Government has now raised the level of duty on second-hand cars in order to protect the domestic car industry (Clerides, 2004).

UK Trade with Russia 1995 to 2004 - Imports from the UK to Russia - £mn

SITC Division & Description	1995	1999	2004	1995 %	2004 %
78 Road vehicles	21 8	10 4	310 7	3%	21%
89 Miscellaneous manufactured article nes	36 5	22 4	115 5	4%	8%
75 Office machines and ADP equipment	94 7	42 5	111 2	11%	8%
72 Specialised industrial machinery	30 0	63 5	76 7	3%	5%
55 Essential oils and resinoids and perfume materials toilet, polishing and cleansing preparations	56 5	34 4	70 2	6%	5%
76 Telecommunications and sound recording and reproducing apparatus	112 2	31 9	69 8	13%	5%
88 Photographic apparatus equipment and supplies and optical goods nes. watches and clocks	20 1	22 0	63 0	2%	4%
74 General industrial machinery and equipment nes and machine parts nes	35 3	38 3	52 9	4%	4%
77 Electrical machinery apparatus and appliances nes and electrical parts thereof	64 2	23 2	44 7	7%	3%
69 Manufactures of metal nes	17 8	10 4	41 0	2%	3%
59 Chemical materials and products nes	30 5	18 6	40 7	4%	3%
64 Paper paperboard and articles of paper pulp etc	11 4	11 5	37 0	1%	3%
Other	339 4	214 3	435 0	39%	30%
Total trade	870 4	543 4	1 468 4	100%	100%
Growth	100%	62%	169%	100%	169%

Source: Compiled for Author by DTI Statistics from HM Revenue & Customs data

Table 2.11 – UK trade with Russia 1995 to 2004 – Imports from the UK

2.6   Conclusion

Transportation has always been a vital element of the Russian economy. The demands for freight transportation imposed by a command economy are quite different from those of a market driven system. Fortunately, much of the transport infrastructure that exists in Russia now, was established before the autarkic policies of the communist regime irreparably damaged the external linkages. This means that there are numerous viable freight corridors that are available across all the main surface modes. Although the imbalance of raw materials and finished goods still persists, there is sufficient flexibility in both the transport infrastructure and transportation units to accommodate this.

There are clear advantages for using maritime-based modes of transport (and there are sufficient services to make this highly competitive). Even so, the longer road-based corridor, involving the transit of five intervening countries, still remains popular (EBRD, 1993). Whether this is due to the greater flexibility provided by the smaller transportation units, or a door-to-door service without mode change is preferred, is not certain.

The remainder of this study sets out to discover why freight transport decision-makers choose different surface modes (sea, road or rail) based on (what should be) the same information. The main determinants of modal choice are identified. Consideration is given to their saliency, whether cost-based, service oriented, or influenced by other factors - not readily apparent from the existing body of knowledge, i.e. the influence of dissatisfaction with aspects of an existing service product offering and the psychological profile of the decision-maker.

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Chapter 3

3   CHAPTER 3 – LITERATURE REVIEW

3.1   Introduction

The purpose of this review is to identify the previous work relevant to transportation choice and its analysis in order to establish, a) a starting point for this piece of research, and b) an appropriate methodology for the type of investigation envisaged. As the objective of this study is to illuminate the transport decision structure and determinants of choice, this review provides background references that focus on that field of study and identify those issues that are relevant to the decision-making process. The chapter is structured as shown in Figure 3.1.
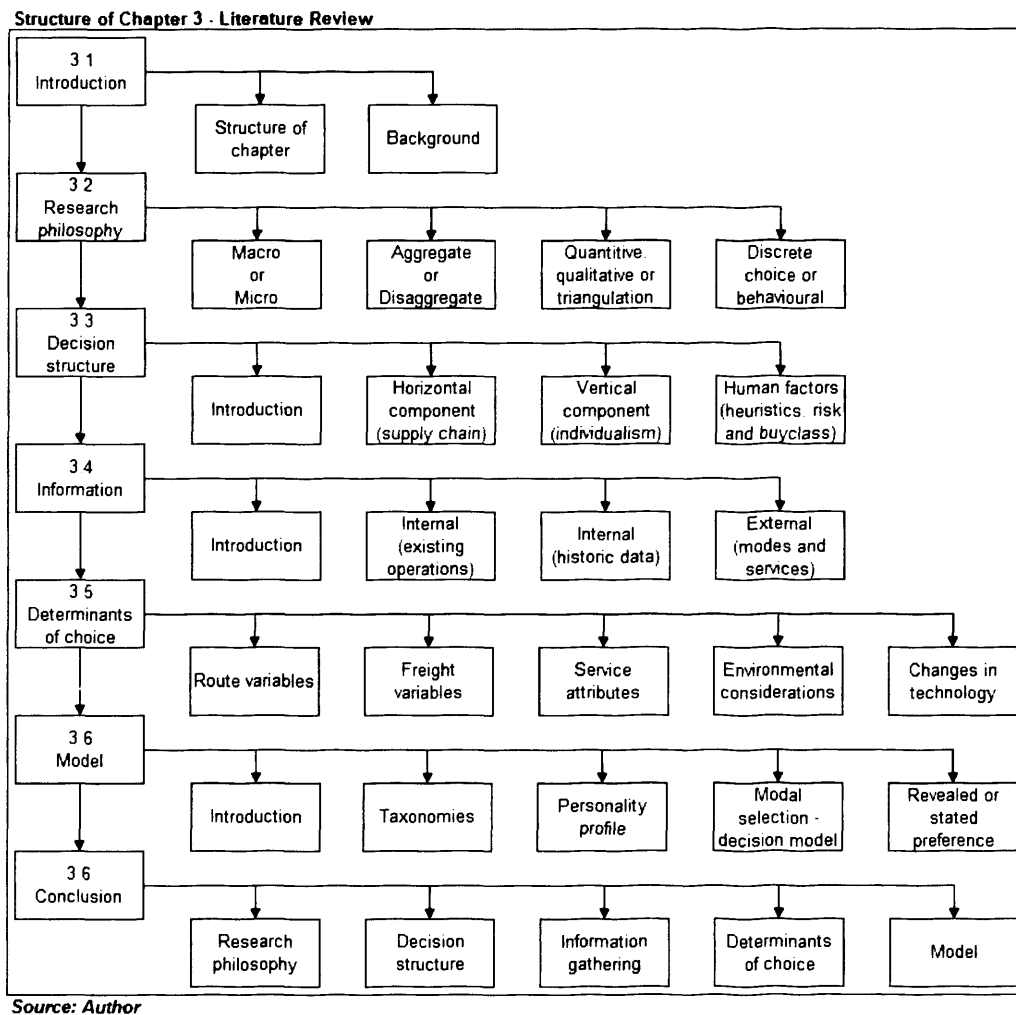
Figure 3.1 – Structure of Chapter 3 – Literature review

Modelling modal choice is one of the most important aspects of transportation analysis as it determines allocation of resources and the impact on the environment. Society is acutely aware of the disadvantages of certain modes of transport (e.g. road and air) and that encouraging a shift towards more environmentally friendly modes is desirable (Campisi & Gastaldi, 1996). The proportion of freight moving by road in Europe, when compared with other surface transport modes) has increased from 52% in 1970 to 74.6% in 2000 (Ribbink, 2005 & Arnold, 2004a). Considerable effort is being applied, to find methodologies that are suitable to explore and define the determinants of modal choice. This has resulted in a very extensive literature with the main objective of gaining an insight into the decision-making process of transportation buyers.

There is a growing realisation that the transportation choice decisions are extremely complex and difficult to analyse and model reliably. For that reason, this literature review has investigated as many as possible of the traditional methodologies whilst, at the same time exploring the boundaries to see if related disciplines could produce useful guidance. Kauffman and Oliva (1994), referring to Day, Farley, & Wind (1990), argue that "methodological opportunities lie in the development of better data and the adoption and development of methods not currently used in the field." Mangan, Gardner, & Lalwani (2001a) note that "The literature on transportation choice and modelling is rooted in many diverse subject areas including, *inter alia*, transportation, logistics, management science, econometrics, marketing, maritime economics, decision theory, etc."

Some studies are designed to forecast future trends in order to aid policy makers form legislation that is in the public interest, or plan transportation systems to address future demand. Bolis & Maggi (1998), for example, justifying this form of study, suggest that some policies are promoted without a sound knowledge guiding demand. Other studies reflect on the effect of regulation and in some cases show that instruments designed to influence transport choice, such as taxation or subsidies, may not actually be effective (Haugen, & Hervik, 2004). This study does not attempt to model a future trend at this macro level. The objective of this study is to provide a better understanding of the determinants of

transportation choice and the underlying mechanics of the transportation decision.

Taking account of all the factors influencing transportation choice, identified in previous research, and attempting to model these realistically, is impractical. Thus, there has to be a trade-off between accuracy and complexity (Abdelwahab & Sargious, 1992a). However, by using the findings of other studies to identify the importance and, based on Brooks (1984 and 1985) and Malchow and Kanafani (2004a), the salience of the various factors, it is intended to specify the most parsimonious model that can be used realistically to describe the transport choice decision in a given set of circumstances.

Much of the research to date appears to be inconsistent. Economic theory assumes that people make perfectly rational, informed choices. Unfortunately, there is a view that Garcia-Menendez, Martinez-Zarzoso and Pinero De Miguel (2004a) represent that transportation decision-makers do not always follow perfectly rational and predictable rules. Moreover, the decision-makers are not always in possession of perfect information about the transportation systems they are contemplating and their various alternative options. Jeffs and Hills (1990) put it more ruthlessly, that "... businessmen possess neither sufficient ability nor sufficient information to act as 'perfectly rational' economic men..." "In fact, for both conscious and subconscious reasons, the decision-maker's search for a suitable alternative is often biased and limited in scope." Bruning and Lynagh (1984) are not so stringent in their view and find that many firms do evaluate carriers but that "...managers should be more aware of various evaluation techniques and be willing to use them."

The transportation decision process is more complex than simply specifying the variables that influence the decision-makers utility, i.e. this mode is cheaper than that mode, that carrier offers better quality-of-service attributes, or port "A" is more efficient than port "B". The whole structure of the decision-making process that empowers the decision-maker, the information on which he or she bases the decision, the context in which the decision is made, as well as the determinants of choice, have to be identified and analysed.

In order to try and address all these issues and provide a background for the study itself, the remainder of this chapter is set out as follows:

- Research philosophy;
- Decision structure;
- Information;
- Determinants of choice;
- Model.

3.2 Research philosophy
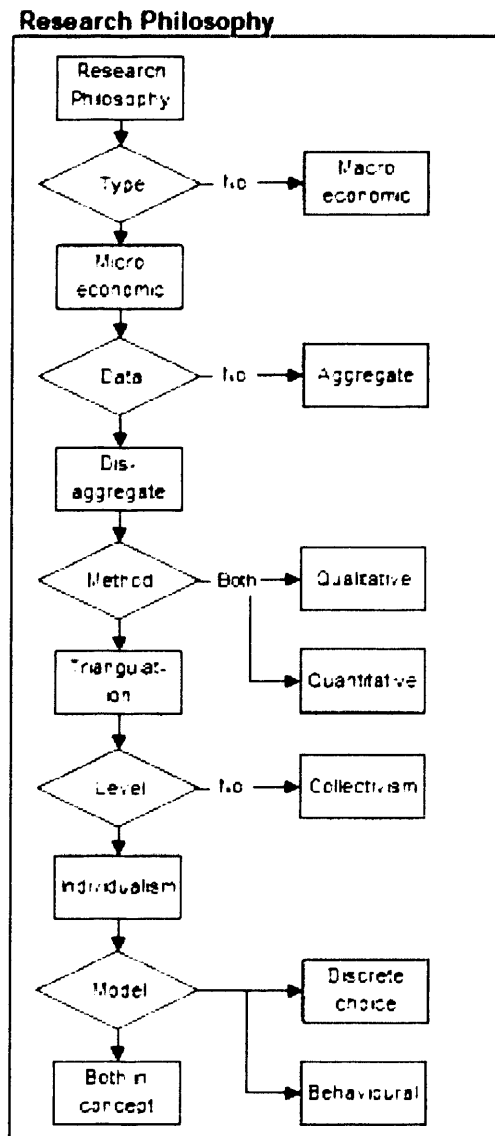
Source: Author

Figure 3.2 – Research philosophy

There are numerous approaches to modal choice. This section sets out the basic principles of the research philosophy adopted in this study based on earlier research.

There are essentially two types of transportation research. The macro economic approach looks at the total demand for freight transportation for a particular area or region and attempts to determine the overall modal split. Such studies are typically, although not exclusively, based on aggregated data and are primarily of interest to policy makers. The micro economic approach concentrates on the choices made by individual firms and, as such, is concerned more with disaggregated data. Such studies are usually of relevance to the decision-makers within individual firms whether as service providers or buyers.

Disaggregate models are becoming more popular even when the ultimate aim is to generalise the findings across entire transportation systems. Winston (1985), in his review of freight-demand models, describes an evolution from aggregate to disaggregate models and defines the two approaches: "Aggregate models are used to forecast the behaviour of an entire transport system, while disaggregate models are used to predict the behaviour within a specific transport system." Zlatoper and Austrian (1989) refer to this distinction as "Winston's convention."

This study uses a disaggregate approach because there are distinct empirical advantages of disaggregate over aggregate models (Garcia-Menendez, Martinez-Zarzoso & Pinero De Miguel, 2004b). First, they are based on individual behaviour, secondly, the model is richer because it is able to capture important characteristics of the decision-maker and, finally, a better understanding is achieved since the results are estimated using the actual attributes of modes and the characteristics of the goods to be transported. Disaggregate models are also more attractive because they are consistent with behavioural theory and allow for a richer empirical specification (Danielis and Rotaris, 1999a). There are other important advantages of disaggregate models

such as the ability to value and test variables that are obscured in aggregate models, such as shipment size.

The main argument against using disaggregate models is that data collection can be more cumbersome because data describing the characteristics of each mode (chosen and unchosen) must be collected. Another problem to consider is that respondents are sometimes reluctant to provide information that may be commercially sensitive. For example, freight rates are often individually negotiated, and thus, held commercially confidential (Bolis & Maggi, 1998b). The solution proposed is to assure respondents that the results will be aggregated, but this, in itself, can limit the presentation of some of the findings and the richness of the approach may be lost.

A more difficult decision when dealing with a complex transportation choice process is whether to adopt a quantitative, qualitative or combined (triangulated) research methodology. Qualitative and quantitative research methodologies are generally applied in completely different settings, according to the type of study (Eldabi et al., 2002a). Quantitative methods place greater emphasis on methodology, procedure and statistical measures of validity (Eldabi et al., 2002b).

> *"Quantitative research typically has a logical and linear structure, in which hypothesis take the form of expectations about the likely causal links between the constituent concepts identified in the hypothesis. Thus, determination of the causal links specified by the hypothesis will result in an acceptance or rejection of the theoretical proposition. Hence, quantitative research places emphasis on methodology, procedure and statistical measures of validity."*

Citing Bryman (1993), Eldabi argues that those that subscribe to a quantitative stance tend to adopt the following concepts:

- *Concepts and their mechanisms for measurement* – The concepts in each hypothesis have to be observed and measured in order to be accepted or rejected;

- *Causality* – The causal relationships between concepts are also determined;

- *Generalisation* – Researchers endeavour to collect data from subsets of a population, which is analysed (estimated) and the results applied across the whole population;

- *Replication* – This argues that experiments performed under the same conditions will yield the same results;

- *Individualism* – Although the data is to be aggregated, discrete enquiry is made of each individual within the subset.

One of the main weaknesses of quantitative research is that in order to elucidate causal relationships or provide descriptive statistics, it is necessary for researchers to ask the right questions. Thus, it is incumbent upon researchers to have a good idea of the answers sought before starting the survey (Gable, 1994). This leads to the opinion of some, that quantitative research (in its pure sense) becomes an instrument of confirmation rather than enquiry.

Qualitative researchers, on the other hand, consider that it is not possible to assign meaning to a phenomenon (or behaviour) without describing the context and understanding the position of the people who affect, or are affected by the phenomenon (Eldabi et al., 2002c). Marshall and Rossman (1989) rationalize this by saying that first, human behaviour is significantly influenced by the setting in which it occurs; second, some techniques associated with experimental or quantitative research often influence the findings of the study; and finally, a researcher cannot understand human behaviour without understanding the framework in which subjects interpret thoughts, feelings and actions. If, as suggested by Miles (1979), qualitative data is "rich, full, holistic and real whose validity is unimpeachable", then this methodology would appear to have the potential of giving greater insight to the transport decision-making process than a purely quantitative approach.

However, despite the advantages of qualitative research, there are inherent weaknesses. The collection and analysis of data, because of the number of respondents, the level of detail and the methods of elucidation, can be time consuming and often expensive. Consequently, this cost of data collection can be one of the major constraints (and causes of error). Secondly, the relationship

between theory and research can be weak. To overcome this, Marshall and Rossman (1999) suggest that the researcher should show they are studying a case within the context of a larger phenomenon. Linking specific research issues to larger theoretical constructs shows that the research study illuminates a larger issue and is therefore of significance. Finally, one of the major weaknesses of qualitative research is that there is no prospect of replication because the research setting itself influences the results. Changing the research setting destroys the interaction of the variables and hence the underlying philosophy of the research method.

Mangan, Gardner and Lalwani (2004) refer to the work of Gummesson (2000) and Burrell and Morgan (1979) to describe four meta-theoretical paradigms encompassed by qualitative and quantitative research philosophies. Having noted that inter-paradigmatic journeys are rare, Mangan, Gardner and Lalwani suggest combining the two approaches. They point out that qualitative methods dominate much logistics research and qualitative methods are less often applied. They support their argument for combining the two by referring to Naslund (2002) who observes, "It is necessary to use both quantitative and qualitative methodologies if we really want to develop logistics research". Dunn, et al. (1993) provide a similar view by saying that "... a given field may be underachieving if all of its research is being conducted within a narrow methodological domain." This type of approach is identified by Easterby-Smith, Thorpe and Lowe (1991) as "Triangulation" of which combining quantitative and qualitative techniques, as is done in this study, is called "Methodological Triangulation".

The purpose of incorporating qualitative data in the study is to improve understanding of the buying behaviour of the decision-maker. Burdg and Daley (1985a) rely on Cunningham (1982) for defining the types of techniques that may be used for mode choice analysis, namely (1) traditional approach, (2) revealed preference approach, (3) behavioural models, and (4) inventory theoretic models. In Burdg's estimation, only the behavioural approach, "taking its roots from consumer buyer behaviour and attitude attribute theory, offers any comprehensive insight about the modal choice process." Burdg further cites

several models that have been evolved from the behavioural approach (Krapfel & Mentzer, 1982; Saleh & La Londe, 1972; Slater, 1982 and Stock & La Londe, 1977a).

Behavioural researchers stress the importance of the cognitive processes on choice behaviour. As Walker (2001a) explains, "Far from the concept of innate stable preferences that are the basis of discrete choice models, they [behavioural models] emphasise the importance of things such as experience and circumstances and a whole host of amorphous concepts. Such behavioural constructs, she says, are pervasive throughout consumer behaviour textbooks (e.g. Engle, Blackwell and Miniard, 1995; Hawkins, Best and Coney, 1989 and Peter and Olson, 1993) and papers in research journals (Engel, Kollat & Blackwell, 1968; Howard & Sheth, 1969 and 1988, and Nicosia & Wind, 1977).

Given the apparent inconsistency of previous research on transportation choice, another feature of the behavioural frameworks relevant to this study is the research into cognitive anomalies that appear to violate the basic axioms of utility maximization - that is the basis of discrete choice theory. Much of the work on this has been performed by Kahneman and Tversky (Kahneman and Tversky, 1979; Tversky, 1977 and Tversky and Kahneman, 1974) who accumulated experimental evidence of circumstances in which individuals exhibit surprising departures from rationality (Walker, 2001b):

"They found that decision-makers are sensitive to context and process, they are inconsistent at forming perceptions and processing information, and they use decision-making heuristics."

One of the difficult decisions to make in study of this nature is whether the behaviour being explored is as a result of group or individual decisions. Literature suggests that decisions made by groups will be different from those of individuals – individualism versus collectivism (Lauriola & Levin, 2001; Parthasarathy, 2006 and Passos & Caetano, 2005). Two issues have to be resolved:

- In the real transportation environment are decisions of the type being investigated made by groups (board of directors, executive committees, multi-disciplinary teams, transport teams, etc.) or individuals (owner/directors, department heads or shipping managers – or equivalent)?

- If, the decision is made at group level, how can the investigation be structured to solicit the collective variables (e.g. by aggregated individual responses or representative responses)?

There is a volume of studies on group decision-making in business (173 peer reviewed studies have been identified), from "business process re-engineering" (Wilmott, 1994), to "models" (Muralidharan, Anantharaman & Deshmukh, 2002), and even the role of the CEO (Dalton & Dalton, 2005). From the literature, it appears that constituting specialist or multidisciplinary teams is a widespread business strategy. Although there is some research that supports the fact that more complex or strategic decisions are made by teams (Hurst, Rush & White, 1989), there appears to be little evidence to support the benefits of enquiry at dyad, team or group level. Some studies touch on the subject, e.g. Murphy, Daley and Delenburg's (1991) study on intermediaries and Deeter-Schmelz's (1997) fairly limited study on logistics teams, but there is nothing to substantiate that an investigation at group decision-making or individual level is better.

However, turning to other areas of research, there is a wealth of literature (Forza, 2002) that warns of the dangers of sampling methods where the level of aggregation and the unit of analysis are different, i.e. collecting data at one level and interpreting the results at a different level – "cross level inference problem" (Dansereau & Markham, 1997). If the data is collected at group level with the intention of drawing conclusions at individual level the "ecological fallacy problem" will be encountered (Robinson, 1950 and Babbie, 1990). Forza (2002) provides a pragmatic summary with regard to operations management (OM):

"Very often the unit of analysis in OM research is the plant or company. However, the plant (company) cannot give answers; it

is the people that work for in the plant (company) that provide information on that plant (company. "

If the transportation choice decision is made at group level, this seriously impacts on the complexity and the practicality of carrying out an investigation into the decision-making process. If a collective approach is required, then the team has to be constituted to respond to any instrument collectively. This would make obtaining sufficient responses extremely difficult (and expensive), and would be in danger of creating cross-level inference and ecological fallacy problems in the subsequent analysis. The alternative is to aggregate individual responses that would allow collection of individual personality data but would ignore group dynamics (Group Membership Behaviour), and thus, is likely to yield a poor result. A further option is to use one individual as representative of the group, but this is flawed on the same basis (that the individual response might be different from the group response). The solution adopted here is to administer the experiment as though the decision is made by the individual alone but to collect information about the context of the respondent in both the hierarchy and, where applicable, the decision-making group.

The next question is whether to use a behavioural or discrete choice model. This is discussed in more detail under 3.6 (Decision model) as, in concept, both approaches are used in this study. To put this in into perspective, Walker (2001) closes the gap between what she terms simplistic behavioural representations (discrete choice models) and the complexity of the actual behavioural process (behaviour theory). Referring to Lancaster (1966) and McFadden (1974), she says that, "choice" is a manifestation of the underlying utilities and assumed to be a function of the attributes of the alternatives and the characteristics of the decision-maker. In the case of the latter, behavioural-researchers stress the importance of the cognitive process on choice behaviour. They emphasize the importance of things such as experience and circumstance and a host of other amorphous concepts. For example, "Context", meaning such things as experience and motivation, "Knowledge" (e.g. information), "Point of view" (e.g. perceptions and beliefs) and even "Choice" (e.g. problem recognition) may all be influential in the choice decision.

Thus, in this study the following research philosophy is applied:

- Micro-economic approach;

- Disaggregate data;

- Triangulation (both qualitative and quantitative);

- Individualism;

- Both discrete choice and behaviour models used conceptually.

3.3   Decision structure

3.3.1   Horizontal and vertical components
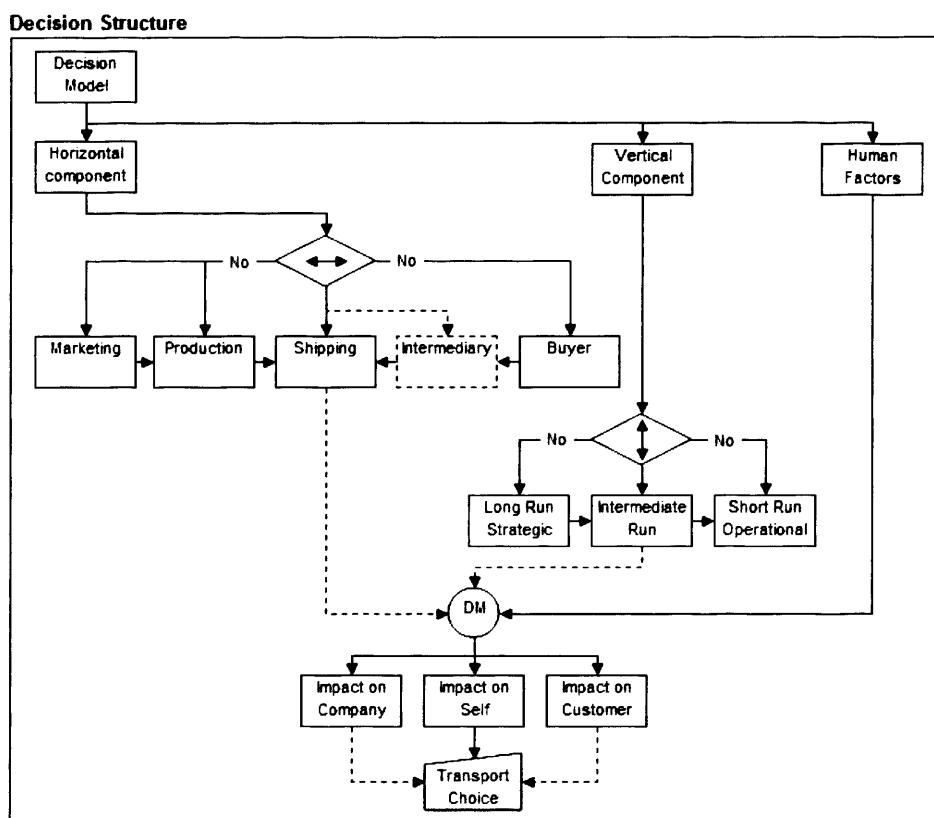
Figure 3.3 – Decision structure

There are three dimensions of the transportation decision process, namely, horizontal, vertical and a human factors component (See Figure 3.3). Horizontally, it can be argued that in today's global economy, the freight transportation decision no longer resides simply with the shipping or distribution manager but may be taken or influenced at a number of points along the supply chain (Murphy, Daley and Dalenburg, 1991a). This may include elements of the

supply chain, such as marketing, production, shipping, consignees and buyers. It may even embrace intermediaries in the transport chain, such as logistics service providers, freight forwarders, carriers, transport operators, ports, inland depots and warehouses (NEA, 2002a). The vertical component to the transportation decision process reflects longer-term strategic objectives at corporate level or, at lower levels, more short-term service evaluation and convenience issues. The third dimension is the human factors component that circumscribes the characteristics of the decision-maker, the environment and the decision-making heuristics (D'Este and Meyrick, 1992).

Considering, first, the horizontal component, Bardi (1973), in an early example, puts the transportation decision firmly in the context of a firm's supply chain. He says, "The business logistics function of a firm is concerned with bridging the gap between production and consumption of raw materials and finished goods." Such a view is extended to the vertical dimension by Evans and Danks (1998), who observe "the challenge now is to take supply chain management to a more strategic level in a firm."

Emerson and Grimm (1996) are more grounded, and see logistics and marketing as key components of customer service. Referring to the MGK model (See Mentzer, Gomes and Krapfel, 1989) they propose seven dimensions of customer service, three from logistics (availability, service quality and communications) and four from marketing (pricing policy, quantity, product support - sales and product support - customer services). They say that logistics customer service activities "...provide place, time and form utility, by ensuring the product is in the right place, at the time the customer wants it, and in an undamaged condition."

Bergmann and Rawlings (1998) confirm that integrating transport into the supply chain is ultimately the key to business success. Lai, Ngai and Cheng (2004) use the concept of Supply Chain Performance (SCP) to measure logistics service effectiveness in delivering value to members in the supply chain. Referring to other authorities, they say that SCP is composed of multiple dimensions, including time and speed (Towill, 1996), agility and flexibility (Van

Hoek, Harrison and Christopher, 2001) and quality and productivity (Stainer, 1997). In the Lai, Ngai and Cheng study, they look at three aspects of service efficiency, Service Efficiency for Shippers (SES), Operational Efficiency in providing the services (OE) and Service Efficiency for Consignees (SEC). Customer facing aspects of SES and SEC are measured in terms of reliability (REL) and responsiveness (RES) whilst OE relates to the efficient use of resources in two aspects – cost (COST) and assets (ASSETS).

By introducing the concept of supply chain performance (SCP) the significant measure of successful transport delivery becomes customer satisfaction and so, by proxy if not in fact, in some circumstances the consignee or buyer is designated as a surrogate for the transport decision-maker. In particular industries (e.g. minerals), it is even more explicit, especially with relatively stable supply chains involving bulk commodities. Here, the consignee's requirements are paramount. In a short article in "Pulp and Paper", Ferguson (reporting an "A.T. Kearney study") concludes, "Customer directive is the prime factor in industry's transportation decisions" (Ferguson, 1991).

Burdg and Daley (1985b) find that the most important transportation selection factor is "satisfies customer's needs." In a later study, Gentry and Farris (1992) highlight the role of purchasing managers in the supply chain. In a similar vein, Murphy and Daley (1994a) in their study on water port selection factors surveyed 350 members of the National Association of Purchasing Managers (NAPM) in the USA. Indicating a contrary finding, they observed that previous US studies appeared to be very "outbound" focused. La Londe and Powers (1993) also highlight the increasing importance of the consumer/user at the terminal point in the distribution system. This, they say, has two consequences. First, inventory is pushed back up the channel and, secondly, because of this, as safety stocks are eroded, reliability and consistency become even more important than speed.

Although a lot of the literature is concerned with transportation choices from a freight buyer's perspective (shipper or consignee), it is not always the

shipper nor even consignee that makes the freight transportation choice decisions. Murphy (1991b) says:

> "...previous empirical transportation choice research has focused primarily on one group of users of transportation services, namely shippers... This predominant shipper orientation ignores the fact that intermediary parties such as brokers, shipper cooperatives, and freight forwarders may also be actively involved in transportation choice, especially for small shippers."

The NEA say that a range of decision-makers, who have varying degrees of decision power over transportation choices, make up the supply chain (NEA, 2002b). These are identified as shippers/consignees, forwarders, logistics service providers, railway companies, barge operators, ferry operators, shipping companies, terminal operators, intermodal (terminal to terminal) operators and shipping agents. The NEA accords these "actors" with different degrees of influence on various sectors of the supply chain with the most significant (other than shipper and consignee) being forwarders, large road hauliers and logistics service providers. The NEA, however, also refers to SYSTEMA et al. (1998) that say that shippers have the greatest influence on the decision process within the total transport chain. Even if the intermediary is not the actual decision-maker, they may work closely with the freight payer, defining the requirements that allow the forwarder, for example, the "freedom to choose the appropriate transport operators, as well as the routes and the modalities of the transport chain functioning."

Recently, outsourcing the logistics function has become more common as organisations focus on their core competencies. This has encouraged the growth of a new genre of logistics service providers that supply a whole spectrum of services from transport and warehousing to added value activities such as light manufacturing, order assembly, packaging and labeling (Wagner and Frankel, 2000 and Shah, 1995).

Some studies have chosen to concentrate on sampling the views of such intermediaries, not because they are necessarily the decision-makers per se, but because of their "knowledge endowment" (Bergantino & Bolis, 2003).

Bergantino and Bolis make the point that, in relation to their study on evaluating the maritime option in Italy, the forwarding sector "… on average, accounts for more than half of the transportation decisions, as outsourcing of transport operations is spreading rapidly". Bolis and Maggi, in an earlier study (1998c), say that when "distances and complexity of market penetration increases, companies tend to use specialized intermediaries and to reduce [i]nflexible transport systems". This accords with Murphy and Daley (1997a) who observed, "The literature suggests that international freight forwarders (IFFs) are important intermediaries for cross border shipments."

Bowman (1994), in his article on air cargo makes an interesting point about the influence of freight forwarders. He says, "Frequently, a freight forwarder acts as a middleman, making it difficult for shippers to assess their carriers." Consequently, it is hard for shippers to know whether they are getting value for money and the level of service for which they are paying. Van Damme and van Amstel (1996) also warn of the dangers of outsourcing the logistics function. Even from a legal point of view, as Tetley (2003) observes, it is often not certain whether a freight forwarder is assuming the status of shipper or carrier.

This raises the question of whether the decisions made by logistics service providers, forwarding agents and other intermediaries replicate those that would be taken by their principals (shipper or consignee). Murphy, Daley and Dalenburg (1991a) conclude that they do not. In their study on selecting links and nodes in international transportation, they find that the post deregulation studies on shippers ranked reliability and cost as the most important factors. This was in contrast to the findings of their earlier study where freight forwarders ranked equipment availability, shipment information and loss and damage performance at the top with reliability and cost lying fourth and fifth respectively (Murphy, Dalenburg & Daley, 1988).

Some studies of modal choice use samples that comprise exporters and forwarding agents (Garcia-Menendez, 2004) or shippers and forwarding agents (Shingal and Fowkes, 2002). In the Shingal and Fowkes study, examining freight

mode choice in India, the sample is made-up of exporters, freight forwarders and transporters, combined with the chemical and electrical and electronics sectors. In this disaggregate stated preference study, the forwarding agents and transporters display (on average) an opposite preference for intermodal transport to those of the other groups. Thus, such aggregation can be quite dangerous. As Murphy and Daley (1997b) warn, "Recent transport research has demonstrated that aggregate results can mask important differences between respondent subgroups."

With the widespread use of freight forwarders and intermediaries, their influence on transportation decisions becomes significant. Murphy, Daley and Dalenburg (1991b) found that large U.S. industrial companies make extensive use of freight forwarders. Maltz (1992) says that the use of third party logistics providers is more extensive in Europe than in the US. Mangan, Gardner and Lalwani (2001b) also observe an increasing trend towards outsourcing which, they say, "...in turn impacts on the locus of choice decision."

In a study investigating route competition via European seaports, Bird (1988) surveyed only freight forwarders. Even with such and apparently homogeneous group, there seems to be opposing views between forwarders in different geographic regions - those based in mainland Europe and those based in the UK. In response to the proposition that "Reliability, time and safety are more important" [determinants choice] than "sea route and cost", 28/34 (82%) of UK forwarding agents agreed, compared with only 15/28 (54%) of European forwarding agents.

Before drawing conclusions on the horizontal dimension of the decision-making process it is worth examining the vertical one – the decision hierarchy. In other words; a) would the same results be obtained by surveying corporate level directors as, for example, shipping managers or freight clerks, and b) which result would most closely replicate actual observations (revealed preference) were the same options available? The literature gives some direction to resolving these issues

Choice Hierarchy in Freight Transport

Source: Abdelwahab and Sargious (1992)
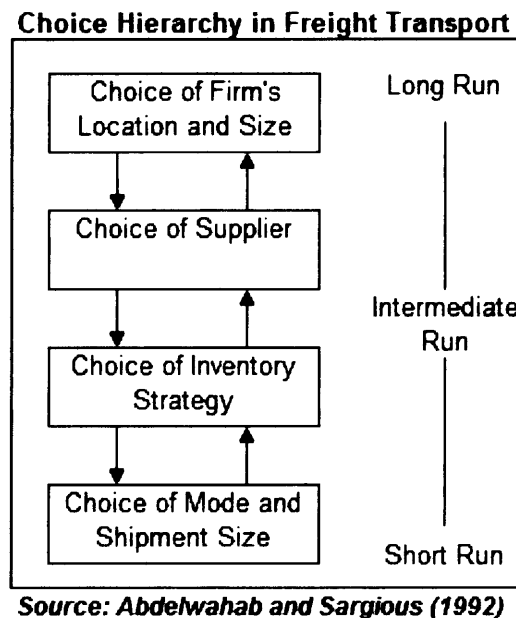
Figure 3.4 – Choice hierarchy in freight transport

Bolis and Maggi (2003) assume a three level decision structure in their study on logistics strategy and transport service choices. In the long-term, a firm defines its logistics strategy by its location in relation to its supplier/client network. The medium-term strategy relates to the transport services available on the market, and the third level decides on which of those services meet specified criteria described by vector characteristics such as price, transport time, reliability and safety. Abdelwahab and Sargious (1992b) also propose a hierarchical model with slight variations in description (see Figure 3.4).

Danielis and Rotaris (1999b), in their study on own account versus third-party freight transport in Norway, refer to Fridstrøm and Madslien's (1995) division into two decision level groups according to the "choice temporal horizon". The first group which they call the "Operational (shipment) Decision Level" includes the variables of time, punctuality and damage risk. The second group (in this very specific study) they term "Strategic Decision Level" contains such variables as employer's responsibility for drivers, vehicle advertising and company size. Their conclusion on this aspect of the study has some relevance here:

"The freight market complexity required [us] to artificially divide the short term choices from the long term ones although they

are actually interrelated aspects of the logistics chain. The potential bias deriving from this procedure, added to the distortion caused by the analyst['s] lack of knowledge concerning the decision context and the individual choice mechanism, question the validity and reliability of the final results. "

The decision framework offered by Brand (1987), shows how choice can be influenced by the decision hierarchy, without necessarily being subject to invasive intervention in the actual day-to-day decision-making process:

> "*Corporate level personnel have become more involved in selecting carriers resulting in: (a) widespread use of approved carrier lists; (b) widespread use of specific carriers; (c) increased involvement in the purchasing function; (d) increased use of contracts...*"

Not all studies, however, support the proposition that decision strategies at different levels of an organisation may yield different choices. Murphy and Daley (1994b) in an analysis of port selection factors, classified respondents in terms of six aspects of the transport buying process; namely initiators, gatekeepers, influencers, buyers, purchasers and users. The study conclude that "Analysis of these findings by the respondent's role in transport choice decisions discovered minimal differences between those actively involved in the port selection process and those less involved."

Using this as background, it follows that the views of respondents at the operational (short-term) level of the hierarchy may accurately reflect the firm's longer-term strategies, providing the decision-maker is actually aware of the corporate objectives of the company or other higher-level directives. Thus, whilst it may be argued that the level of the decision-maker within an organisation may not be salient, particularly in aggregate studies, the more detailed information available about the decision-maker (demographics etc.) is worth recording in disaggregate experiments, where such additional information can enrich understanding and possibly explain outliers or anomalies.

In this regard, there are potential differences between the decision-making processes in small firms and that of large firms. Bellizzi (1981) argues, "Organisational size does appear to be a factor, which may help determine

patterns of buying. The influence of presidents, vice-presidents, and owners declines as corporate size increases, while the influence of other participants, such as purchasing agents increases as organisational size increases." Halley and Guilhon (1997) take a similar view that firms are "...defined through interactions between different components, exhibit a specific strategic behaviour based on the dominant role of the owner-manager and his or her perception, and on the dependent relationship in the environment."

Schematic selection decision model
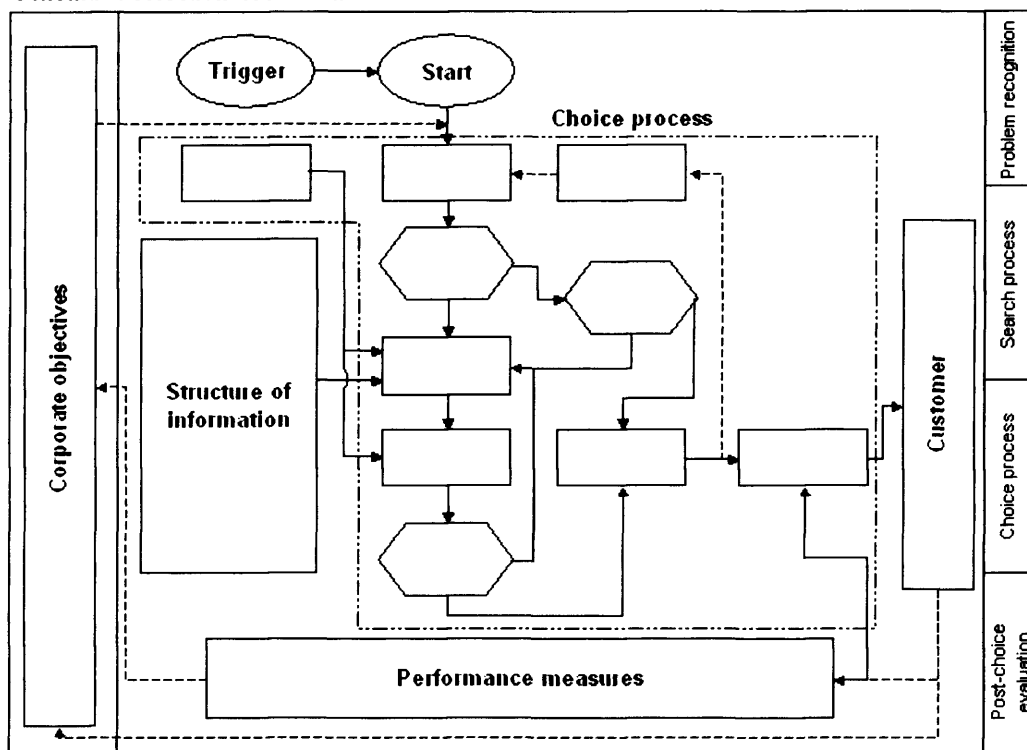
Source: Adapted from Stock & La Londe (1977)

Figure 3.5 – Schematic modal selection decision model

Another factor is exposed by Harrington (1995). Smaller firms, she finds, are more likely to assign logistics decisions to an individual with other responsibilities who are not necessarily versed in the logistics area. Quoting one of her interviewees, she says "This generally means that logistics approaches in smaller companies are not as sophisticated as those for larger companies." Presutti (1988), investigating the purchasing practices of small manufacturing firms says that, whilst those responsible are well educated, they have no formal training and lack such analytical skills as price and cost analysis, as well as value analysis. In the purchasing environment, at least, there is a heavy reliance upon

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on-the-job-training, and guidance from others with experience but who, themselves, have no formal training. By implication this suggests that in larger firms, those responsible for logistics are formally trained and take a more sophisticated approach to logistics. Garcia-Menendez, Martinez-Zarzoso and Pinero De Miguel (2004) say that large firms tend to have greater bargaining power or their own transport fleets. Murphy, Daley and Knemeyer (1999), on the other hand, find that larger firms tend to use more than twice the number of intermediaries (freight forwarders and brokers) than their smaller counterparts.

Stock and La Londe (1977b) brought a new perspective to mode and carrier choice. Although dated 1977, their work foreshadowed the importance of the decision-making process referred to in later studies. The concept of "corporate objectives" was placed firmly within the decision environment (see Figure 3.5). They show that in larger companies, there is an evolution from problem recognition through search strategies and the eventual choice made, before ending up with evaluation (and more importantly, feedback).

It is clear from the above that the transportation decision, and thus the choice between modes, may be made, or contributed to, at several points along the supply chain (horizontal component) and in the corporate hierarchy (vertical component). If, as is intended, the experiment is to be conducted at individual level, then to obtain the best results the enquiry should be directed at the person who, in the majority of cases, is best able to provide insight into the judgments made. Bergantino and Bolis (2003), justify their enquiry of freight forwarders on the basis of "...not because they are necessarily the decision-maker per se, but because of their knowledge endowment." Forza (2002), on the other hand, observes "Due to the functional specialization and hierarchical level in the organization, some people are knowledgeable about some facts while others know only about others."

Clearly, the person that should be endowed with the most knowledge of the transportation process, and has the greatest commitment to ensuring that the company objectives are implemented, is the specialist that co-ordinates the transportation on behalf of the exporting firm (internal or external). They should

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be aware of and be able to represent the corporate objectives of the firm (vertical dimension), they have input from other departments, such as the service requirements and strategies of the sales department, they are able to represent the needs of other actors in the supply chain (upstream or downstream) and they have access to key performance indicators and informal feedback (knowledge endowment).

Appropriate Informant
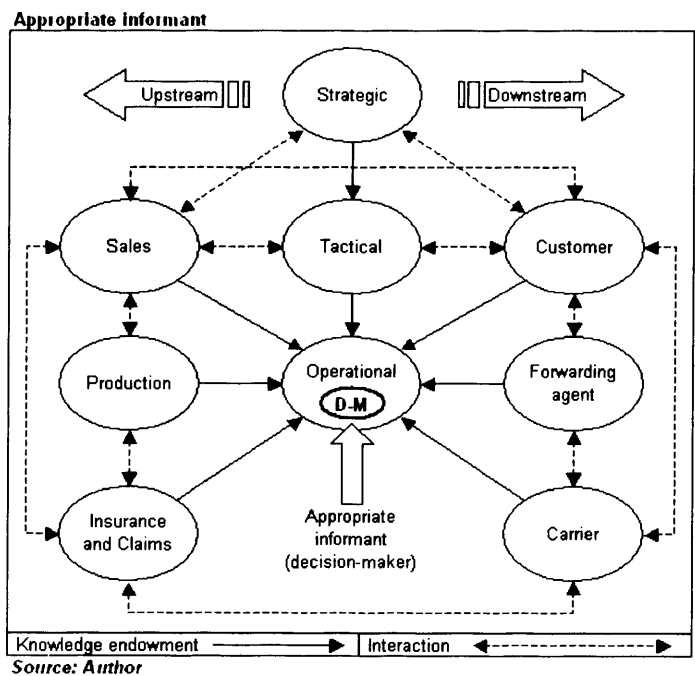
Figure 3.6 – Appropriate informant

Whilst a board of directors may be able to affect modal choice by such factors as "location", and other actors in the supply chain can influence determinants by providing preferences, the person endowed with the most knowledge, and thus influence on modal choice, is likely to be the transportation specialist (shipping manager or close forwarder/LSP) contracted by the exporting firm. Taking all the previously identified research into account, for the purpose of this study, the appropriate informant is deemed to be the person performing this function at operational level (see Figure 3.6).

3.3.2 Human factors component

Cognitive style governs the way decision-makers evaluate information and make choices (Averett, 1991). Swan (1997) noted that managerial cognition is an

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essential element in strategic decision-making that has been under-researched in the management literature. He pointed out that studies tend to focus on producing normative idealized models rather than descriptive models of the decision-making process. According to Swan, the weakness of this normative approach is that it produces generalised models that do not take account of cognitive differences between individuals.

There is a range of possible decision protocols and heuristics available that transport decision-makers may use, both consciously and unconsciously. They are classified as follows:

- **Unconscious bias or fallacy:**
    - Availability heuristic;
    - Representativeness heuristic;
    - Anchoring heuristic;
    - Conjunction bias.
- **Risk attitude:**
    - Corporate risk;
    - Individual risk;
    - Risk/ambiguity aversion.
- **Information:**
    - Confirmation bias;
    - Evaluative heuristic or stopping rule;
    - Satisficing.
- **Ranking and selection:**
    - Elimination by Aspects (EBA);
    - Majority Rules;
    - Weighted average.

Sometimes the *availability heuristic* is defined as "a judgment based on information readily available from memory" (i.e. "Experience"). In Tversky and Kahneman's (1974) original specification, it is the ease with which something can be brought to mind that is important. In other words, people tend to make judgments based on whether they can relate to previous examples easily.

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Although the availability heuristic is associated with unconscious bias, in many cases its occurrence can lead to satisfactory decisions as, the ease with which something can be recalled subconsciously ranks it as important. However, this is not always so, as there are many other factors that draw something to our attention, not all of which are conducive to good judgment. Nisbett and Ross (1980) argue that one of the reasons that the availability heuristic sometimes leads to incorrect decisions is the "vividness criterion". In their submission, they say that people recall information that is "vivid" far more easily than information that is "pallid". In other words, information that is emotionally interesting and relevant (highlights a potential opportunity or risk to the business), or that is image provoking (ice fields in the Baltic), is far more likely to persist in memory and be recalled readily. Other factors that may unduly weight the importance, and thus potentially create bias in comparison to other recollections, are the simplicity of the concept and the freshness ('recency') of the information.

Another heuristic that impacts on the decision structure is the *representativeness heuristic*, also proposed by Tversky and Kahneman (1974). This heuristic describes how people attempt to estimate the extent to which objects or events relate to one another and then use this resemblance as a basis for judgment when making other decisions. In other words, people tend to make judgments on unknown events based on 'comparable' known events, assuming that the outcomes will be similar. Although this may work in some cases (by coincidence), the primary fallacy of this heuristic is that similarity in one aspect does not necessarily lead to similarity in other aspects. A well-known example of the weakness of the representativeness heuristic, is the gambler's fallacious belief in runs of good and bad luck i.e. that odds in a future scenario are somehow related to a previous coincidental pattern.

The third heuristic proposed by Tversky and Kahneman (1974) is the *anchoring heuristic*. The concept behind this heuristic is that once people have made an initial judgment they give disproportionately lower value to new information such that the adjustment from their original starting position is insufficient. In other words, they tend to use their first estimate as an "anchor," and are reluctant to adopt a new position that substantially differs from their

original decision. The saying that "First impressions are important" is probably correct from a perception point of view but not necessarily accurate if subsequently examined objectively.

A bias that affects both the availability and representativeness heuristics is the *conjunctive bias* or fallacy (Tversky and Kahneman, 1983). The conjunctive fallacy is where people believe that the conjunction, or combination, of two or more attributes is more likely to occur than one of its parts. This is because the coincidence of the attributes is perceived to be more representative of imagined stereotypes than the respective components. In their study, Tversky and Kahneman describe such an imaginary stereotype that has since become a classic example of this form of bias:

> "Linda is 31 years old, single, outspoken, and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and participated in anti-nuclear demonstrations."

In the study, many of the respondents rated the statement a) "Linda is a bank teller active in the feminist movement" as more likely to be true than the statement b) "Linda is a bank teller." The fallacy of selecting "a" lies not in the original information but in the fact that as a matter of deductive logic, the latter statement includes the former. Hence, the probability of "a" being more likely is wrong as it can only equal but not exceed "b". There are numerous examples where even experts in a particular field make similar seemingly incorrect deductions, e.g. "A survey of geologists ranked an earthquake killing 100 people in California more likely than an earthquake killing 100 people in the USA" (Rachlinski and Guthrie, 2004). Even with such obvious logic, there is an opposing view that the former description in the Linda example is more plausible as it matches the stereotypical characteristics more closely (Gigerenzer, 1991).

There are many obvious comparable analogies of each of these heuristics (or potential bias) available in a transport environment, and particularly in an emerging, and unfamiliar, situation such as Russia. Reliable information may not always be available and is sometimes replaced by apocryphal stories and hearsay

evidence. Evaluation of the available options under such circumstances moves the process from the domain of calculated risk towards one of uncertainty.

Risk taking is a major factor in research into decision-making (Cyert & March, 1992). The Royal Society (1992) defines two polarized approaches that firms take towards risk as being "homeostatic" and "collebrational" (See Figure 3.7). Homeostatic firms tend to react to events in terms of managing risk whilst collebrational firms are more proactive, such that risk is estimated and managed. Smallman (1996) argues that such "fatalistic" or "holistic" approach aligns with the Miles and Snow (1978) taxonomy of firms categorised as "Analysers", "Prospectors", "Defenders" or "Reactors". Smallman goes on to consider the risk perception of managers and impact on the strategies of organizations. This is a major issue in the research into risk as to whether the risk appetite of the organization is consistent with the risk appetite its staff (Kendrick, 2004). Cyert and March (1992) point out "the classical theories of choice characterize risk preference as a fixed trait of the organization or the decision-maker operating within the utility function."

Organisational types and risk paradigms
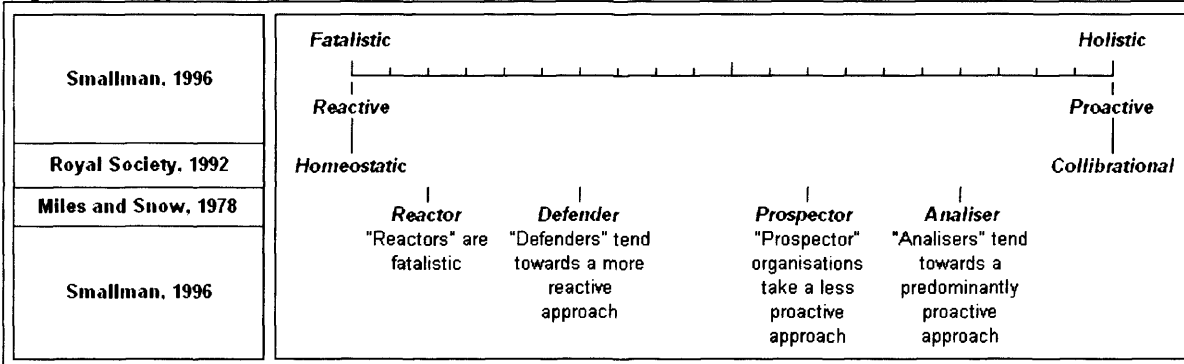
Source: Adapted from Smallman, 1996

Figure 3.7 – Organisational types and risk paradigms

Although Miles and Snow (1978) attribute characteristics to an organization, such organizational behaviours are actually quite difficult to measure. In defining their "Confidence Index", Banomyong and Beresford (2001) accord the responsibility for assessing the level of risk, albeit the consequences being "corporate" (that the goods will, or will not, "arrive safely at destination") to the individual decision-maker. They say, "The respondents

intuitively assign a rating [confidence index] for each transport mode, intermodal transfer charge and other nodal activities." Thus, adopting a similar approach, for the purpose of this study, the characteristics and possible bias of the individual decision-maker is explored in the context of how this affects their corporate decision-making.

Although bias itself is generally unconscious, people are by and large aware of their personal *risk attitude*, if not the precise mechanics and possible implications on their decision-making bias. Different individuals have different risk attitudes so that "different people will make different decisions within the same risk environment" (Flanagan and Norman, 1993). Even the same person may have a different *affinity* for or *aversion to risk* depending on circumstances (Williams & Heins, 1989). As Moore and Thomas (1988) point out "any theory of choice behaviour must explain direct preferences and attitude to risk."

Utility functions of the three risk attitudes (Risk Neutral, Risk Averse, Risk Taker/Seeking)
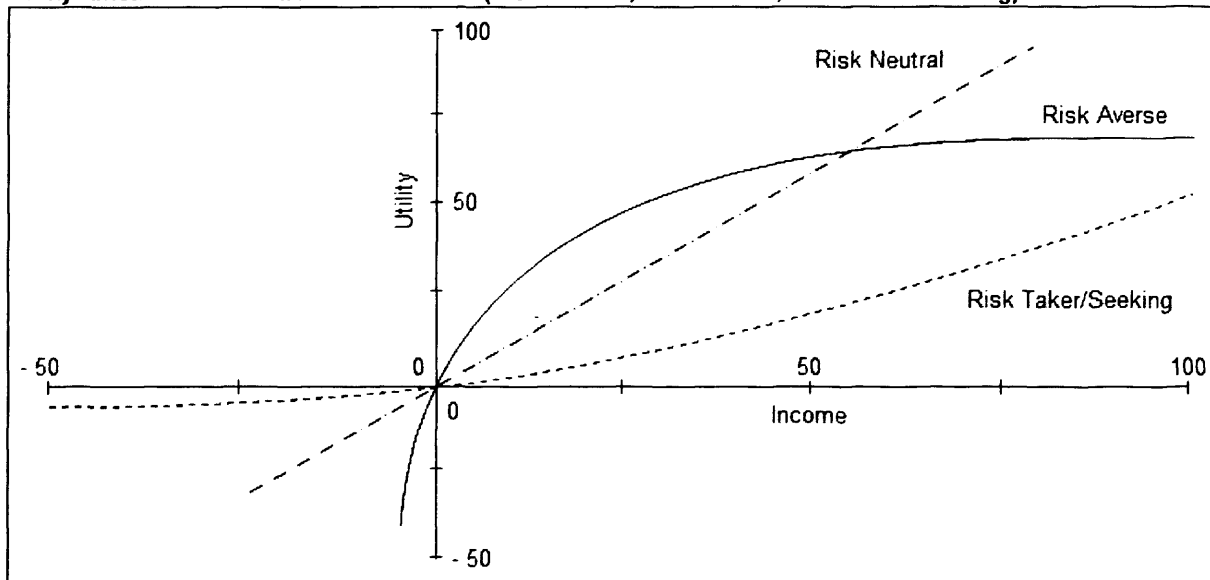
Source: Adapted from Ruegg and Mashall (1990)

Figure 3.8 - Utility functions of the three risk attitudes (Risk Neutral, Risk Averse and Risk Taker)

In terms of risk, there are essentially three types of decision-maker, namely risk neutral, risk averse and risk taking (seeking) – Figure 3.8. Risk neutral is when an individual is indifferent to risk. He will neither pay to avoid risk nor to take it. In a nutshell, risk does not affect the risk neutral's decision-making process. Risk aversion occurs when an individual is willing to accept a lower

expected payoff if it means they can have a more predictable outcome. A risk seeker is an individual that prefers taking decisions in uncertain situations. Despite the higher degrees of risk accepted, risk seekers are generally associated with success (MacCrimmon and Wehrung 1986, 1990) and entrepreneurial tendencies (Swails, 1997).

Individuals display different risk attitudes according to the different situations they are confronted with. In 1979 Kahneman & Tversky, proposed that risk taking is asymmetric about a reference point, and that people will be risk averse when they perceive themselves to be in the domain of gain, and risk seeking in the domain of loss. In their 1982 study, Kahneman and Tversky (1982) observe:

- "the threat of loss has a greater impact on a decision than the possibility of an equivalent gain;

- people will tend to take risks (risk-seeking) if the situation is a sure loss even though there is a high probability of a larger loss;

- people will tend not to take a risk (risk averse) if the situation is a sure gain even though there is a higher probability of a higher gain."

The last two points made by Kahneman & Tversky have come to be known as the "fourfold pattern of risk attitude", namely, risk aversion for gains and risk-seeking for losses at high probability, and risk-seeking for gains and risk aversion for losses at low probability (Di Mauro and Maffioletti, 2004). Di Mauro and Maffioletti explore this notion further in their study on *ambiguity aversion*. Krahmer and Stone (2006) provide a background explanation of this distaste for uncertainty[5]:

> "*Ambiguity aversion refers to an agent's distaste for making choices under conditions of uncertainty in which some relevant probabilities are unknown ex ante as opposed to conditions of risk in which all relevant probabilities are known in advance. Crucial for our argument is the observation that the resolution of an ambiguous lottery reveals information about the unknown probabilities of the events associated with that lottery. Thus, when an agent chooses such a lottery its resolution may alter*

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[5] For a more detailed explanation, including the "ambiguous urn" experiment, see Ellsberg (1961).

his ex post assessment of what he optimally should have done at the moment of choice, leading him to regret his past choice. By contrast, the resolution of a risky prospect reveals no such information and so leaves the agent's original assessment of the wisdom of his past choices intact."

Although there is not universal agreement[6], Di Mauro and Maffioletti (2004) conclude that the fourfold pattern is confirmed under risk as well as under uncertainty but that ambiguity aversion, wherever present[7], tends to be stronger than risk aversion.

This is significant insofar as it influences even the way that the information is acquired in order to support a decision. When the data available is ambiguous, there is a tendency to give the benefit of the doubt to the prevailing hypothesis (Klayman, 1995). This, of course, introduces a bias confirming the existing strategy (*confirmation bias*). There are a number of confirmatory tendencies identified by Klayman, including the one already mentioned:

- tendency to support the existing hypothesis arising from the ambiguity of data available;
- tendency to regard disconfirming evidence as suspect;
- tendency to regard confirming evidence as valid;
- tendency to pose questions in favour of answers supporting hypothesis (and then treating results as unbiased);
- tendency to avoid the 'cost' of changing course against societal values of consistency and 'courage of convictions'.

Although confirmation bias is generally deleterious to the reliability of the choice made, it is inherently attractive to "lazy" decision-makers as a substantial amount of data implicitly resides within the existing hypothesis. In concept, at least, this is not unreasonable as, in real decision-making scenarios, the acquisition of information has to be limited by the finite amount of time,

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[6] Di Mauro and Maffioletti (2004) note that ambiguity preference at high probabilities for losses and at low probabilities for gains is found by Curley and Yates (1985, 1989). Erev and Wallsten (1993) find that the fourfold attitude towards risk does not extend to uncertainty or, if present, it is very weak. Cohen, Jaffray and Said (1985, 1987) and Einhorn and Hogarth (1986) find mixed evidence.

[7] Fox and Tversky (1995) propose that ambiguity aversion may be observed in comparative contexts but not in non-comparative situations.

knowledge, attention and money spend available. Thus, even though a decision-maker may try to avoid the different forms of bias, it is necessary to adopt an information gathering and decision-making strategy that is limited. This form of truncated investigation is known as bounded rationality (Gigerenzer & Todd, 1999). Such investigations (or computer models designed to emulate the algorithm) have to have some form of stopping rule or evaluative heuristic that sets a predetermined limit on the process.

Predecisional search strategies

Proportion of information available searched	CSS	High proportion searched	Indicates compensatory strategies (e.g. additive and additive-difference)
	LSS	Low proportion searched	indicates non-compensatory strategies (e.g. conjunctive, elimination by aspects)
Variability in proportion searched across alternatives	CSS	Absence of variability by alternatives	Indicates compensatory strategies (e.g. additive, additive-difference)
	LSS	Presence of variability by alternatives	Indicates non-compensatory strategies (e.g. conjunctive, elimination by aspects)
Direction of search	CSS	Intradimensional direction	Indicates dimension-wise search (e.g. additive difference, elimination by aspects)
	LSS	Interdimensional direction	Indicates alternative-wise strategies (e.g. additive, conjunctive)

Additive: Search one alternative, across dimensions, until all dimensions are examined. When done, begin search of new alternative
Additive difference: Examine and compare two alternatives on one dimension, then consider same pair on another dimension until all dimensions have been examined that contribute significantly to the overall differences between the pairs. When done, compare the better to a new third alternative, and so on
Conjunctive (by alternatives): Search one alternative, across dimensions, as long as values are above the pass fail criterion for each dimension. Stop at first observation of a 'fail' value, and begin search on a new alternative. Choose first alternative on which no 'fail' values are obtained.
Elimination by aspects: Look at all alternatives on one dimension, then go to the next dimension and examine those alternatives which passed the acceptability criterion of the previous dimension. Continue until only one alternative passes on the dimension considered

CSS = Comprehensive Search Strategy   LSS = Limited Search Strategy

Source: Author based on Klayman (1983)

Table 3.1 - Predecisional search strategies

For example, Limited Search Strategies (LSS), use a low proportion of available information, a variability of the proportion searched across alternatives and an interdimensional direction of search. Such an approach indicates a conjunctive type search strategy (see Table 3.1). A conjunctive decision rule measures alternatives against preset criterion that must be equalled or exceeded (similar, but essentially opposite, to Elimination by Aspects - EBA). If an alternative fails on any criterion it is dropped from the list. The process proceeds until (if possible) only one alternative remains. This form of bounded rationality, setting aspirations and ending the search for alternatives as soon as one is found that exceeds the aspiration level, follows Simon's (1955) *satisficing* concept:

"Satisficing is a way of making a decision about a set of alternatives that respects the limitations of human time and knowledge: it does not require finding out or guessing about all the options and consequences the future may hold, as constrained optimization does."

Decision-making rules

Rule/Authority	Posits that ...	Illustrative Example				Result
			Cue 1	Cue 2	Cue 3	Analysis	
Weighted averaging rule (e.g. Anderson, 1981)	... the option receiving the higher weighted average rating across all available cues will be chosen	Option A	9	6	8	7.7	Favours weighted average option = "A"
		Option B	7	9	5	7.0	
Weighted adding rule (e.g. Zhang, Hsee and Xiao 2006)	... the option receiving with the greater weighted additive utility across all available attributes will be chosen			Cue 1	Cue 2	Cue 3	Analysis	
		Option A	9	6	8	23	Favours weighted additive option = "A"
		Option B	7	9	5	21	
Conjunctive rule (e.g. Coombs, 1964; Dawes, 1964)	... options failing to pass a low threshold value on any cue will be rejected			Cue 1	Cue 2	Cue 3	Analysis	
		Option A	9	6	8		Favours option "A" (Rejects option "B")
		Option B	7	9	5	Rejected	
Disjunctive rule (e.g. Coombs, 1964; Dawes, 1964)	... the first option exceeding a high threshold value on any cue will be accepted			Cue 1	Cue 2	Cue 3	Analysis	
		Option A	9	6	8	Pass	Favours option "A"
		Option B	7	9	5		
Elimination By Aspects rule (Tversky, 1972)	... eliminates any options that do not contain specific predetermined cue(s)			Cue 1	Cue 2	Cue 3		
		Option A	9	6	8	See	If criteria = "5" Rejects "A"
		Option B	7	9	5	criteria	If criteria <> "5", rejects "B"
		Analysis			= 5		
Maximum-attractiveness-difference rule (e.g. Svenson, 1979; Wright, 1975)	... the option superior on the on the cue that entails the greatest contrast between two options will be chosen			Cue 1	Cue 2	Cue 3		
		Option A	9	6	8		Favours minority-strongly superior option = "B"
		Option B	7	9	5		
		Analysis	1	3	2		
Majority rule (e.g. Zhang, Hsee and Xiao 2006)	... the option superior on most of the available cues will be chosen			Cue 1	Cue 2	Cue 3		
		Option A	9	6	8		Favours majority-weakly-superior option = "A"
		Option B	7	9	5		
		Analysis	A > B	B > A	A > B		

Source: Author

Table 3.2 - Decision-making rules

For completeness, the conjunction rule is shown in the context of other possible decision-making rules (see Table 3.2). It can be seen that each of these rules is synonymous with a particular search strategy:

- **Limited (or satisficing):**

  - Conjunctive;

  - Disjunctive;

  - Elimination by Aspects (EBA).

- **Comprehensive (or maximizing):**

  - Weighted averaging;

  - Weighted adding;

  - Maximum attractiveness;

  - Majority rules.

Sparks and Lillie (1993a) examined the buying behaviour of airfreight forwarders. They refer to Maslow's hierarchical model (Maslow, 1970), which proposes that the decision-making process is in two parts. Davis and Gunton explain (1983), "In this type of model, referring to one factor as being more important is less precise than the understanding that all factors will eventually be considered, if other factors have been found acceptable." They claim that only when two or more suppliers have satisfied the basic four criteria in full will they use "objective appraisal methods" to differentiate between those suppliers thus short-listed. Other texts refer to "checking all the boxes". The concept may be more familiar in terms of the recruitment and selection of personnel to an organisation. Here a screening process is used to eliminate those who, despite the requirements stated in an advertisement, do not have the basic qualifications asked for. Only when this has been done are the remainder then ranked into "Probables" and "Reserves" (Thomason, 1992).

Buying Decision Grid

Type of buying situation	Newness of problem	Consideration of new alternatives	Information requirements
Straight rebuy	Low	None	Minimum
Modified rebuy	Medium	Limited	Moderate
New task	High	Important	Maximum

Source: Author - Modified from Robinson, Farris and Wind (1967)

Table 3.3 - Buying decision grid

Unlike recruitment, however, route or mode selection in transportation choice has another important aspect. Whereas in recruitment it would be very unusual (although not unknown) to consider an applicant previously employed, a person making a transportation choice will often be choosing between options where there has been previous buying experience. This situation is defined as the "Buygrid" model. The buy class framework of Robinson, Faris and Wind (1967)

("RFW") presents a simple, yet coherent model of industrial buying behaviour (Iyer, 1996). Whilst later research has developed the "RFW" seminal work considerably (contexts, product categories and buyer/seller relationships), as Bunn (1993) observes, "the buy-class dimension is really surrogate for many activities and therefore it is very robust." Essentially, the buy grid model distinguishes between three different forms of buying bahaviour (see Table 3.3):

- Straight rebuy;
- Modified rebuy, and
- New task (new buy);

Kotler (1984) provides managerial description for the classes, which have been modified here to apply to a modal choice buying situation:

- *Straight rebuy*: This describes a buying situation where the decision-maker chooses from suppliers that have been used before ("in-suppliers") and who may be on an approved list. Relying on previous experience (formal or informal), weight is given to past satisfaction. Consequently, information gathering in this situation is minimal.

- *Modified rebuy*: The modified rebuy is based on existing suppliers but the choice is made on a combination of factors, including past performance and a renegotiation of some of the terms or service delivery specifications. Some information gathering may take place, combining in-house performance measures with external market comparisons.

- *New task*: The new task purchase occurs when a purchaser is selecting a new route or service for the first time. This buy class has a significant element of risk. Thus, the greater the cost or risk, the greater the information needs and, consequently, the more comprehensive the information seeking.

Kotler (1984) proposes that there are eight stages of the buying process that are an expression of the thoughts and activities that a buyer goes through. The sequential steps are: problem recognition, description of needs, product specification, supplier search, proposal solicitation, supplier selection, order-routine specification and performance review. From Kotler's adaptation of the

buy grid framework (Park & Bunn, 2003), it can be clearly seen that the buy class actually determines the stages (buyphases) that the industrial buyer has to engage in or can avoid according to the buy class preference (see Table 3.4).

Buying stages engaged in or avoided

	Buyphases	New task	Modified rebuy	Straight rebuy
Major stages (buyphases) of the industrial buying process in relation to major buying situations (buyclasses)	1 Problem recognition	Yes	Maybe	No
	2 Description of needs	Yes	Maybe	No
	3 Product specification	Yes	Yes	Yes
	4 Supplier search	Yes	Maybe	No
	5 Proposal solicitation	Yes	Maybe	No
	6 Supplier selection	Yes	Maybe	No
	7 Order-routine specification	Yes	Maybe	No
	8 Performance review	Yes	Yes	Yes

Source: Author (modified from Kotler, 1984)

Table 3.4 - Buying stages engaged in or avoided

Risk is an important aspect in determining buy class and investment in information gathering (Giunipero & Eltantawy, 2003). There are two main components of risk that influence the buying strategy, the decision-maker's previous experience and the newness of the buying situation. Firms or individuals that are not prepared to invest in information gathering and analysis will tend to rely on experience whereas firms or individuals that will tolerate such investment are able to ameliorate the risk of new buy situations by careful research (hard data) and analysis.

Various dynamics can influence the buying preferences including situational factors, the organizational type (Laios & Xideas, 1993) or individual's characteristics (Park & Bunn, 2003). Even individuals within the same organization may have a different perspective on the buying process than others (Chakraborty, Srivastava & Marshall, 2007). Here it is argued that the information gathering, and problem-solving demands of the new buy, or modified rebuy, classes are likely to suit certain individuals more than others.

There are advantages and disadvantages on both sides of the fence that arise from the different buy class strategies. New buy situations involve greater risks and switching costs that may be quite substantial. Loyalty, or rebuy

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strategies on the other hand, are generally associated with a willingness to pay a premium price or, at least, price indifference (Fornell, 1992). Stable buying relationships, such as developing supplier/customer partnerships are important in some purchasing scenarios (e.g. Logistics Service Providers). However, this latter relationship is not a straight rebuy, it is a modified rebuy as there is generally a continuing dialogue (annual review) on price and terms (following the collection of, and comparison with, market data). An illustrative assessment of the advantages and disadvantages of the three buy classes for buyers and sellers respectively are summarised in Table 3.5.

Advantages and disadvantages of the three buy classes

	Transportation buyer's perspective		Transportation seller's perspective	
	Advantages	Disadvantages	Advantages	Disadvantages
New task	Likely to obtain better terms and rates and benefit from changes in technology	Involves investment in information search and problem solving. New buys are relatively high risk due to lack of knowledge/ experience and switching costs.	Able to solicit new customers through proactive marketing.	Customer retention. Higher sales and marketing costs. Necessary to differentiate product and possibly offer more favourable terms than incumbent suppliers.
Modified rebuy	Limited risk based on previous experience but with the advantage of being able to tune the rates or terms according to the market.	Some investment required in information gathering and analysis. Not optimising opportunities by playing the market.	Relatively low maintenance customer. No sales and marketing costs.	Some pressure on prices and enhanced terms.
Straight rebuy	No investment required in terms of information gathering and analysis. Limited risk as satisfactory past experiences.	May be overtaken by business lifecycle and changes in technology. Likely to be paying higher prices and receiving lower service quality.	Loyal customer ("Happily Inert"). Able to retain customer through service quality. No price pressure. Low sales and marketing costs.	None.

Source: Author

Table 3.5 - Advantages and disadvantages of the three buy classes

Using the buy class type of framework, Sparks and Lillie quote Cook (1967) who finds that transportation buyers will rebuy when the supplier's performance exceeds expectations. Other authorities report similar results. Brooks (1985) states that "a satisfied purchaser of freight services will merely choose the carrier chosen 'last time', i.e. a straight rebuy situation, and will not engage in prolonged decision-making". Cunningham and Kettlewood (1976), in their paper on source loyalty, emphasized the significance of the straight buy-class in freight transportation, whereas Saleh and La Londe (1972) stated that

94% of companies they studied were in the modified buy-class. Krishnan and Beckman (1979) sum up the decision-making inertia:

> "The fact that most modal choice decisions follow informal procedures and that non transportation cost factors (factors that are not easily quantifiable in terms of dollars) are considered most important in decision-making suggests that most modal-choice decisions have a great deal of uncertainty associated with them and, in the case of uncertainty, decision-makers seek to simplify decisions by letting past decisions guide future decisions."

There is an aspect of inertia in the rebuy or modified rebuy decision-making process which is contrary to the economic assumption of rational decision-making based on evaluation of objective information. Vanderleest (1991) highlights the necessity of engaging in proper selection criteria when developing a transportation plan and Brand (1987) describes the process by which transportation services are evaluated. This includes the factors triggering the search for new carriers, obtaining information about the carrier capability, the extent to which carrier contracts are applied and the relative importance of the various contract provisions. In this last study, Brand found that both formal and informal methods of evaluation are used and that there is a widespread implementation of approved carrier lists and also a widespread use of specific carriers.

The use of specific carriers or approved carrier lists largely reinforces the concept of buy-rebuy but at some point in time, it must be assumed, a form of carrier evaluation (however meagre) has taken place. Stock and La Londe (1977) offer a four-part decision format to describe buying behaviour:

- Various situations which could cause firms to alter modal patterns, e.g. switch modes (Stock and La Londe, 1997c) The most important of the nineteen factors identified were "Desire to improve customer service", "Deterioration of service provided by mode", "Desire to reduce overall distribution costs" and "Poor pick-up and delivery by existing mode";

- Sources of information about modes (Stock and La Londe, 1977d). The most important of these was found to be "Past experience with mode";

- Selection criteria used to evaluate modal choices (Stock and La Londe, 1977e). Of the twenty three determinants of choice, "Consistent on-time pickup and delivery" came first and "Environmental impact(s) of mode" came last;

- Procedures used by firms to evaluate modal performance (Stock and La Londe, 1977f); of the six criteria proposed, five were concerned with quality of service.

Critically, this work of Stock and La Londe indicates that carrier evaluation is not a continuous process but conducted on an ad hoc basis, usually initiated by some form of negative experience with the existing carrier. Only as a result of dissatisfaction with the current service does the process of investigation and evaluation of alternatives begin. Moreover, the fact that "past experience with mode" is cited as the most important method of investigation suggests that the evaluation process is less than thorough and certainly not objective.

Bruning and Lynagh (1984) go beyond the framework of the evaluation itself and investigate the age and experience of the executives conducting the evaluation. In their study, the four features of the evaluation investigated were:

- Type of evaluation;

- Extent of evaluation;

- Evaluation factors;

- Frequency of evaluation.

The Bruning and Lynagh study found that the majority of respondents undertook some form of carrier evaluation. However, more firms employed subjective, as opposed to objective, evaluation techniques. Firms involved in non-basic production (manufacturing, consumer and food products) engaged in inbound as well as outbound evaluation whereas basic production (paper and chemicals) concentrated more on outbound. Demographic analysis showed younger respondents tended to have achieved higher levels of education and favoured quantitative evaluation techniques more than older respondents but, in any case, formal evaluation methods were not prevalent.

An extreme case is exemplified by Malchow and Kanafani (2004b). In one interview with a carrier (the respondent) they observed "the selection of a port is not entirely predictable, implying that the group deciding often does so without much evaluation". If this is true, it completely undermines any reasonable confidence in the economic principle of rational behaviour. Malchow and Kafani in an attempt to try to justify this apparent lack of diligence suggest that some decisions [presumably rebuy] do not require the same level of analysis.

Other researchers offer an alternative explanation for irrational decision-making. Lillie and Sparks (1993) propose that human factors such as risk minimization and personal satisfaction influence the freight transportation buying process. Davies and Gray (1979), on the same theme, say there is a tendency of industrial buyers to reduce perceived risk, thus implying that buyers employ the services of carriers to ensure maintenance of their own reputation. For example, freight cost, which is generally invisible to most users, becomes subordinate to quality of service factors, which are highly visible to all users. This can also be seen to correspond to the second component of the Fishbein Behavioural Intentions Model (FBI model) (Fishbein, 1963). "…behaviours that have greater interpersonal significance or are open to greater public scrutiny may be more susceptible to normative influences than less observed behaviours" (Miniard and Cohen, 1979).

Concerning reputation, Danielis, Marcucci and Rotaris (2005a), putting the concept into the context of the freight transportation choice, refer to Winston (1979) who "suggests a utility maximizing framework in which a logistics manager seeks to maximise his personal utility by performing outstandingly and by devising efficient transport solutions for his company." Unfortunately, this quote concludes, "Should he fail he might ultimately lose his job."

It can be seen from the previous research that there is good reason to believe that the human factors component of the decision-making process is highly influential to the outcome of the modal choice. In the next section the implication for information gathering is explored further.

3.4   Information

Transportation decision-makers, if they are to make perfectly rational informed choices need good information and the ability to analyse this information judiciously. Crucially they also need to be aware of, and understand, the objectives of the organisation and, possibly to a lesser extent, how the organisation's objectives fit within the framework of society as a whole.

A key element of rational decision-making is access to reliable and accurate data. This raises a critical question regarding the type of data available to industry decision-makers - and how they avail themselves of such information. There are clearly three types of data in a modal choice situation:

- *Internal - Information* regarding existing operations - Management Information Systems, Key Performance Indicators, etc.

- *Internal - Information* regarding routes and modes used in the past - Historic data and collective corporate experience;

- *External - Information* regarding alternatives (routes, modes, carriers etc.) - Journals, trade publications, other media and advertising.

The literature casts some doubt about the veracity of information even regarding current operations. Simon and Taylor (2004) are severely critical of management information available from the freight transportation sector and Gilmour (1976) observes:

> *"It is unlikely that the choice of transportation service is always made from the rational basis of historical information on those factors which are considered to be important to the company concerned."*

Considering the importance of reliable information to the decision-making process there is relative paucity of literature that relates specifically to transportation. Brand and Grabner (1985) set out how carrier performance information is obtained. Stock and La Londe (1977a) rank the various sources and Burdg and Daley (1985a) offer a similar ranking. Viewed alone, neither is particularly convincing that there is any form of methodical approach employed.

However, putting the table into the context of Stock and La Londe's decision-making model (Figure 3.5, page 70) from the same study (applicable to the 357 firms interviewed) it can be seen that there is an underlying internal evaluation process:

- Review of on-time pickup and/or delivery service;
- Analysis of customer complaints;
- Review of claims and loss experience;
- Shipment tracing;
- Distribution cost studies or audits.

Sources of Information About Modes

Information Source	Importance Score	Rank
Past experience with mode	834	1
Carrier sales calls	617	2
Company shipping records	611	3
Trade directories routing guides	498	4
Present users of mode	472	5
Other distribution and traffic managers	469	6
Present or potential customers of firm	441	7
Marketing/Sales department	394	8
Trade magazines and journals	321	9
Local Traffic Clubs	260	10
Tariff Bureaus	244	11
Direct mail and advertising	230	12
Local or national newspapers and magazines	196	13
Accounting and finance department	165	14
Outside consultants	135	15
Yellow Pages	88	16

Source: Stock and La Londe (1977)

Table 3.6 – Sources of information about modes

Lang, Calantone and Gudmunson (1997) investigate the way that managers in small firms seek information and conclude that there is a strong possibility of selective perception (they seek information as they interpret specific issues – threats and opportunities). Hambrick (1982) and Hambrick and Mason (1984), on the other hand, look at the way that executives in large organisations assimilate information, and concluded that executives do not "scan" according to their organisation's strategies but according to their own personal or functional interest. This leads to the concept that "... a 'common body of knowledge' appears to exist within an industry ... which is disseminated by media [read the

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same periodicals, go to the same meetings and participate in the same informal networks] equally available to and used by executives within the same industry."

If, as is indicated by the ranking of information sources (see Table 3.6), trade journals and periodicals contribute materially to this industry body of knowledge, their role in influencing transportation choice is quite significant. This is of greater concern because of the doubt about the reliability of the information provided especially with the growing trend towards advertorial (Stout et al., 1989; Saltz, 1995 and McDonald, 1996). Burdg and Daley (1985), investigating the marketing implications of user and carrier attribute perceptions, found that "shipper respondents relied on information received directly from trade journals, carrier sales people, advertising and other media sources, or indirectly from others in their firm and outside consultants." Marketing literature and advertorial, which, according to Burdg and Daley, is inherently biased, appears to be one of the major external sources of information on which transportation choice decisions are made.

Shipper utilization of information sources

Information Source	Mean response score*	Rank
Carrier sales people	3.6	1
People in my firm	3.5	2
Current users of transportation mode	3.2	3
Trade journals	3.2	3
Technical journals	2.7	5
Trade associations	2.5	6
Advertising brochures	2.4	7
Trade conferences	2.4	7
Outside consultants	2.1	9
* 5 = consult nearly all the time. 4 = consult rather often. 3 = occasionally consult. 2 = seldom consult. 1 = never consult.		

Source: Burdg and Daley (1985)

Table 3.7 – Shipper utilization of information sources

It is, of course, possible to employ marketing strategies positively or negatively. Positive marketing promotes the use of a particular carrier or port and can be informative, even if inherently biased. Negative marketing creates disproportionately adverse impressions that, by their nature, can hook into

Tversky's (1972) "elimination by aspects" model. This relates directly to the human factors dimension described by Lillie and Sparks (1993), as the perceived risk of cargo being delayed, especially where the possibility is widely exposed by advertorial, impacts directly on the decision-makers' reputation. This fear is intensified by it appearing that the decision-maker is, apparently, less aware than his colleagues (who rely only on the media) of a potential business threat. There are many examples of this type of negative marketing, being particularly prevalent in volatile transport situations.

The EC funded programme promoting the Northern Maritime Corridor (NMC) provides just one example that relates directly to this study. Here, the marketing literature promoting the Barents Sea route as an alternative to the Baltic (NMC, 2002), states:

> "The dramatic growth of Russian traffic flows over recent years has placed considerable pressure on the Port of St. Petersburg. In particular, St. Petersburg suffers from a number of major constraints including congestion, ice, high port handling charges and other related costs."

As decision-makers have to assimilate more information, the decision-making process becomes even more complex. This does not necessarily mean that the decision itself becomes more reliable but, in order to shortcut the process, a certain amount of dependence is placed on carrier reputation and routing capabilities (Evans, Feldman, & Foster, 1990). Thus, the route elements, comprising links and nodes (Murphy, Dalenburg & Daley, 1991b), are implicated in the decision criteria. Information about links such as shipping lines and road hauliers, or nodes such as ports, freight terminals, inland depots, warehouses and even border crossing points are all, thus, critical to the decision-making process for modal choice.

3.5   Determinants of choice

The decision heuristics and the information commonly available to the decision-maker provide the background for evaluating the potential determinants of choice and their salience. Salience itself is an important concept because it

helps decide which attributes are actually influential – and thus rate as determinants. Some authors use the term influential - Cullinane and Toy (2000), but do not specify what this actually means. However, Mangan, Gardner and Lalwani (2001) describe the concept of salience by bringing together the arguments of Aaker and Day (1980) and Brooks (1985). Aaker and Day, observing on extant studies:

> *"Just because an attribute is judged to be important by a large proportion of the respondents doesn't necessarily mean that it is a 'determinant' (of choice) – in the sense of making a difference in the purchase patronage decision ... Importance is therefore a necessary but not sufficient condition of attribute determinance".*

Brooks uses the term 'salient attribute' to describe those attributes that are justifiably influential in the choice decision – in other words, they are actually the determinants of choice. It is not sufficient for the attribute simply to be rated as important, the chosen option must be seen to perform better on this attribute *vis a vis* an alternative option. Mangan, Gardner and Lalwani provide a good example relating to drivers using freight ferry services. A decision-maker may identify facilities for drivers as a very important factor in terms of choosing which ferry service to use. If, however, the facilities on board the chosen option perform as well as those on the non-chosen alternative then, patently, facilities for drivers are not a true determinant of choice – it is not a salient attribute.

Unfortunately, the literature stretches across a whole range of possible factors, promoted by the respective authors as prospective determinants of choice - according to the specific perspective of the study (modal split, carrier selection, port selection, bulk cargoes etc.). In order to give some semblance of structure to the discussion here, while incorporating as many as possible of the issues raised by the other authors, this section is organised as follows:

- Route variables (mode, distance, location, port/terminal/CFS, carrier);
- Freight variables (cargo characteristics, cargo imbalances, commodity groups, shipment size);
- Service attributes (price, quality of service, past service satisfaction/dissatisfaction);

– Externalities (ecological considerations, changes in technology).

3.5.1 Route variables

Historically the transport choice decision has been characterized as a choice between modes. Modal choice is, in fact, a substitute term for a number of other route/mode/carrier preferences. Matear and Gray (1993) find that the second component of carrier choice for shippers is "Route Characteristics". Route characteristics combine consideration of the attributes of the carrier or mode of transport with those of any nodes, such as ports or other interchange facility. For example, Bird (1988) uses the concept of "routes" in his study of route competition between European seaports. Cullinane and Toy (2000) also use the route/mode choice concept. Banomyong and Beresford (2001) term their study "multimodal transport" and examine modal choice as part of a route mode concept (e.g. route/mode choice - road to Danang or road and rail to Bangkok, Laem Chabang or Port Klang).

There have been numerous studies on modal choice[8] (as opposed to carrier or port selection, for example). These studies represent the huge diversity in approach to mode choice such that it is difficult to determine a central philosophy. Talvitie (1972) in 1972 used "probabilistic" models. In 1985 Jeffs introduces behavioral model analysis (Jeffs, 1985). In 1999, Abdelwahab and Sayed (1999) evaluate the use of Artificial Neural Networks to determine freight mode choice. Looking at the Norwegian freight transport system, Haugen and Hervik (2004) use a game-theoretic model to understand some of the counter-intuitive features of modal choice. Walker (2001) looks at the possibility of incorporating latent variables in her logit-kernel model and, in 2005, Parola and

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[8] Since 1970 there have been numerous studies concerned with modal choice, and the determinants of choice, including (amongst others) Talvitie (1972); Gilmour (1977); Stock and La Londe (1977); (1978); McGinnis and Corsi (1979); Currim (1981); Ogden and Rattray (1982); Slater (1982); Cunningham (1982); Jeffs (1985); Faller (1985); Lungstrom (1985); Seidenfus and Van Rens (1985); Wilson and Bisson (1986); Jeffs and Hills (1990); Foster and Strasser (1990); Owaki (1994); Nam (1997); Meersman and Van de Voorde (1997); Pauwels (1998); Abdelwahab and Sayed (1999); McFadden and Train (2000); Cullinane and Toy (2000); Sayed and Razavi (2000); Walker (2001); Shinghal and Fowkes (2002); Garcia-Menendez, Martinez-Zarzoso and Pinero De Miguel (2004); Haugen and Hervik (2004) and Ribbink, Van Riel, and Janjaap (2005).

Sciomachen (2005) investigated intermodal container flow in a port system network using simulation.

A good starting point for a discussion on modal choice is the distance between the points of origin and destination. Rail is generally accepted to be more expensive per unit distance travelled than road over short distances and less expensive over longer distances. Sea is commensurately cheaper than either road or rail. If each mode is represented graphically, plotting total cost against distance, the difference between the road and rail cost-distance gradients gives an intersect, which, according to Marlow and Boerne (1992), was between 350 and 400kms (but may be shorter now). The situation is rarely this simple, as it is unusual, but not unknown, for the ultimate points of origin and destination to coincide with rail or port facilities. Consequently, most rail-based options are actually multimodal (using more than one mode) as shown by Beresford and Dubey (1990). In the Garcia-Menendez's study on determinants of mode choice (Garcia-Menendez, Martinez-Zarzoso, & Pinero De Miguel, 2004b), they find that road transport is dominant up to 700km and intermodal is dominant above 1,400.

Putting this into the context of the routes between UK and Russia, the road distance between Hull and Moscow is about 3,600km – well in excess of Marlow and Boerne's 400km or even Garcia-Menendez's 1,400km. This should indicate that very little use is made of road transport. In reality it is not the case (EBRD, 1993). Arnold, Peeters and Thomas, (2004c) look at modelling rail/road transportation systems from the Iberian Peninsula, where there are some similar issues to this study (rail gauge change etc.). Here they note "location theory may be used to deal with some of the spatial aspects of modal choice."

It is clear from Chapter 2 that maritime services to Russia focus on a few port complexes such as the Humber range. Feser and Bergman (2000) describe buying and selling patterns and industrial clusters. They refer to Czamanski and Ablas (1979) making the distinction that earlier literature defined clusters as sectors related through formal production linkages, regardless of geographical proximity. Later literature, such as Redman (1994), on the other hand, defined a

cluster as "a pronounced geographical concentration of production chains for one product or range of similar products, as well as linked institutions than influence the competitiveness of these concentrations." Lösch (1938) notes that trade is "helped by large scale production, and handicapped by the cost of transportation." In his paper on the nature of economic regions, August Lösch describes a cone of supply, whereby the maximum shipping distance (radius of the cone) is determined by the price at the centre of production, plus transportation cost being equal to the price at the edge of the cone.

It follows then that the more specialized the cargo, the larger the cone of supply and more flexible the transport options. This is the case for Scotch Whisky where both the uniqueness of the product (Targett, 1983) and the clustering of the producers is sufficient to induce waterborne carriers to deviate from their normal schedules, or even base hubs on such consistent cargo flow (Baird, 2002). OOCL, operates two services into Grangemouth (SBX1 and SBX2) based on the Baltic trade but also acting as feeder services to their deep sea trades, transhipping at Rotterdam (Containerisation International, 2004).

Cargo emanating from a region close to a seaport is far more likely to be shipped by sea, ceteris paribus (Vanderleest, 1991). A different situation exists where the cargo origin lies outside the normal hinterland of a port – or, at least, a port with services to the intended destination. Here the cargo is termed "discretionary", meaning that a choice of port (or other mode of transportation) is more marginal. In the case of sea transport, Malchow and Kanafani (2004) consider that other factors come into play, such as the position of the port in relation to carrier itineraries. In this case, ports that are last (or towards the end of a loading rotation) will be preferred over ports that are earlier in the schedule. The converse applies to discharge ports. Obviously, this is particularly true for short-sea trades where coastal passages represent a larger proportion of the overall transit time.

Tiwari, Itoh and Doi (2003) summarise the relationship between modal choice, route selection and ports:

"However, it seems reasonable to assume that modal choice and the question of port selection are ultimately related, and the results from modal choice studies are directly applicable. Investigating decision factors - for example, Gilmour (1976), McGinnis (1979), Ogden and Rattray (1982), Brooks (1985), Wilson et al (1986) and Meyrick and D'Este (1989) - have identified three factors: route factors (which include frequency, capacity, convenience, directness, flexibility and transit time), cost factors (freight rate and other costs) and service factors (delays, reliability and urgency, avoidance of damage, loss and theft, fast response to problems, co-operation between shipper and carrier, documentation and tracing capability).

Port location, although very important, and position in the schedule are just two of the factors influencing port choice. Murphy, Dalenburg and Daley (1988) propose a range of port selection factors in their study on how worldwide ports evaluate themselves. These include (paraphrased) handling capabilities, low freight handling charges, low frequency of loss and damage, equipment availability, convenient pickup and delivery times, the provision of information concerning shipments, assistance in claims handling and flexibility meeting special handling needs. The results of the 1988 study show that ports perceive "having equipment available" as the most important factor. The issue of cargo embargoes and security from terrorism are considered, but not measured.

As has previously been indicated, the risk of congestion is a potentially important determinant of choice. There are many examples of congestion influencing route choice. In November 1997, rail car shortages on Union Pacific and Southern Pacific rail networks, combined with shortages of stevedores at Los Angeles, created severe congestion at the port causing U.S. shippers to seek alternative routes (Rose, 1997). Even though a potentially valid determinant of choice, congestion on a specific route is particularly difficult to model, especially in cross-sectional analysis, because of its transient nature and interaction with traffic volume. Even so, its effect on port choice, and by association route and mode choice, can be significant. As Tiwari, Itoh and Doi (2003) find, "modal choice and the question of port selection are ultimately related."

Research into the determinants of port choice exposes significant differences between the various actors in the supply chain. Murphy and Daley

(1997a) found that freight forwarders value equipment availability as the most important criteria along with loss/damage performance, large shipment capabilities and pickup and delivery times. The results of the Murphy and Daley study also demonstrated that situational considerations play a key role in freight forwarder transportation choice decisions. For example, Hall and Wagner (1996) find that key selection criteria for one mode or modal segment may not be applicable or critical for another mode or modal segment. Other research by Murphy and Daley (1994a) examines port selection factors from the perspective of purchasing managers. Here, they conclude that shipment information and loss and damage performance are the most important factors, while the ability to handle large volume shipments and large and odd-sized freight are the least important.

The body of literature delivers numerous diverse port selection factors. Bird (1988) investigates the perception of freight forwarders, Suthiwartnarueput (1988) focuses on the directness of sailings, and Pearson (1980) looks at locational factors from a carrier perspective, such as port itinerary and port proximity. Tiwari, Itoh and Doi (2003) evaluate the port/carrier interface. They measure port variables such as ship calls, total TEUs (twenty-foot equivalent units) handled, number of berths, number of cranes, water depth, routes offered, and usage factors. Shipping line variables include total TEUs handled during the year and fleet size, while shipper characteristics are defined as distance of shipper from the port and the type of trade/commodity involved.

Nir and Lin (2003) refer to Murphy and Daley's (1994) work to define the topics of port choice research as being (1) the factors that managers find most important, (2) what factors have a bearing on port choice, and (3) how to compare the results of previous studies with current studies. Nir and Lin use three types of model to discuss shipper's demand behaviour in relation to port choice, namely a "basic" model, an "experience" model and a "competitive" model. In the conclusions to their investigation they find that in the basic model, distance and time are the most important factors, i.e. shippers choose the closest port. Slightly contradictory to Pearson (1980) (study based on deep-sea carriers) they do not find frequencies of call and route to be significant. In the experience

model, the results show that the "last time, this time" variable is significant (but this could simply be that the basic model criteria, i.e. distance from port, remains unchanged). A similar argument can be advanced for the competition model.

Carrier selection factors

Author	Date	Factor 1	Factor 2	Factor 3
Bardi	1971	Meeting estimated pick up	Meeting estimated delivery	Frequency of damage
Saleh and La Londe	1972	Pick up service	Transit time	Delivery time
Evans and Southard	1974	Dependability of service	Total transit time	Ability to trace shipments
Jones	1975	Reliability	Total transit time	Claim settlement
Anderson, Jerman and Constantin	1976	Freight damage experience	Total transit time	Assistance obtaining rate changes
Pearson	1980	Flexibility by the carrier	Preference given to shipper	Fast transit
Dunn	1982	On-time deliveries	Care in handling	Transit time reliability
Chow and Poist	1984	Transportation cost	Transit time reliability	Door-to-door transit
Bruning and Lynagh	1984	Pick-up and delivery	Line haul performance	Rates
Brand and Grabner	1985	Consistency of	Competitive rates	Pick-up/delivery times
Burdg and Daley	1985	Satisfies customer	Dependable transit times	Low freight charges
Quinn	1987	Pick up and delivery schedules	Tracing	Flexibility
Bardi et al.,	1989	Transit time reliability	Transportation rates	Total transit time
Foster and Strasser	1990	Schedule reliability	Willingness to negotiate service	Willingness to negotiate rates
Jeffs and Hills	1990	Reliability	Control over	Control over delivery
Abshire and Premaux	1991	Reliability of service	Transit time	Carrier response in an emergency
Gentry	1991	On time delivery	Rates	Geographical
Morash and Calantone	1991	On time pickup and delivery	Reliability	Safe delivery without loss or damage
Damas	1992	Price	Short transit times	Service reliability
Hall	1992	On time pickup and delivery	Equipment condition	Willingness to improve service
Lambert, Lewis and Stock	1993	Quality of dispatch	On-time pick up and delivery	Competitive rates
Whyte	1993	Ability of representatives	Promotional material	Physical facilities
Murphy and Daley	1997	Reliability	Equipment availability	Transit time
Garcia-Menendez, Martinez-Zarzoso and Pinero De Miguel	2004	Cost	Transit time	Frequency of shipment

Source: Various

Table 3.8 – Carrier selection factors

Nir and Lin (2003), and Malchow and Kanafani (2004a) argue that with the maritime carriers establishing rates independent of inland location (called equalization in the UK context) the area considered a port's hinterland has disappeared. This, however, is less true now, particularly on short-sea trades. Even so, in such circumstance, "ports compete primarily through their investment program". As a result of the study Malchow and Kanafani are forced to conclude "…that the variables furthest from the control of port authorities, the oceanic and inland distances, have the greatest impact on carriers' distribution of

shipments." They also find that this is not necessarily true for discretionary cargo (cargo originating from a region that does not contain a port) where such factors being the last port of call in a loading itinerary may dominate.

Port selection is obviously linked to the range of carrier services available and the attractiveness of these to the decision-maker (see Table 3.8). The evidence on the most important carrier selection criteria is a little inconsistent. Some say that freight charges were found to be the most important factor and cite Chow and Poist (1984) and Brand and Grabner (1985) that support this finding. However, other early work clearly shows that service factors were ranked higher - Bardi (1973), Saleh and La Londe (1972), Evans and Southard (1974), Jones (1975) and Anderson, Jerman & Constantin (1978). The fact that results are generally inconsistent adds weight to the argument that there are other factors influencing the studies, or other salient factors not otherwise taken into consideration.

3.5.2 Freight variables

One of the most obvious influences on transportation choice, whether this is mode, port choice or even carrier, is the distinctiveness of the freight itself. This is evidenced at the extreme by the existence of specialist facilities e.g. oil, coal, gas, timber and refrigerated cargoes etc. The distinctiveness does not just mean the physical characteristics of the cargo, but its value, the typical parcel size, method of handling, the constraints this places on the carrying unit and the consequent imbalance of such units – specialist road vehicles, ships, barges and freight containers. Danielis, Marcucci and Rotaris (2005b) provide aggregate results based on their modal split study but then break these out by sector (commodity groups). However, they acknowledge that because the sample size in each sector is quite small the results are not statistically robust.

There is some controversy in the literature as to whether mode choice variables differ significantly across the range of commodity groups. Nam (1997b) acknowledges that most of the previous studies reveal different variables across the groups but reports that his study across six sectors (textiles, paper,

chemicals, basic metal, earthenware and electrical housewares) disclosed relatively small mode choice variables. However, he concludes, "Some heterogeneity does exist with accessibility, frequency and rate." Malchow and Kanafani (2004c) in their study on port selection support the proposition that importance of attributes varies with commodity type and, in fact, find that choice behaviour varies significantly across commodities (Malchow & Kanafani, 2004d). In a study by Owaki (1994) on modal choice in commodity transport, the commodity variable is specified by "commodity price". Owaki then explores the relationship between commodity price, freight cost and transit time to determine modal choice with the aim of forecasting a multimodal trade mix.

Taking a broader view, Zlatoper and Austrian (1989) reviewed the work of Boyer (1977), Levin (1978), Oum (1979b), Oum (1979a), Oum (1979c), Freidlander and Spady (1980), Lewis and Widup (1982), Miklius et al. (1976), Allen (1977), Daughety and Inaba (1981), Daughety (1979), Winston (1981a), Winston (1981b) and McFadden et al. (1985). They noted that, "a wide range of commodities were accounted for in these studies", but the results often varied with the commodities, "making it difficult to generalise the findings of the different studies".

Thus, there does appear to be a trend towards disaggregate models and segmenting modal studies. In the preliminary work by Beuthe et al. (2004) for the ERSA Congress, they proposed a multi-criteria experiment based on interviews with 100 freight transport managers in Belgium. It is clear, from the structure of the research, they anticipated different results from different commodity groups. Question 9 elucidates information about the specific good with the intention of segmenting responses by value/weight. Question 10 categorises the goods in terms of bulk or containerised, dangerous or non hazardous, dry or wet and reefer or ambient. Data about shipment size, transport distance and network access were also collected.

The demarcation between types of study is not always clear with the term "disaggregate" sometimes being used to describe segmented rather than homogeneous, For example, Nam (1997) conducted a modal choice study

(rail/road) in Korea which is based on a survey comprising 1647 observations across six commodity groups (textiles, paper, chemicals, earthenware, base metal and electrical goods). The study concluded that whereas previous studies reveal different mode choice preference across commodity groups, this study found little difference in the specifications of accessibility, frequency and rate. Nam commented that only with transit-time was there a significant difference that may indicate, "disaggregation is desirable in some cases" (Nam, 1997).

In their review of other studies, Zlatoper and Austrian (1989) also observe that, "In the theoretical realm, one limitation has been the tendency to treat certain transport decisions such as mode choice, separately from other transport considerations. Notable exceptions are the study by Friedlander and Spady (1980), which allowed for endogeneity of rates and relevant shipment characteristics, and the study by McFadden et al [McFadden, Winston and Boersch-Supan (1985)] in which mode choice and shipment size are endogenous."

McGinnis and Corsi (1979) take the view that shipment size is not only significant but divides modal choices into two groups:

> "Modal choices seem to be divided into 2 groups: 1. those for small shipments, and 2. those for large shipments. For small shipments, the study shows that each mode meets the needs of a distinct set of shippers. The shippers who cluster around a particular mode of transportation tend to have many common attributes. There are similar groupings of larger shippers. For example, those shippers who prefer rail are the ones with shipments that are of low value, non-perishable, not fragile, and easy to handle without special equipment. There is very little overlap in shipper characteristics."

Leading on from the differences between commodity groups, one of the most important issues in freight transportation is cargo imbalance, whether this is in terms of total volumes (Brodin, 2000), cargo characteristics or (derived from this) modal imbalance. All three features are prevalent in the trade between the UK and Russia. The imbalance phenomenon influences modal choice in all sorts of ways (Gilmour, 1976; Owaki, 1994). Dominant legs, i.e. origin and

destination pairs where the cargo moving in one direction exceeds that moving in the other, will generate much lower freight rates on the return leg. Modal choices determined on dominant legs will attract cargo less suitable for the mode on the non-dominant leg (Lloyds List, 2005):

> *"Analysts say the rise in imports from China is improving Russia's cross-border trade as containerisation continues to spread. Small businesses in Russia have begun using the thousands of empty containers that have to be returned to East Asia for the shipment of fertilisers, rolled steel and agricultural produce. The businesses are able to export products using containers rather than having to charter a whole ship... "*

The container imbalance problem is not confined to Russia, it is a worldwide trend (Hagen & Reichert, 2002):

> *"Shippers of baled cotton and other low-valued agricultural products, such as animal feed, hay, and paper waste, will continue to see declining rates due to the trade imbalance as the ocean carriers try to supply more containers to Asia. "*

Modal imbalance, requiring specialist equipment (unless ruthlessly disciplined) creates equipment surpluses and shortages, which in turn can lead to congestion (shortage of rail wagons to move cargo away from a port, or surplus empty container stock clogging up the storage areas of the port).

The issue relating to road transport is highlighted in the NEA Report (NEA, 2002c) where it is referred to as "pairability". In this manifestation of the imbalance phenomenon, the report says, "...intermodal choice is favoured if the flows are organised in order to guarantee the return load for the transport of goods, meeting the requirements of the operator that the capacity on the return trip is optimally used." Fite et al. (2002) take a similar view, finding "Freight balance has now become a major component in many TL [Truck Load] trucking companies because of its potential effect on overall profitability." The work of Choong, Cole, and Kutanoglu (2002) is useful, insofar as it raises a number of planning issues with regard to container imbalances.

3.5.3 Service attributes

From the 1980s, some studies on transportation choice looked at determinants of choice other than cost and the pure capability of transporting the goods - see Winston (1985) Chow & Poist (1984), Zlatoper & Austrian (1989) and later (in summary) De Maeyer & Pauwels (2002). Researchers began to emphasize the importance of Quality of Service (Q-o-S) in transport as a major determining factor in choice. In order to further increase the understanding of the choice process in the transport environment, experience accumulated in related disciplines, such as psychology (Luce & Tukey, 1964), marketing (Burd, 1985 and McFadden, 1986), supply chain management and logistics (Lai, Ngai, & Cheng. 2004) were adopted and modified.

The Belgium Public Planning Service, in their report on freight transport modes (SSTC, 2003) assessed the quality differences between freight transport modes. The report draws heavily on the work of De Maeyer and Pauwels (2002) and Danielis 2005. De Maeyer and Pauwels (2002) argue that:

> "... as transportation systems evolve, increasingly characterised by smaller more frequent shipments (with an outspoken preference for flexibility, reliability and availability), other parameters can play a significant role in the decision process."

When identifying these other determining factors De Maeyer and Pauwels refer to Cullinane and Toy (2000), Matear and Gray (1993), Jeffs & Hills (1990) and McGinnis (1990). Broadly, they say, these alternative characteristics of transport services are of a qualitative - behavioural nature - otherwise named "hedonic characteristics." Lewis and Widup (1982) view that Q-o-S attributes, influence transport demand through their impact on freight rates and account for such attributes with hedonic aggregators.

De Maeyer and Pauwels (2002) go on to say, "Surveys where respondents need to rank or rate data is the most obvious and elementary manner to identify influential attributes." They propose that a more powerful tool is to compute estimates for monetary evaluations concerning these "hedonic attributes". For

these qualitative differences between modes, they point at the work of Maggi and Bolis (1999), Jovicic (1997 & 1998) and Abdelwahab (1998).

In a later study by Maggi & Bolis (2001), elasticities were found to be higher for rail than for truck indicating that the relative market share for rail transport is more sensitive to change in modal attributes than the one for trucking. This, they say, might be due to the fact that road transport is perceived to be qualitatively superior to rail and combined transport. In other words, because users of trucking services are satisfied with the level of Q-o-S of road transport, qualitative improvements can have a weaker impact on the road market share, than similar improvements on rail or combined transport services.

Danielis, Marcucci, and Rotaris, (2005c), in their study on modal shift in Italy, conclude:

> "Both estimates indicate, on average, a strong preference for quality attributes over cost. They indicate a high willingness to pay for quality freight transport services, especially for reliability and safety... This result confirms that successful modal shift policies should focus mainly on the quality aspects of the mode to be promoted."

3.5.4 Environmental considerations

Environmental issues have been gaining in terms of the importance accorded them, both in society as a whole, and in transportation research in particular (Aronsson & Brodin, 2006). Indeed, since this piece of research was started, a great deal of attention has been focused on environmental issues, such as the benefits of improving the use of intermodal transport (e.g. Ballis, & Golias, 2004), the role of information technology (e.g. Vannieuwenhuyse, Gelders & Pintelon, 2003) and even personality traits and their influence on modal choice (e.g. Johansson, Heldt & Johansson, 2006) – albeit in respect of passenger transportation. However, much of the literature is taken up with policy issues such as corridors (e.g. Woodburn, 2004) and tax regimes to incentivise modal shifts (e.g. Ribbink, Van Riel & Janjaap, 2005).

Society's dilemma in the context of transportation is the necessity of mobility (passengers and freight) versus the inevitable environmental impact of such mobility. Consideration of possible solutions is split into two main domains:

- Macro – actions taken by governments and legislative authorities to reduce the impact of transport on the environment (often manifested as encouraging modal shifts to more environmentally acceptable modes), and

- Micro – actions taken by companies either to comply with legislation where necessary, or to voluntarily embrace environmentally positive policies because they make business sense.

Logistics decisions that affect the environment (including reverse logistics)
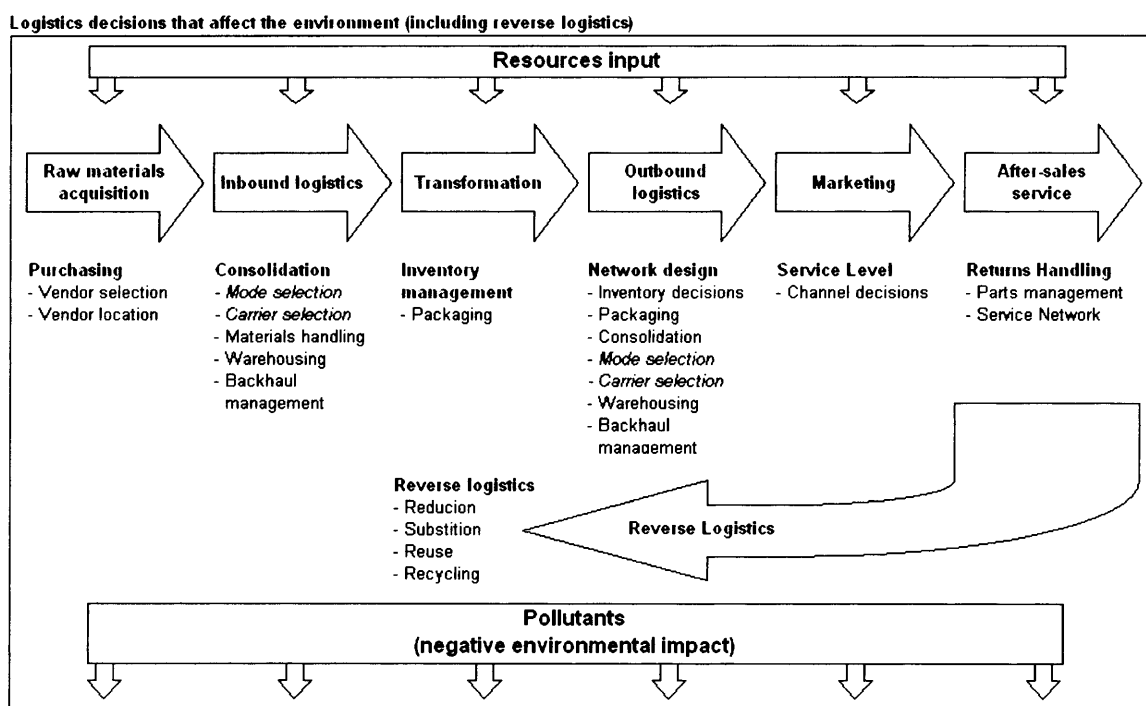
Source: Author (Adapted from Wu & Dunn. 1994)

Figure 3.9 – Logistics decisions that affect the environment (including reverse logistics)

This study, and hence the discussion here, is largely concerned with the latter, whether environmental issues form part of the current consideration of decision-makers in this study and, if so, how they should be handled.

There are very real business incentives for addressing the "green" agenda, apart from just social responsibility. In the European Union, the demand for road

traffic has increased dramatically (CEC, 2002) both in real terms and as a percentage of the modal mix. The proportion of road transport has increased from about 50% in 1970 to 75% in 1999 (Ribbink, Van Riel & Janjaap, 2005). This has led to chronic congestion, an overall reduction in traffic speed and increase in fuel consumption. The OECD reports the impact of this in major OECD cities (OECD, 1995) as a decrease of 10% in traffic speed, 6% more fuel is consumed in traffic jams and through delays. The economic loss in the EU is estimated at 2% of GDP (CEC, 2001).

There are a number of business areas within the supply chain that impact on the environment. Wu and Dunn (1994) show the relationship between the resources input and the negative environmental impact (see Figure 3.9). Here it can be seen that mode and carrier selection fall under inbound and outbound logistics thus further inferring that these choices are made at operational level.

Measures taken by industry to control mobility problem
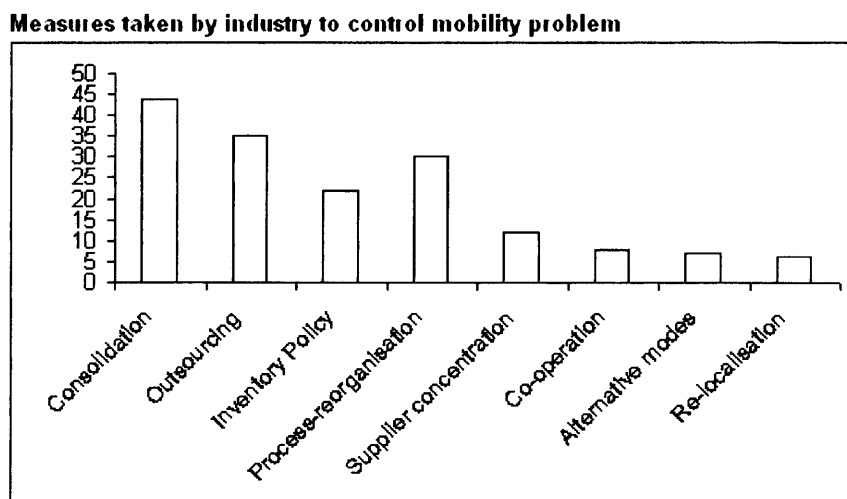
Source: Vannieuwenhuyse, Gelders & Pintelon (2003)

Figure 3.10 – Measures taken by industry to control mobility problem

Vannieuwenhuyse, Gelders & Pintelon (2003) see the potential impacts from a different perspective. In their study on decision support (multi criteria decision-making) for transportation mode choice with regard to environmental impact, they identified eight measures taken by industry to control the "mobility" (cause of transportation need) problem (see Figure 3.10). These are:

    – Consolidation;

    – Outsourcing;

    – Inventory policy;

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- Process re-organisation;

- Supplier concentration;

- Co-operation;

- Alternative modes;

- Relocalisation.

In their survey of 1,530 Flemish shippers and logistics providers (Vannieuwenhuyse, Gelders & Pintelon, 2003), of which 500 were valid responses, 70% indicated they needed to deal with structural problems (such as location/organization (strategic issues). However, of the measures being implemented to resolve the mobility issues, 44% of respondents were addressing consolidation (optimizing the space/weight utilization of freight vehicles), and 35% were outsourcing transport and logistics activities (operational issues). Although some of the strategies might imply a change of mode down the line, only 7% actually acknowledged modal shift as a strategy being implemented within the scope of the survey.

How changes in the logistics structure relate to environmental impact
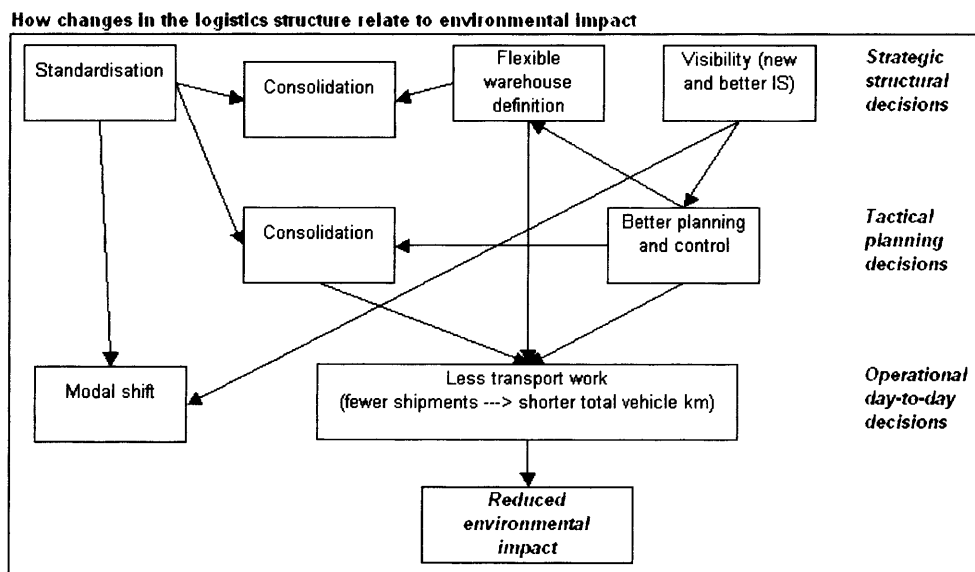
Source: Author (adapted from Aronsson & Brodin, 2006)

Figure 3.11 – How changes in the logistics structure relate to environmental impact

It is clear that environmental choices are hierarchical within an organization, with the challenges dealt with at different levels according to the capital or organizational investment required. According to Aronsson and Brodin (2006), structural decisions involving standardization, warehousing and visibility

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(implying investment in IT) are more likely to be made at the strategic level whereas modal choice will be delegated to more operational levels (see Figure 3.11). It is also worth noting that Aransson and Brodin (2006) see modal shift as a separate strategy from "less transport work".

Aronsson and Brodin (2006), as part of their study on the environmental impact of changing logistics structures, identify 2,026 journal articles (1995 up to 2004) in ten academic journals that might address logistics and environmental issues (search keys "logistics" and "environment"). A closer inspection of the actual articles (by title) revealed that only 45 were of true relevance. Of these, only Wu and Dunn (1995) investigated environmental issues with respect to modal choice and Vannieuwenhuyse, Gelders, & Pintelon with regard to both modal choice and carrier selection. Even these studies do not establish clear endogenous relationships between environmental issues and modal choice. In fact, Vannieuwenhuyse, Gelders, and Pintelon only consider "environment" as part of the company's image, and rank this at ten out of eleven.

Stern and Oskamp (1987) observe that environmental behaviours are often only performed when they are easy to perform. More importantly, as Oskamp, et al. (1991) note, they will not be performed when they are perceived to be cumbersome, costly, inconvenient, ineffective or when others who are similarly expected to be acting environmentally, are perceived as not doing so. Although, these observations are made at individual level, they may be similarly applied to organizations. Everybody interviewed in the Aronsson and Brodin (2006) study agreed that cost and environmental impact often point in the same direction, Thus, they argue, a solution for lower cost almost always reduces pollution as well. The concerns that arise are capacity of the more environmentally positive modes and their reliability (Woodburn, 2004).

As far as this study is concerned, trying to embrace the various factors that fall within the gambit of "environmental considerations" would overly complicate the experiment. As has been demonstrated by Vannieuwenhuyse, Gelders and Pintelon (2003), the "environmentally driven" attributes that might come into consideration in this study (cost, transit time, transit time reliability

etc.) can be adequately represented by existing determinants of choice. Issues, such as location, standardization, and inventory policy are considered outside the remit of decision-makers at the intended level of enquiry. Thus, for the purpose of this study, environmental "attributes" will not be considered as separate determinants of choice (or dissatisfaction).

3.5.5 Changes in technology

Slater (1982) is the only study that has been reviewed here that alludes to the issue of technology as a possible determinant of choice, although Tweddle and Fowkes (1996) investigate the impact of the Channel Tunnel (the commissioned subject of the study). Clearly, there are technological advances that influence choice. Some are massive and widely adopted, such as the advent of containerisation (Tirschwell, 2005), and others less so, e.g. the Channel Tunnel (Tweddle and Fowkes, 1996). Following on from the example set by the courier industry, shipping lines are now making cargo-tracing facilities available on the Internet (EDI, 1997):

> *"Growing numbers of companies that ship containerized freight have been using the Internet to book shipments, review schedules, and check the status of ocean deliveries. Now APL, the California-based transportation company, is adding a series of new interactive features to its Internet Web site that are designed to save customers time, reduce the flow of paperwork, and improve supply chain management."*

For the purpose of this study, technical developments, whether excellence (such as the use of Internet technology for shipment tracking) or innovation (such as fast ferries) are considered under existing attribute headings, for example, "shipper information" is surrogate for use of the Internet and high speed ferry crossings would come under "transit time".

3.5.6 Other studies

In order to focus on the most commonly evaluated determinants of choice, previous studies have been reviewed to identify the number of occurrences of

each factor referred to (see Appendix 1). The descriptions of some factors have been slightly amended in order to achieve some commonality of terms, and where there are multiple occurrences these have been reported under a logical taxonomy. In addition, where determinants are uncommon, but still represents a reasonable explanatory variable, these are reported individually (see Appendix 2) so that their importance can be weighed in the context of this study. The ranking of these potential determinants, and the aggregation of some of them to form a table, does not infer any judgment as to salience (see Table 3.9).

Appearance of potential determinants transportation choice in earlier studies

Potential determinant	Σ	Rank	Studies included - 1 to 88
Price	49	1	········ · · ··· ···· ··· ··· ···· · · ·· · · ·· ·· · ·· ····· ···
Short transit time	44	2	·· ·· · · ·· ·· · ··· ·· ·· · · · · ··· · ··· · · · · · ········ ·
Reliability	40	3	· · · · ··· ·· · ··· · ·· · ·· · ··· ·· ·· · ··· · · ·· · ···
On-time pickup/delivery	25	4	·· · · ··· ·· · · ·· · · ··· ···
Loss/damage record	24	5	· · · · · · · · · · ·· ·· ·· · · · ···· ·
Flexibility	20	6	· · ·· · ··· · · · · · · · · · · ··
Shipment information	20	6	· · ·· · · · · ·· · · ··· · ·· · ·
Capability	16	8	· · · · · · · · · · · ·· · · · · ·
Frequency	16	8	· · ·· · ··· · ·· · · · ··
Location	12	10	· · · · · · · · · · · ·
Customer service	11	11	· · ·· · · · · · ·
Intermodality	11	11	· ·· ·· ·· · · ··
Reputation	11	11	· · · · ·· ·
Claims response	10	14	· · · · · · · ·· ·
Speed	9	15	· ·· · · · · · ·
Transit time reliability	9	15	· · ·· · · · · ·
Characteristics of goods	7	17	· · · · · · ·
Distance	7	17	· ·· · · · ·
Ecological/Environmental	6	19	· · · · ··
Ability/expertise	5	20	· · · · ·
Congestion/risk of delay	5	20	· · · · ·
Equipment availability	5	20	· · · ··
Security	5	20	· ·· · ·
Documentation	4	24	· ·· ·
Schedule	4	24	· · · ·
Coverage	3	26	· ··
Freight rate stability	3	26	···
Lifts in transit	3	26	· · ·
Purchaser	3	26	· · ·
Route options	3	26	· · ·
Technology	3	26	·· ·

Source: Devised by Author from various studies specified in Appendix 1

Table 3.9 – Appearance of potential determinants of choice in earlier studies[9]

The list of various determinants of choice investigated in previous studies (ranked by the number of occurrences) was used as a basis for further consideration. The final selection to be used in the experiment was developed on

[9] The list of studies on which Table 3.9 is based is included as Appendix 1. The potential determinants that have not been included in this table, with an occurrence of two or less in the studies reviewed, are listed in Appendix 2.

the basis of salience (the inherent distinctiveness of particular modes) and practicality of observation (in the type of instrument envisaged):

- Claims response;
- Flexibility;
- Loss/damage record;
- Lower overall cost;
- On-time pickup/delivery;
- Reliability;
- Shipment information.
- Transit time.

3.6 Decision Model

3.6.1 Introduction

This section examines the literature relating to main elements of a model that can be used to associate the characteristics of the decision-maker to the decision-making process with respect to modal choice. Various psychometric tests are evaluated to determine their suitability for this type of inquiry, academic acceptance and, ultimately the practicality for this experiment (including operalisational and cost considerations). Existing taxonomies are explored to see if any are appropriate for use in their original form, or in an adapted format, for this experiment. The possible methodologies and models used in this type of research were appraised in order to provide background for the theoretical model formulated here. Finally, the use of a stated preference technique as part of the research instrument is discussed.

The remainder of this section is divided as follows:

- Personality profile;
- Taxonomies;
- Model selection – decision model;
- Stated preference.

In selecting a suitable psychometric instrument for this experiment, three issues have to be addressed:

- Whether the instrument is suitable for the subject area being investigated;

- How the instrument is rated by the academic and business community;

- Operalisation, including access, cost and the practical issues of actually administering the instrument.

Studies based on psychometric instruments and key themes

Instruments	All	All Sources Biz	Info	Dec	Risk	Seg	Mark	D-M	Cog	Tot	Journals and Peer Reviewed PR	Biz	Info	Dec	Risk	Seg	Mark	D-M	Cog	Tot
16PF	519	1	1	5	10		1		15	33	25	1	1				1		1	4
BarOn EQ-i	12																			
BTRSPI	20	2							1	3	18	2							1	3
Big Five	399	14	3	2	2				11	32	99	7	1	1	1				2	12
CPI	10			1						1										
EQ-360	2																			
FIRO-B	282		1	6	2			4	4	17	10		1							1
INWALD	21										3									
MBTI/Jung	972	7	15	33	8	1	1	14	59	138	53	3		3	1			1	5	13
STRONG	122	1	2	1	3				3	10	8	1		1						2
TAIS	4																			
Voices	12								1	1										
Total	**2375**	**25**	**22**	**48**	**25**	**1**	**2**	**18**	**94**	**235**	**216**	**14**	**3**	**5**	**2**		**1**	**1**	**9**	**35**
16PF	100%	0%	0%	1%	2%		0%		3%	6%	100%	4%	4%				4%		4%	16%
BarOn EQ-i	100%										100%									
BTRSPI	100%	10%							5%	15%	100%	11%							6%	17%
Big Five	100%	4%	1%	1%	1%				3%	8%	100%	7%	1%	1%	1%				2%	12%
CPI	100%			10%						10%										
EQ-360	100%																			
FIRO-B	100%		0%	2%	1%			1%	1%	6%	100%		10%							10%
INWALD	100%										100%									
MBTI/Jung	100%	1%	2%	3%	1%	0%	0%	1%	6%	14%	100%	6%		6%	2%			2%	9%	25%
STRONG	100%	1%	2%	1%	2%				2%	8%	100%	13%		13%						25%
TAIS	100%																			
Voices	100%								8%	8%										
Total	**100%**	**1%**	**1%**	**2%**	**1%**	**0%**	**0%**	**1%**	**4%**	**10%**	**100%**	**6%**	**1%**	**2%**	**1%**		**0%**	**0%**	**4%**	**16%**

All = All studies included in the review; PR = Journals including Peer Reviewed; Biz = Studies relating to business; Info = Studies relating to information gathering/processing; Dec = Decision process; Risk = Studies relating to risk and risk management; Seg = Studies relating to market segmentation; Mark = Studies relating to marketing; D-M = Studies relating to decision-making; Cog = Studies relating to Cognition and cognitive processes

Source: Author

Table 3.10 – Studies based on psychometric instruments and key themes

Fourteen instruments were identified as being potentially suitable for this type of experiment, namely 16PF, BarOn EQ-I, BTRSPI (Belbin), Big Five (NEO-PI), CPI (California Personality Indicator), CSI (Allison, Cognitive Style Index, EQ-360, FIRO-B, INWALD (IPI), KA-I (Kirton Adaptive-Innovative Index, MBTI (Myers Briggs Typology Indicator)/Jungian scales, STRONG, TAIS and Voices. MBTI was considered in conjunction with other Jungian

approaches and Big Five includes NEO-PI (more often referred to in academic literature).

A literature search was carried out, and 2,375 separate psychometric-based studies that appeared to deal with the type of subjects under consideration, were located. Many of these were Ph.D or Psy.D studies. 216 were from academic journals including peer reviewed (See Appendix 3). Of all the studies, 235 deal with the key subject areas of this experiment, and 35 of those appeared in academic journals. These were considered in more detail (see Table 3.10).

For each of the psychometric instruments reviewed (2,375), the occurrences of common themes with this research were identified in order to establish the level of synergy with the research here. The themes used were:

- Studies relating to business;
- Studies relating to information gathering and processing;
- Studies relating to the decision process;
- Studies relating to risk and risk management;
- Studies relating to market segmentation;
- Studies relating to marketing;
- Studies relating to decision-making, and
- Studies relating to cognition and the cognitive process.

Face value evaluation shows that the MBTI (972 studies), Big Five (399 studies), 16PF (519 studies) and Firo-B (282 studies) are the most popular instruments reported in the literature reviewed. Of the two, the MBTI is clearly superior to the Big Five in terms of synergy with this work based on all studies (138:32). However, there is less differentiation between MBTI and the Big Five when considering only the academic literature (13:12). However, Big Five appears to becoming more popular and so the occurrences over time were analysed. This analysis showed that Big Five is now the more frequently used instrument (see Figure 3.12). This is particularly true if the analysis is based purely on studies reported in academic journals (See Table 3.11).

The (Allison) Cognitive Style Index (CSI) was reviewed in more detail, as it initially appeared to closely match the requirements of this experiment. Of the 11 studies identified, ten were peer reviewed. However, all but two[10] of these dealt with reliability and validity issues of the instrument not the operalisation and results. It was decided there was insufficient evidence of comparable studies to consider the instrument further.

Occurrences of psychometric instruments evaluated
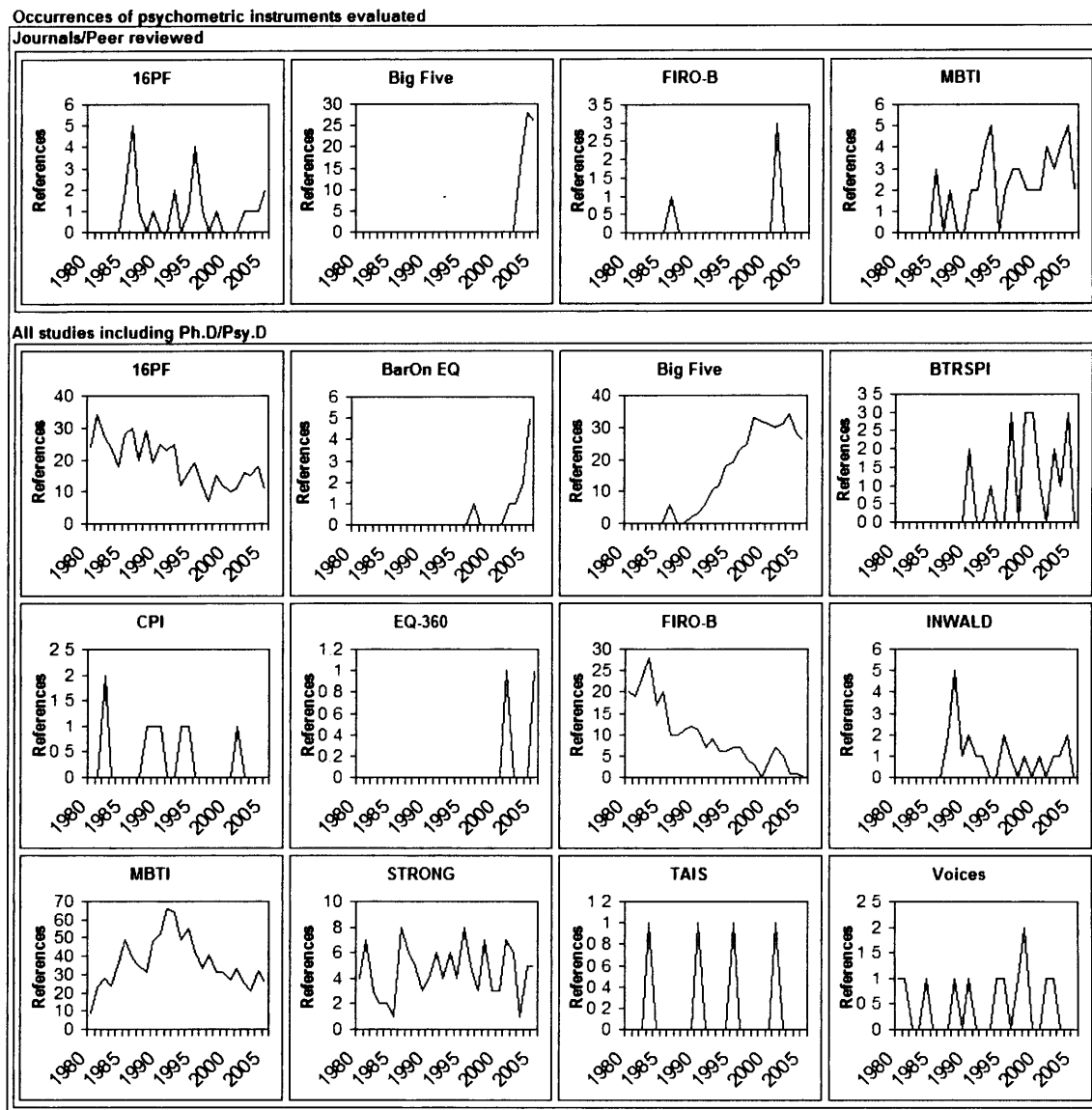
Figure 3.12 – Occurrences of psychometric instruments over time

Similar results were experienced with the Kirton Adaption-Innovation Inventory (KAI), where there was also very limited evidence of substantial

[10] CSI studies: "Examining the relationship between leadership, emotional intelligence and intuition in senior female managers" (Downey, Papageorgiou & Stough, (2006); "Intuition, women managers and gendered stereotypes" (Hayes, Allinson, & Armstrong, 2004).

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studies. Even so, of the studies that were identified, one (Crookes & Thomas, 1998) aligned closely with the concepts being explored in this study. Thus, although the instrument itself was not thought suitable, the continuum between "highly adaptable" and "highly innovative" types provided some useful supporting arguments for the principles proposed here.

The Myers Briggs approach had some attraction partly because of its fairly comprehensive adoption across the business world (and, because, as a result, the author has some experience of its use at Ashridge Management Centre). However, Many scientists, and especially psychologists, do not support the Jungian approach. This is partly because it is based on a teleological view, i.e. that "We are lead by our ideas about a future state" (which is accepted by most personality theorists); but, more importantly, that Jung goes a step further and postulates the mystical interconnectedness of synchronicity, i.e. two events that are not linked either causally or teleologically (Samuels, 2000). Moreover, Michael (2003) advises that there are inconsistencies between Carl Jung's (1923/1971) conceptual studies and the development of the MBTI instrument. Even so, he acknowledges that the MBTI is by far the most widely used and studied psychometric test applied today - with over three million people a year completing the instrument.

Use of psychometric instruments reported in academic journals in the last ten years

	Business	Psychology	Total
16PF	4	3	7
Big Five	48	50	98
FIRO-B	3	1	4
MBTI	25	2	27
Total	80	56	136

Source: Author

Table 3.11 – Use of psychometric instruments reported in academic journals in the last ten years

Furnham (1996) compares the MBTI with the NEO-PI Five Factor Personality Model (Big Five). He notes that the MBTI is the most widely used instrument in the consulting and training world, whereas the NEO-PI is one of the most heavily used measures in academic research area on personality. This coincides with the finding from the literature search here (Table 3.11). In his

conclusion Furnham finds that his study "shows a clear overlap between the two now widely used measures". He suggests that researchers specializing in both these measures would benefit considerably by examining the behavioural and cognitive correlates of the dimensions of both scales that overlap.

The purpose of this study is not to test psychological theory and methods, but simply to identify an instrument that can measure the constructs effectively. Clearly, from the results of the literature review, showing the synergy between this and other studies, both the MBTI and Big Five instruments satisfy this requirement. This "layman's approach" is further supported, from a theoretical point of view, by Furnham (1996) and Michael (2003). However, probably the most important criterion highlighted by Michael is that it can be "easily administered and interpreted by individuals trained outside the field of psychology." Thus, although the Jungian approach is not the most widely used by academics (according to the literature reviewed, meaning academics in psychology based disciplines and education), it is used extensively in the business world, it has been used for comparable cognitive studies[11], is available on the Internet (at no cost) and is relatively easy to operationalise. For these reasons, the Jungian approach was the one selected for this study.

3.6.3 Development of typology taxonomy

Researchers engaged in organizational research, psychometric analysis, behavioural psychology, and even market research, sometimes specify an appropriate taxonomy to characterize the behaviour of an entity (organization or team), an individual or a strategy. Table 3.12 shows various specifications used in different environments. By definition, taxonomy is the classification of items into groups based on similarities or differences. In behavioural psychology, the taxonomies used are often a metaphor that provides a useful shorthand for categorising the main characteristics of an individual or group (e.g. Karakowsky and McBay, 2004). It is important to note that the taxonomy is merely a label that identifies the underlying specification. Context is important and care has to

be taken not to assume an existing classification if the underlying specification or context is different. Most important, though, despite the use of metaphoric labels, taxonomies are used to assist with the communication of ideas; they are not intended to be pejorative.

Taxonomy for organisational and individual roles or behavioural preferences

Author	Date	Level	Taxonomy	Discipline
Aritzeta, Ayestaran & Swailes	2005	Individual	Integrating, Obliging, Dominating, Avoiding and Compromising	Conflict Management
Marcellino	2005	Individual	Sequential, Precise, Technical and Confluent	LML
Walsh	2005	Individual	Risk-averse, Risk-neutral/averse, Risk-neutral and Risk Seeking	Based on MBTI
Karakowsky & McBey	2004	Team	Male-dominated, Female-dominated and Balanced Gender	Team performance
Lampe	2004	Individual	Neuroticism, Extraversion, Openness, Agreeableness and Conscientiousness	NEO-PI/ Big Five
White &Yanamandram	2004	Individual	Happily Inert, Unwittingly Inert and Concerned Inert	Market Segmentation
Stevens & Burley	2003	Individual	Rainmaker and non-Rainmaker	MBTI/ Rainmaker Index (RI)
Fisher, Hunter & Macrosson	2002	Individual	Completer Finisher, Co-ordinator, Implementer, Monitor Evaluator, Plant, Resource Investigator, Shaper and Team Worker	BTRSPI
Jessup	2002	Individual	Thoughtful Realists, Action-oriented Realists, Thoughtful Innovators and Action-oriented Innovators	MBTI/Jung
LoBue	2002	Individual	Trainer, Expert, Advisor and Mentor	TSA
Myers	2002	Individual	Explorer, Innovator, Conductor, Scientist, Coach, Sculptor, Curator and Crusader	MTR-i
Benet-Martinez	2000	Individual	Creative, Mystical, Inventive, Eccentric, Romantic, Bohemian, Worldly, International, Philosophical and Conventional	Extrapolated from Big Five
Eliashberg & Shugan	1997	Individual	Influencers and Predictors	Nominal
Murphy & Daley	1994	Individual	Gatekeepers, Influencers, Deciders, Purchasers and Users	Decision chain
Rowe & O'Brien	1994	Individual	Golem, Pygmalion, and Galatea	Education
Furnham, et al.	1993	Individual	Activist, Reflector, Theorist and Pragmatist	Adapted from Belbin
Miles, et al.,	1986	Firm	Defender, Prospector, Analyser and Reactor	Market position
Kirton	1976	Individual	Adaptor and Innovator	KAI
Kolb	1976	Individual	Reflector and Activist	Education
Riding	1976	Individual	Analytic and Wholist	Education
Anderson	1975	Firm	Quadrant I, Quadrant II, Quadrant III and Quadrant IV	Market position
Argyris	1973	Individual	Wild Ducks	Managerial
Pask	1972	Individual	Serialist and Holist	Education
Ansoff	1971	Firm	Functional, Divisional, Adaptive and Innovative	Market strategy
Kagan	1965	Individual	Reflective and Impulsive	Education
Witkin, et al.	1962	Individual	Field Independent and Field Dependent	Development
Myers	1962	Individual	Intuitive/Thinking, Intuitive/Feeling, Sensing/Thinking and Sensing/Feeling	Management
Guilford	1956	Individual	Converger and Diverger	Psychology

Source: Author

Table 3.12 – Taxonomy for organisational and individual roles or behavioural preferences

A particular problem with metaphoric taxonomies, especially if they relate to individuals, is that sometimes people identify with their own perceptions of

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[11] Other cognitive style studies using MBTI:- "Intuition as a Brain Skill in Management" (Agor, 1985); "The influence of decision style on decision-making behaviour", (Henderson & Nutt, 1980) and "On human cognition and the design of information systems" (Spence & Tsai, 1997).

the stereotype that may not, in fact, coincide with the actual specification or the context used. For this reason, some researchers prefer nominal labels, such as "Quadrants I to IV" used by Anderson (1975). Even with this approach there are problems, as "Type A" may be perceived as being "better "than" Type B. This is (now) particularly true of the outdated socio-economic classification "A", "B", "C1" and "C2" (Nairn, 2002).

Some of the earlier taxonomies illustrated here (Miles, et al., 1986; Anderson, 1973 and Ansoff, 1971) are concerned with how firms behave in the market although, even in these examples, it can be seen that the corporate or collective behaviour is likely to be influenced by the component culture of key players. Equally, Karakowsky and McBay (2004) investigate how a whole team will interact, and the different decisions that will be taken, according to whether the team it is male dominated or female dominated. Lobue (2002) and Aritzeta, Ayestaran and Swailes (2005), despite considering individual behaviours, do so in the context of how these roles contribute to the team. In a special case of this treatment they deal with conflict management where the personalities depicted by the metaphor negotiate in different ways to reach a compromise.

Psychometric instruments tend to rely on their own specifications to define individuals, and later researchers, such as Fisher, Hunter and Macrosson (2002) may adopt these. Meredith Belbin's BTRSPI instrument is used in numerous studies with the same eight-part specification (Completer Finisher, Co-ordinator, Implementer, Monitor Evaluator, Plant, Resource Investigator, Shaper and Team Worker). On the other hand, Furham et al. (1993) has used a four-part taxonomy adapted from the Belbin test. The outputs from the NEO-PI/Big Five have been included to illustrate the type of language used, although these, in fact, are output factors (that are scored) rather than true taxonomies. Some interpretations are quite logical, and Bennet-Martinez (2000) appears to have created an imaginative taxonomy based on the Big Five test. More faithfully, Walsh (2005) uses the four MBTI/Jungian bi-polar scales to infer risk attitude behaviours not specifically measured by the test (i.e. "risk seeking", "risk-neutral" and "risk-averse", etc.).

Other disciplines use behavioural taxonomies, either as metaphors, as with Argyirs' (1973) "wild ducks", descriptors for a processes (Fisher, Hunter & Macrosson, 2002), "strategies" epitomized by the self-fulfilling Pygmalion approach in education and management (Rowe & O'Brien, 1994) and "influence" represented by Eliashberg & Shugan's film critics. On occasions, the border between a behavioural taxonomy and a role or function is quite blurred, especially where behaviour is adopted into the vernacular as a function, i.e. Murphy and Daly's (1994) "influencer" or "gatekeeper".

MBTI typologies mapped to other taxonomies

MBTI			
ISTJ	ISFJ	INFJ	INTJ
ISTP	ISFP	INFP	INTP
ESTP	ESFP	ENFP	ENTP
ESTJ	ESFJ	ENFJ	ENTJ

Source: McCaulley (1985)

Risk Attitude	
Risk-averse	Risk-neutral
Risk-neutral/averse	Risk-seeking
Risk-neutral/averse	Risk-seeking
Risk-averse	Risk-neutral

Source: Walsh (2005)

The Four Temperaments	
Thoughtful Realists	Thoughtful Innovators
Action-oriented Realists	Action-oriented Innovators

Source: Jessop (2002)

Decisive/Adaptable Types	
Decisive Introverts/Extroverts	
Adaptable Introverts/Extroverts	
Decisive Introverts/Extroverts	

Source: Jessop (2002)

Tough-minded Executive Types		
TMEs		TMEs
	Gentler types that seek harmony	
TMEs		TMEs

Source: Jessop (2002)

Rainmaker Index	
non-Rainmakers	RAINMAKERS

Source: Stevens & Burley (2003)

MTR-i			
Curator	Curator	Innovator	Innovator
Scientist	Crusader	Crusader	Scientist
Sculptor	Sculptor	Explorer	Explorer
Conductor	Coach	Coach	Conductor

Source: Myers (2002)

Source: Author - based on studies detailed

Table 3.13 – MBTI typologies mapped to other taxonomies

A whole raft of taxonomies have been created by educationalists, educational psychologists and psychologists. These range from learning

strategies (Pask & Scott, 1972) to child development investigated by Kagan (1965). Whilst there is some useful background, such as the contextual work by Witkin, et al. (1962) on field dependence and field independence, none of these taxonomies are particularly appropriate to use here.

As the most suitable psychometric instrument for this experiment has been identified as the MBTI, taxonomies that related to this were examined in more detail. The four MBTI or Jungian bi-polar scales are represented by sixteen specifications comprising sets of four initial letters (indicating the dominant preference) (see Table 3.13). However, to use all sixteen different types in this experiment would be unwieldy. Several other possible taxonomies for the MBTI were identified, namely "Risk-attitude" (Walsh, 2002), "The Four Temperaments", "Decisive/Adaptable Types", "Tough-minded Executives" (Jessop, 2002), the "Rainmaker Index" (Stevens and Burley, 2003) and "Explorers" (Myers, 2002).

The Four Temperaments merely combine and simplify the original MBTI typology specifications. Similar rationalization is achieved by combining other rows and blocks to show Decisive and Adaptable types and Tough-minded Executives. The Rainmaker Index is based on the percentage preference on the bi-polar scales towards iNtuitive and Thinking types. For illustration it is shown as occupying the whole of the "NT" column on the right-hand side of the MBTI table. A similar approach is applied by the Management Team Role Indicator (MTR-i) which uses a system of scoring (double ticks and crosses) to generate positive and negative associations between the MBTI and a new MTR-i taxonomy.

In a very similar experiment to the one described here, Crookes and Thomas (1998), using Weber's (1947) bureaucratic theory as a precedent, compare the problem solving behaviours of civil service managers in Hong Kong with private sector managers. Here they suggested that civil service managers were more likely to adopt "conformity and low risk approaches" than those in private enterprise. In fact, they were unable to support the proposition for either Chinese or expatriate managers. However, they did establish a statistical

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difference supporting their theory between Chinese and expatriate managers, both in the civil service and private enterprise.

Unfortunately, none of the established specifications appear uniquely suitable for this experiment. Most of the taxonomies do not relate to the type of decision-making process that is being examined here, i.e. they tend towards education, market position etc. Those that might be suitable are the ones that may be used to describe behaviours. The four categories used by Miles et al. (1986) appear on face value to have some synergy with this study, but are actually concerned with the behaviour of firms, and how they address their market. The Belbin specifications have some advantages (partly because they rely on existing instruments) but even these have to be distilled from eight separate categories to a more manageable number. It would be inappropriate to use the factors identified in the Big Five specification as a taxonomy even on a "majority rules" basis.

Another existing taxonomy is the Rainmaker Index. This categorization refers to the N/T scale of the MBTI such that high iNtuitive and Thinking scores contribute to a "Rainmaker Index" (RI). Research in other areas of business shows that people with this typology are most likely to generate commercially profitable ideas. As an illustration of the significance of this index, in their study of new business development (NBD) analysts, Stevens and Burley (2003) found that NBD analysts in the top third of the RI were up to 95 times more productive than the analysts in the lower third. They observed:

> "An equation for 'Profit per Analyst' is shown below, arising from the regression analysis of the MBTI instrument subscales. We found that the preferences for 'N' and 'T' correlated with profits almost equally, while the other two subscales were not statistically significant (EI and JP). The resulting equation indicates that each additional point on the "N" side of the SN continuous scale for an analyst is associated (on average) with an extra $95,170 profit and on the 'T' side of the continuous TF scale is associated with an additional $119,930 in profit."

There are two problems arising out of selecting two of the bi-polar typology scales to define the characteristics of decision-making executives. The

first is that the other scales may also be influential. For example, NTJ may define a battlefield strategist and NTP a scientist providing strategies for scientific gains (Gonsowski, 1999). At the other end of the scale, SF typologies include, for example, the SFJ elementary school teacher who nurtures the minds of her students and the SFP artist who nurtures the environment through art. The second problem is that on the MTBI® circumplex, NT maps to the Ennigram "achiever" and SF to the "nurturer". This nurturing of the environment in the wider sense could cause an anomaly due to selective perception issues highlighted by Lang, Calantone and Gudmunson (1997).

Given that the Rainmaker specification exists, and there is empirical evidence to support measurable behavioural differences in certain circumstances, this would appear to be the obvious choice to translate the MBTI scales. However, to adopt such a classification would give the impression that Rainmakers make positive contributions in business and non-Rainmakers do not. This is not the intention of this study, nor the Jungian or MBTI personality measures. It can be seen from Table 3.13 (page 120) that other combinations of the bi-polar preferences may make equally useful contributions in different circumstances (i.e. decision-making in transport may require different risk and personal inventory attributes than, for example, NBD managers).

Although already discarded as an investigative approach for this study (see Section 3.2, page 54) there has been a substantial amount of work on group dynamics and decision-making (Lessem & Baruch, 2000). This includes Meredith Belbin's Completer Finisher, Co-ordinator, Implementer, Monitor Evaluator, Plant, Resource Investigator, Shaper and Team Worker and Steven Myers' Management Team Role Indicator (MTR-i).

The MTR-i taxonomy differentiates different types of person within an organisation or team and labels them (according to perceived strengths or contribution to the team) as Explorer, Innovator, Conductor, Scientist, Coach, Sculptor, Curator and Crusader. Unfortunately, this taxonomy only reduces the original sixteen MBTI typologies by half. More importantly, although the representation in Table 3.14 appears to be a direct translation of the MBTI scales

(derived by the Author by translating the MBT-i ticks and crosses into numerical scores), the actual association is more complex.

MTR-i (Management Team Role Indicator) evaluation

Type	Explorer				Conformer			Other
MTR-i Classifications	Explorer	Innovator	Conductor	Scientist	Coach	Sculptor	Curator	Crusader
ENTJ	0	1	2	0	-1	-1	-2	-2
ENTP	2	0	0	1	-1	-1	-2	-2
INTJ	0	2	1	0	-2	-2	-1	-1
INTP	1	0	0	2	-2	-2	-1	0
Category I	3	3	3	3	-6	-6	-6	-6
ESTJ	-1	-2	2	0	-1	0	1	-2
ESTP	-1	-2	0	1	-1	2	0	-2
ISTJ	-2	-1	1	0	-2	0	2	-1
ISTP	-2	-1	0	2	-2	1	0	0
Category II	-6	-6	3	3	-6	3	3	-6
ENFJ	0	1	-1	-2	2	-1	-2	0
ENFP	2	0	-1	-2	0	-1	-2	1
INFJ	0	2	-2	-1	1	-2	-1	0
INFP	1	0	-2	-1	0	-2	-1	-2
Category III	3	3	-6	-6	3	-6	-6	-1
ESFJ	-1	-2	-1	-2	2	0	1	0
ESFP	-1	-2	-1	-2	0	2	0	1
ISFJ	-2	-1	-2	-1	1	0	2	0
ISFP	-2	-1	-2	-1	0	1	0	-2
Category IV	-6	-6	-6	-6	3	3	3	-1
Category I	3	3	3	3	-6	-6	-6	-6
Category II	-6	-6	3	3	-6	3	3	-6
Category III	3	3	-6	-6	3	-6	-6	-1
Category IV	-6	-6	-6	-6	3	3	3	-1

Source: Author - adapted from Myers, 2002

Table 3.14 – MTR-i evaluation

With the various literature on psychometric analysis and taxonomies as background, a new specific taxonomy is proposed for the decision-makers being investigated in this study.

There are three main issues that need to be addressed in developing a new taxonomy:

– How many categories are required?

– Should the specification be notional (Category A, Category B etc.) or should it be metaphoric (capturing the essence of the classification it represents)?

– How can the taxonomy be related to the underlying personality measurement?

In deciding on the number of categories to create for specifying the taxonomy, there is a choice in the range between sixteen and two (Garner, 2005).

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Sixteen is the maximum number as this is the level at which the MBTI typologies are observed. Two is the minimum necessary to investigate whether the decision variables are endogenous with personality type. Thus, the available options are:

- 16 (MBTI typologies);
- 8 (Individual preferences);
- 8 (MTRi categories);
- 4 (Bi-polar scales);
- 2 (Rainmakers and non-Rainmakers).

Given the anticipated small sample size, 16 categories would give insufficient frequencies to provide statistically significant results. This would also apply to both the individual preference scales (8) and the MTR-i (8) categories. In addition, in the case of the former, these relate to preferences rather than specific individual behaviours. There is also a difficulty with the MTR-i as this cannot be absolutely specified by the MBTI. The four bi-polar scales are also measures of preference rather than individual behaviour. The Rainmaker Index is an existing taxonomy but has the disadvantage of appearing to undervalue the decision-making attributes of the non-Rainmakers.

Categorical Taxonomy

Cat 4	Cat 3	Cat 2	Cat 1
Non-Rainmaker			RM
		TMEs	TMEs
Gentler types that seek harmony			
		TMEs	TMEs

Source: Author

Table 3.15 – Categorical taxonomy

However, using an interpretation of the MRT-i as a basic framework, it can be seen that taxonomy specified by Myers (2002) can be reduced to four categories, namely Category I (NT), Category II (ST), Category III (NF) and Category IV (SF). Category I, corresponds to Myer's "Explorers", "Innovators", "Conductors" and "Scientists", whereas Category IV approximates to his

"Coaches", "Sculptors" and "Curators". Categories II and III are not as well aligned. If these types are adopted, NTs are specified to "Rainmakers" (Stevens and Burley, 2003) and NTs and STs relate to "Tough Minded Executives" (Jessop, 2002). At the other end of the continuum, SF types correspond to Crookes and Thomas' (1992) "conforming" bureaucrats. This gives a logical split into a taxonomy comprising three distinct groups namely, Categories I and II (NT and ST types), Category III (NF types) and Category IV (SF) types (see Table 3.15).

Of the eighteen different taxonomies considered in Table 3.12 (page 118), only one was notional (categorical), all the rest adopted some form of explicit (White and Yanamandram's "Happily Inert") (e.g. White & Yanamandram, 2004) or, in some cases, obscure metaphor (e.g. Rowe and O'Brien's Galatea) (Rowe and O'Brien, 1994). Thus, it is reasonable to assist understanding to create a metaphoric taxonomy that is <u>representative (not descriptive)</u> of the typologies it describes.

A similar study to the one here, where Henderson and Nutt (1980) related the decision-making styles of hospital managers to the Myers Briggs Typology Index (MTBI), relied on the style descriptions of Mason and Mitroff (1973) and Mitroff and Kilman (1975). These descriptions are combined here to provide a new specification (see Table 3.16).

New taxonomy for decision-making styles

Adapted from analysis of MTR-I (Myers, 2002)	Category I	Category II	Category III	Category IV
Jungian types	NT Type	ST Type	NF Type	SF Type
Decision-making styles based on Henderson & Nutt (1980), Mitroff & Kilman (1975) and Mason & Mitroff (1973).	Prefers decision-making by defining and solving problems based on relaxing contextual factors	Prefers decision-making based on objective assessment of hard, logical data.	Prefers contextual decision-making, consideration of the human element to achieve growth and profit.	Prefers participative, consensual decision-making and clear cut work roles and work rules.
New taxonomy	Explorer		Improver	Conformer

Source: Author based on references noted

Table 3.16 – New taxonomy for decision-making styles

Here, it has been decided to combine Categories I and II and so a new taxonomy is proposed. This new taxonomy takes account of the decision-making

styles formulated by earlier works, including the taxonomy already proposed by combining Myers' (2002), "Explorers" and Webber's (1947) "Conformers" with the work of Crookes and Thomas (1998). The third category of "Improver" is taken from the decision-making style (combining maximizing and satisficing techniques) that is described in the next section. The taxonomy used for the three types of decision-maker investigated in this study is:

- **Explorers – Categories I and II:** - comprising a mix of sensing and intuitive, thinking types (Explorers, Innovators, Conductors and Scientists), preferring decision-making based on hard logical data, defining and solving problems and relaxing contextual factors.

- **Conformers – Category IV:** - exemplified by a more conforming, careful approach (Coaches, Sculptors and Curators), preferring participative, consensual decision making and clear-cut work roles and work rules.

- **Improvers – Category III:** - occupying the middle ground, with a mix of styles including objective assessment of hard data and taking account of the human elements to generate growth and profit.

3.6.4 Decision-making model

The purpose of this section is not to provide an academic evaluation of the various types of transportation models, but to discuss the main features of the different approaches and how they may be suitable (or not) for examining the decision-making process being investigated in this study. Figure 3.13 illustrates how the subjects discussed in this section are developed. The progression runs from "A" to "G" and the topics are discussed in this order. The diagrams ("E1" to "E10)" of the various models are representative and are not meant to be followed in detail in this developmental illustration. They are reproduced in their simple, but larger form, as they are discussed below. The remainder of this section is laid out as follows (adhering to the notation on the diagram):

a). The principles and use of the choice theoretic approach;

b). The principles and use of the behavioural approach;

c). How the various cognitive styles might relate to or prefer the choice theoretic or behavioural approach

Consideration of various approaches (models) for transportation choice
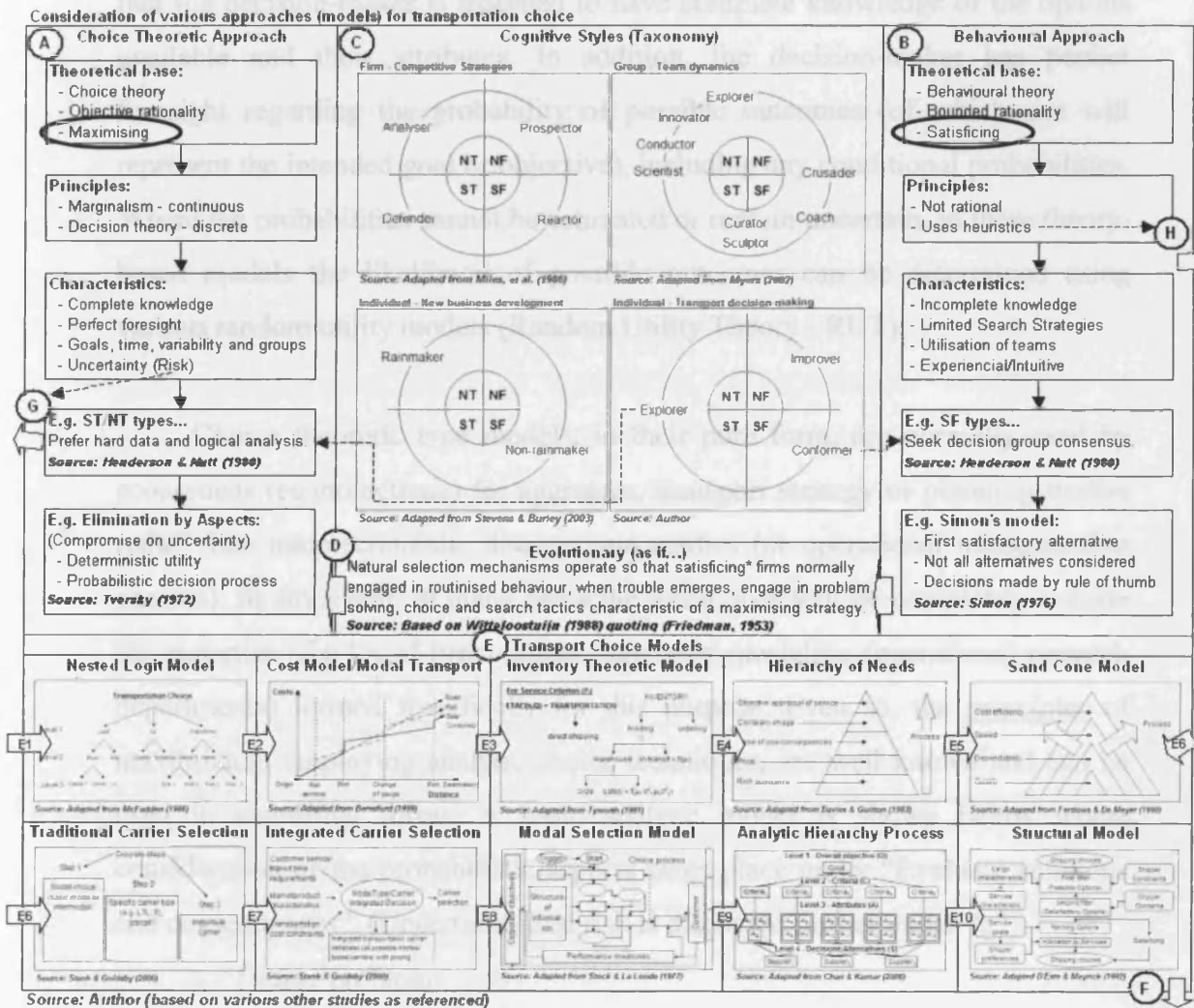
Figure 3.13 – Consideration of various approaches (models) for transportation choice

a).   **Principles and use of a choice theoretic approach**

The choice theoretic approach is essentially that adopted by economists based on the principle that "economic man" makes objective, rational decisions in order to maximize his utility ("*maximizing*"). There are two forms of this maximizing behaviour, namely "marginalism" and "discrete choice". In the case

of the former, benefits and costs of certain behaviours are equated at the margin and require a continuous set of action variables. Decision theory (discrete choice), on the other hand, is based on the principle that the decision-maker will make the best choice from a finite number of possible options.

There are several basic principles of the maximizing approach. The first is that the decision-maker is assumed to have complete knowledge of the options available and their attributes. In addition, the decision-maker has perfect foresight regarding the probability of possible outcomes (of which one will represent the intended goal or objective), including any conditional probabilities. Where the probabilities cannot be estimated or remain uncertain, in these theory-based models the likelihood of possible outcomes can be determined using various random utility models (Random Utility Theory - RUT).

Choice theoretic type models, in their pure form, are normally used by economists (econometrists) for aggregate, transport strategy or planning studies rather than microeconomic, disaggregate studies (or operational transportation choices). In any event, in many cases the techniques will be completely outside the expertise of a lot of firms unless they have specialists (operational research departments) formed specifically for this purpose. Even so, the principles of maximizing, employing analytic choice techniques, are well known and can be used in simplified forms. A basic analytic model is shown below where consideration of the probabilistic aspects takes place under "Evaluate solutions and consequences". (Uncertainty and risk is discussed further under "g"):

- Define problem;
- Gather relevant information;
- Consider priorities;
- Consider options;
- List solutions;
- Evaluate solutions and consequences;
- Implement decision;
- Re-evaluate.

However, the maximizing type decision-making strategy has limitations in real life. In practice, where certain outcomes are unacceptable or, more accurately, the probability of such outcomes occurring is unacceptable (or uncertain); the possible solutions that include those outcomes are excluded. This type of decision-making strategy, exposed by Tversky (1972), is called Elimination by Aspects (EBA). It should be noted that EBA is quite different from Simon's (1976) satisficing strategy (discussed in the next section).

b). The principles and use of the behavioural approach

The concept, that there are genuine and practical constraints on real-world decision-makers is the basis of the behavioural approach. Here it is acknowledged that the decision-maker will behave rationally within certain practical boundaries, such as availability of information, knowledge of alternatives, time and financial constraints. This concept is known as bounded rationality. The most important strategy that differentiates bounded rationality decision-making from the maximizing approach is "satisficing". Satisficing, first specified by Simon (1976), is the acceptance of the first suitable alternative. Simon's observation on the limits of human decision-making is:

> "These limits are imposed by the complexity of the world in which we live, the incompleteness and inadequacy of human knowledge, the inconsistencies of individual preference and belief, the conflicts of value among people and groups of people, and the inadequacy of the computations we can carry out, even with the aid of the most powerful computers."

Obviously a satisficing decision-making strategy shortens the decision-making process considerably. Bounded rationality may also be associated with a number of other characteristics that circumscribe the process, such as limited information searches, reliance on past experience, the use of teams to enhance the experiential knowledge base, and various heuristics (discussed in more detail in section 3.3.2, page 73).

c). Cognitive styles

The role of particular typologies in terms of how they address the decision-making process is a key aspect of this research. There is a great deal of literature linking various typologies and their associated cognitive styles with the way that they develop (child development) or approach learning, management, operational situations and even personal relationships. The taxonomies that have been used to describe these behaviours or types have been dealt with under "Taxonomies" above (see 3.6.3, page 117). Here, four are considered as part of the discussion on the decision-making process because they demonstrate a relationship between the Myers Briggs Typology Indicator and preferences towards either maximizing or bounded rationality strategies.
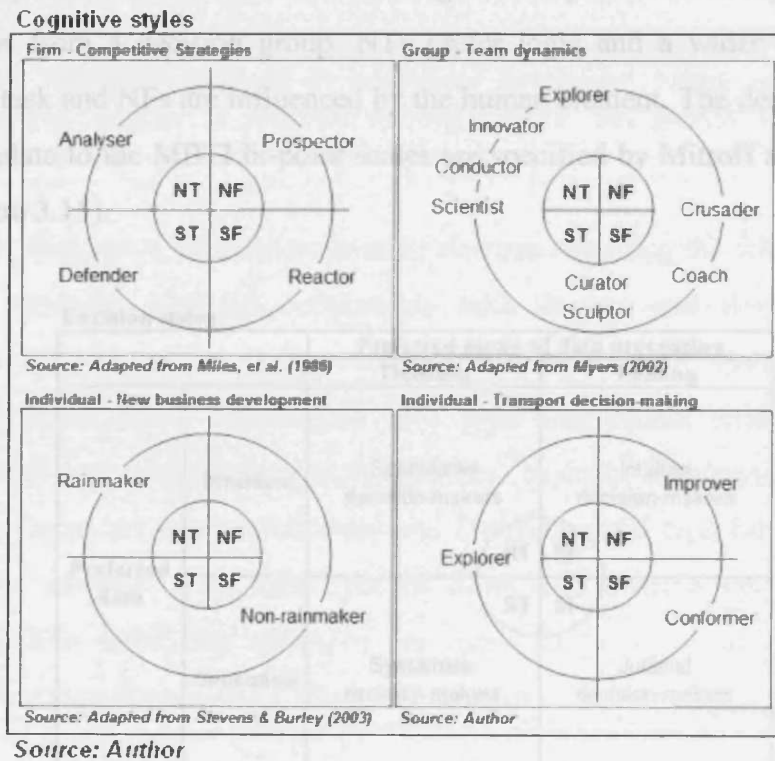
Figure 3.14 – Cognitive styles

Figure 3.14 shows four taxonomies of cognitive style that relate to the Sensing/iNtuition and Thinking/Feeling scales of the MBTI. The first, adapted from Miles et al. (1978), is based on how firms behave in the market place. The four strategies are termed "Analysers", "Prospectors", "Defenders" and "Reactors". These correspond precisely to the NT, NF, ST and SF preferences

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respectively on the MBTI scales. A direct relationship can also be seen between "Rainmakers" and NT types (Stevens & Burley, 2003). With the Myers (2002) team dynamics (MTR-i) the relationship between the taxonomies specified and the four MBTI types are not as clear. In this study, the terms "Explorer", "Improver" and "Conformer" are used. These correspond to NT combined with ST types, NF types, and SF types respectively.

Henderson and Nutt (1980), in their paper on "The influence of decision style on decision-making behaviour", review the work of a number of previous researchers (Doctor & Hamilton, 1973; Drive & Mock, 1975; Edwards, 1968; Hellriegel & Slocum, 1975; McKenney & Keen, 1974; Mitroff & Kilmann, 1975 and Nutt, 1979). Based on Mitroff and Kilman (1975) and Nutt (1979), he notes the ST's preference for hard data and logical analysis. Conversely, SF's seek consensus from a decision group. NTs prefer logic and a wider view of the decision task and NFs are influenced by the human element. The decision styles, as they relate to the MBTI bi-polar scales are specified by Mitroff and Kilmann (see Figure 3.15).

Decision styles

| | | Preferred mode of data processing | |
		Thinking	Feeling
Preferred data	iNtuition	Speculative decision-makers	Intuitive decision-makers
		NT	NF
		ST	SF
	Sensation	Systematic decision-makers	Judicial decision-makers

Source: Adapted from Mitroff & Kilman (1979b)

Figure 3.15 – Decision styles

From the earlier work on cognition and decision styles it can be seen that thinking types (NT and ST) are more likely to incline towards the hard data, analytic choice theoretic approach, and the feeling types towards the bounded rationality format.

d). Evolution;

Witteloostuijn (1988) compares the maximizing and satisficing approaches to decision-making and concludes that there is little contradiction between them. However, he goes on to note that the right question to ask is "*what* (individual or group) decision-makers maximize or satisfice?" Although he does not answer this question specifically, he concludes that firms or individuals that behave "*as if*" they apply the maximizing rule are more likely to survive economically and, thus, dominate in reality. To underline this point, he quotes Fieldmann (1953) (paraphrased):

> *"Natural selection mechanisms operate so that satisficing firms normally engaged in routinised behaviour, when trouble emerges, engage in problem solving, choice and search tactics characteristic of a maximising strategy."*

The findings of Witteloostuijn and Friedman regarding the effectiveness of the two strategies also sits comfortably with Stevens and Burley's (2003) "Rainmaker" and Miles' (1986) "Analyser", "Defender", "Prospector" and "Reactor" type firms. Rainmakers (NT type individuals tending towards maximising) are considered as successful new business developers. Analysers (NT type firms) are market followers and Defenders (ST type firms) maintain their niche markets. Both these type of firms tend towards the maximizing approach. The satisficing strategies are more likely to be adopted by NF "Prospector" type firms and SF "Reactor" type firms.

e). Transport choice models

There are a variety of types of decision-making model available from different disciplines in the choice sciences. These range from the classic choice theoretic models (Witteloostuijn, 1988) to Masuch, & LaPotin's (1989) "structured" Garbage Can approach. Here we examine just a few to illustrate

how the model used in this study was selected. Ten separate models are briefly presented. They are:

- Nested Logit Model (McFadden, 1986) – Fig. 3.16 (E1);
- Cost Model for Modal Transport (Beresford, 1999) – Fig. 3.17 (E2);
- Inventory Theoretic Model (Tyworth, 1991) – Fig. 3.18 (E3);
- Hierarchy of needs (Davies & Gunton, 1983) - Fig. 3.19 (E4);
- Sand Cone (Ferdows & De Meyer, 1990) - Fig. 3.20 (E5);
- Traditional Carrier Selection (Stank & Goldsby, 2000) - Fig. 3.21 (E6);
- Integrated Carrier Selection (Stank & Goldsby, 2000) - Fig. 3.22 (E7);
- Modal Selection Model (Stock & La Londe, 1977) - Fig. 3.23 (E8);
- Analytic Hierarchy Process (Chan & Kumar, 2006) - Fig. 3.24 (E9);
- Structural Model (D'Este & Meyrick) - Fig. 3.25 (E10).
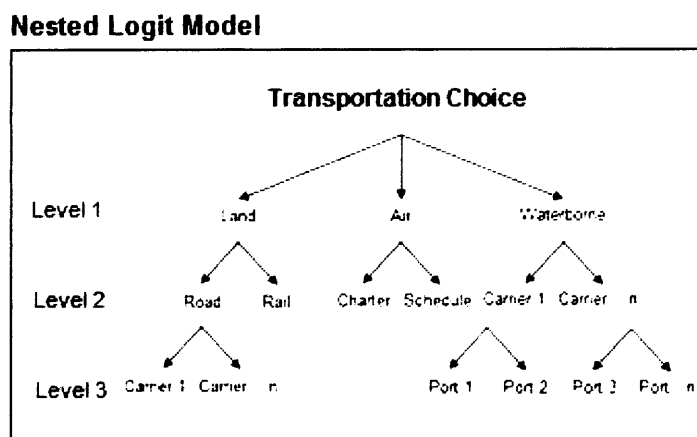
Nested Logit Model

Source: Adapted from McFadden (1986)

Figure 3.16 – Nested logit model (E1)

The Nested Logit model (see Figure 3.16) is part of a family of discrete choice model that use a utility-maximising approach. The other main models of this type include Multinomial Logit and Probit models. The Nested Logit Model has been introduced at this stage partly because it ties in with the higher level econometric type models and also because the format (as well as illustrating the "nested" concept), demonstrates how modal choice implies both route and carrier choice (or, conversely, carrier and route choice). Although the nested logit model is cast within the realms of random utility theory, the basic format that shows the mapping of the available choices can be used in much simpler forms of analysis. However, it is not likely to be used as an evaluation technique for most freight

buyers and so, although the concept is useful as background, the model itself is unsuitable for exploring the decision-process.

The graphs shown in Figure 3.17 are based on the early work of Beresford and Dubey (1990). This model was first formally published in Beresford (1990). The interpretation of their work on the competitiveness of trade corridors is adapted by the Author, and based loosely on the transport corridors between the UK and Russia. It can be seen that the gradient of the curve for each mode of transport is different reflecting the fact that sea, for example, has a lower unit transportation cost than road. At ports or other interchange points (e.g. rail gauge change at Brest) the curve rises vertically indicating that cost is incurred but no physical distance is covered. It can be seen from this illustration that for both rail and sea transport there may be elements of road transport involved at the origin and destination. Although sea appears to be the cheaper option, if inventory costs (cargo and equipment) are included, this could change the outcome of the cost structure completely.

Cost Model for Modal Transport

Source: Adapted from Beresford (1999)
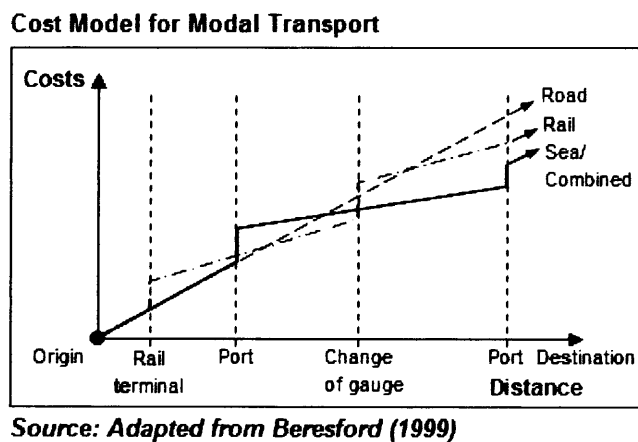
Figure 3.17 – Cost model for modal transport (E2)

This cost model provides useful background for the study. However, even were it properly calculated it would not assist with examining the transport choice process. Clearly, transport costs are not the sole differentiator in this trade otherwise it is likely that all cargo would be using one mode, probably sea.

The cost of transportation itself is not the only cost that should be taken into account when evaluating transport services, especially across different modes. It can be seen from Figure 3.18 that the inventory theoretic model attempts to capture all the costs in the supply chain including both inventory and transport costs. Inventory costs comprise costs that arise from the time-based costs of both stock (cargo) and equipment. This does not simply relate to time in transit, but also to order processing, cycle times, warehousing and stock holding (as well as any safety stocks). Equipment inventory has comparable constructs but cycle time (including any empty imbalance moves) is the most significant of these.

Inventory theoretic model
Trade-off between transport costs and inventory costs

Source: Adapted from Ballou (1999) and Tyworth (1991)
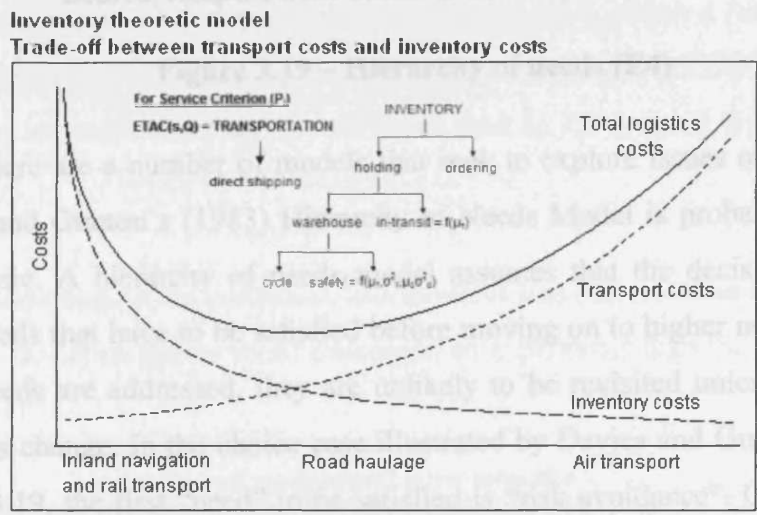
Figure 3.18 – Inventory theoretic model (E3)

In the illustration shown at Figure 3.18, the graphs represent the respective costs (transport and inventory) of three modes of transport. On the left hand side are representative costs for inland navigation and rail transport. Here the transport costs are low but, because of the relatively long time the goods are in transit, the inventory costs are high. On the right-hand-side of the illustration, the costs of airfreight are high but, because of the shorter time in transit, the inventory costs are low. In this example, at least, road appears to offer the most economic overall cost (note that sea is not included in the example).

Although the inventory theoretic model is a useful refinement of the cost based models, it still lacks the scope (non-cost attributes) necessary for this

investigation. This applies to all the cost models including the more theoretic Generalised Cost.

Hierarchy of needs

Source: Adapted from Davies & Gunton (1983)
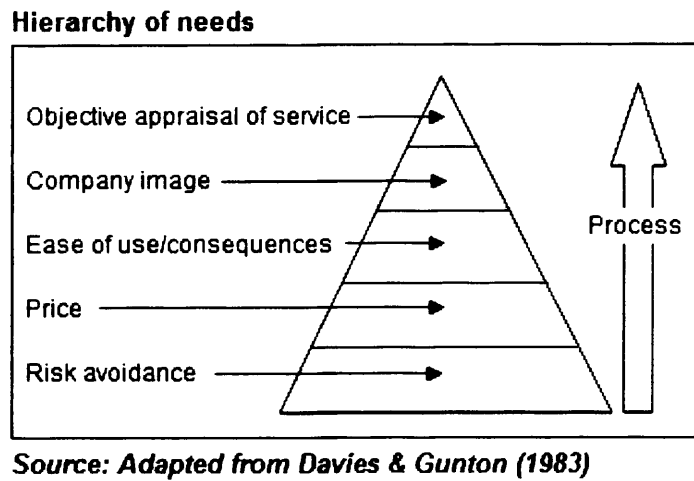
Figure 3.19 – Hierarchy of needs (E4)

There are a number of models that seek to explore issues other than cost. Davies and Gunton's (1983) Hierarchy of Needs Model is probably one of the most basic. A hierarchy of needs model assumes that the decision-maker has basic needs that have to be satisfied before moving on to higher needs. Once the basic needs are addressed, they are unlikely to be revisited unless the external variables change. In the choice case illustrated by Davies and Gunton (1983) in Figure 3.19, the first "need" to be satisfied is "risk avoidance". Only when this has been dealt with, will the focus change to "price", and so on. This is an important concept in this study because it will be argued later that some typologies may streamline the process by not revisiting certain stages in the hierarchy (e.g. "risk") through several decision-making evolutions. Other typologies may even reorder the hierarchy to satisfy some other basic criterion.

Sand Cone Model

Source: Adapted from Ferdows & De Meyer (1990)
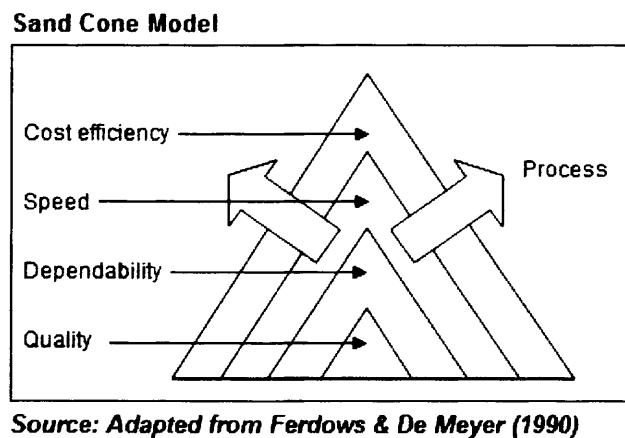
Figure 3.20 – Sand cone model (E5)

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Even so, the model whilst defining the hierarchy, omits any goals or criteria against which the characteristics and attributes of a service may be measured.

The Sand Cone Model is a more recent refinement of the Hierarchy of Needs Model whereby the core issues, in this case "quality" (see Figure 3.20), are dealt with first, and then the smaller "grains of sand" are addressed on the outside. In this illustration there are four layers but Vokurka, Zank & Lund (2002) quote Vokurka and Fliedner (1998) who have added a further layer for "supply chain agility". It can be seen that even though the principles are similar, the layers of sand are in quite a different rank to Davies and Gunton's (1983) hierarchy.

If anything, in the particular, this model is less suitable than he hierarchy of needs as the layers appear more concerned with attributes than the process itself.

Traditional mode/class/carrier selection
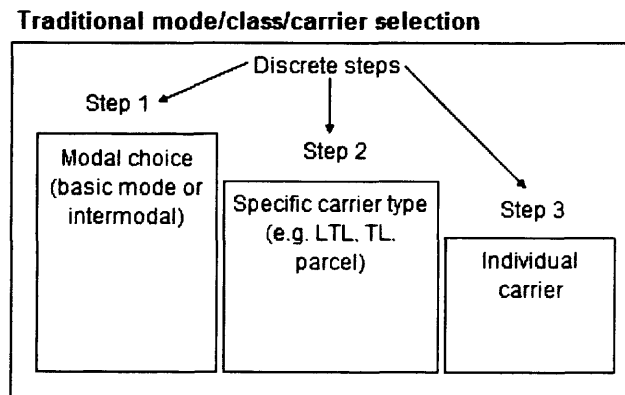
Source: Stank & Goldsby (2000)

Figure 3.21 – Traditional mode/class/carrier selection (E6)

Figure 3.21 shows the first model that actually defines a decision process suitable for this experiment. Stank and Goldsby (2000) effectively translate the decision tree shown in the nested logit model and turn it into a process. It lacks certain aspects, such as the criteria against which the choices are made, and

information on which a choice may be based, but it does have a logical progression from modal choice to carrier selection.

Stank and Golby (2000) develop from their representation of a traditional model to an integrated model (see Figure 3.22). Although the mode, carrier type and individual carrier decision-making progression has been lost in detail, three important sets of criteria against which the available options can be measured have been added ("service requirements", "cargo characteristics" and "transport characteristics"). In addition, there is a reference to an information source, although the scope and depth of information contained in the "database" seems a little improbable (because of the maintenance costs of refreshing data on modes, types and carriers that are not currently used).

Integrated mode/class/carrier selection
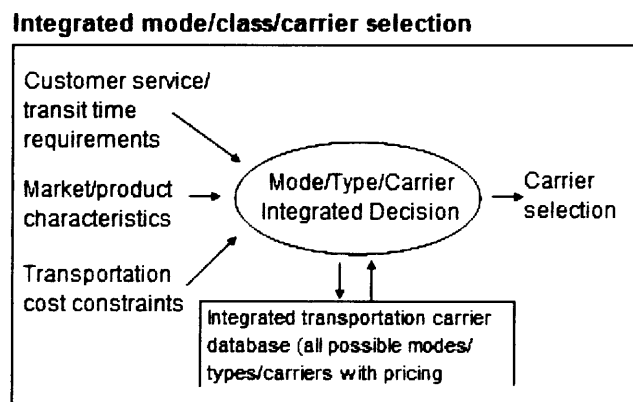
Source: Stank & Goldsby (2000)

Figure 3.22 – Integrated mode/class/carrier selection (E7)

Even so, the Stank and Goldsby (2000) integrated model is a good starting point for considering the decision process in this experiment but it still lacks both structure and specific details.

The only explicit model that has been identified that incorporates all the elements of the decision-making process (thought to exist in theory, if not in practice, in the real world) is that of Stock and La Londe (1977) in their article on "The Transportation Mode Decision Revisited". The model (see Figure 3.23) embraces consideration of the decision environment, including "Overall corporate objectives", the structure of the information sources, external stimulus

(triggers) that start the process, performance measures, feedback loops and a detailed representation of the decision-making process itself. Moreover, on the right hand side of the model the different stages of the process are shown. It is impressive, not just because of the scope and structure, but because the process itself is flowcharted to show how choice is actually made.
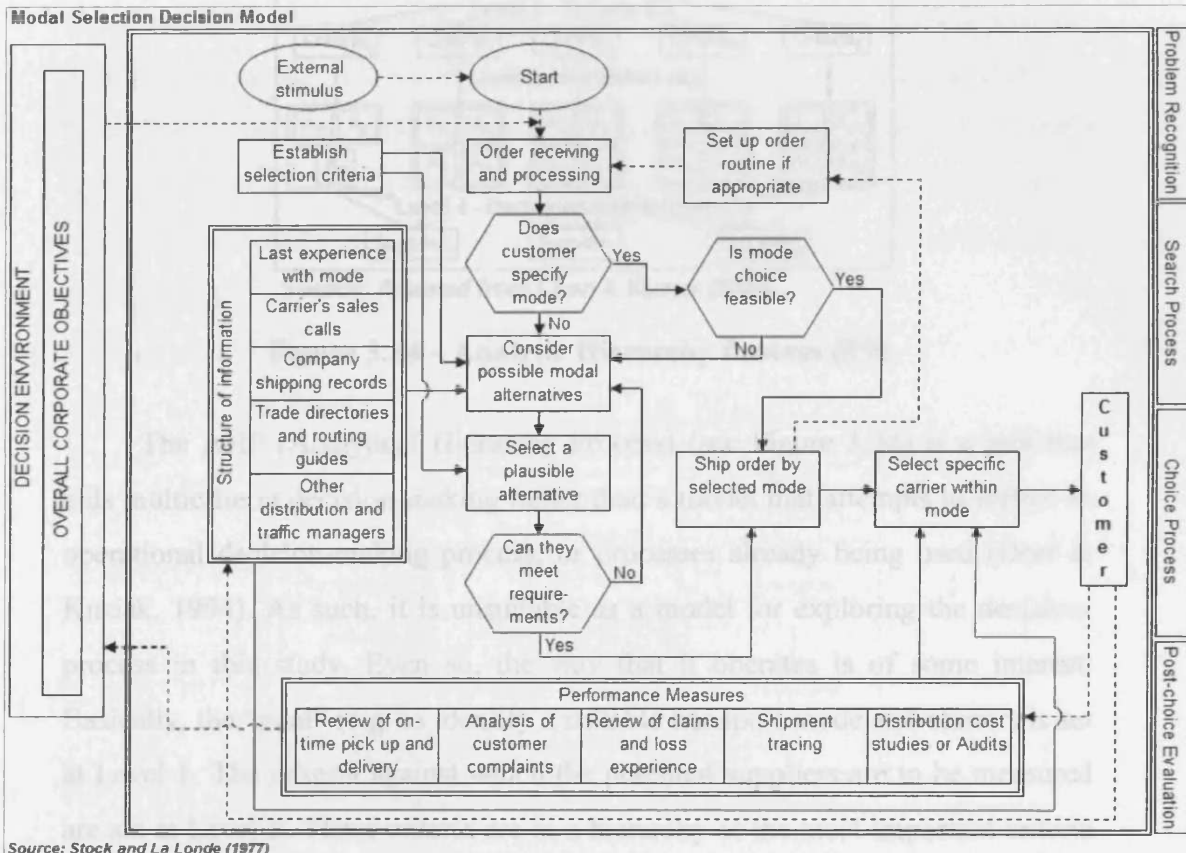
Figure 3.23 – Modal selection decision model (E8)

It is a maximizing model (see "a", Section 3.6.4, page 128), insofar as it "Defines the problem" (Establishes the selection criteria), it "Gathers relevant information" (Structure of information), "Considers priorities" (Does customer specify mode?), "Considers options" (Considers possible modal alternatives), "Lists solutions" (Select plausible alternatives), "Evaluates solutions and consequences" (Can they meet requirements?), "Implements the decision" (Ship order by selected mode) and "Re-evaluates" (Performance measures).

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If anything, the Stock and La Londe model is slightly too complicated (including decision environment and feedback loops) to try and prove in an empirical experiment such as that proposed here.

Source: Adapted from Chan & Kumar (2006)
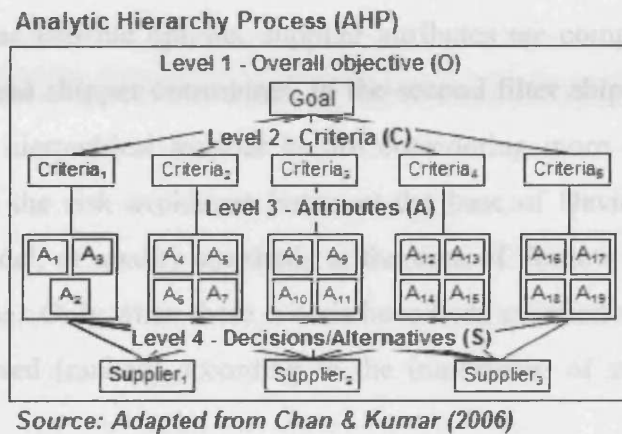
Figure 3.24 – Analytic Hierarchy Process (E9)

The AHP (Analytical Hierarchy Process) (see Figure 3.24) is a tool that aids multicriteria decision-making rather than a model that attempts to reflect an operational decision-making process, or processes already being used (Dorf & Kusiak, 1994). As such, it is unsuitable as a model for exploring the decision-process in this study. Even so, the way that it operates is of some interest. Basically, the "goal" (e.g. to identify a suitable transport mode and carrier) is set at Level 1. The criteria against which the potential suppliers are to be measured are set at Level 2. These criteria are in a hierarchy of the most important criteria first, and so on. The criteria can also be weighted, but this weighting is carefully controlled to ensure objectivity and consistency. In Level 3 the attributes of each potential supplier are then examined against the criteria in pair-wise groups.

The method is of interest in terms of contributing to the consideration of a suitable model, and also because the choice methodology being used is not dissimilar to the Stated Preference techniques contemplated under instrument design (see 3.6.5, page 144 - below).

The structural model proposed by D'Este and Meyrick (1992) operates in a similar manner to the AHP model insofar as it works through a hierarchy of criteria and then ranks the options according to specific attributes (see Figure

3.25). In the first filter the feasible options are identified by considering the various modes, routes and carriers. This is similar to the logic, if not the mechanics, of McFadden's 1986 Nested Logit approach. It also follows the basic steps of Stank and Goldsby's (2000) traditional mode/choice/carrier model. In considering these feasible options, supplier attributes are compared with cargo characteristics and shipper constraints. In the second filter shipper concerns are addressed in a hierarchical manner before considering more detailed criteria. This equates to the risk avoidance issues at the base of Davies and Gunton's hierarchical model, or quality standards at the core of Ferdow and De Meyer's (1990) sand cone. Only when these criteria have been satisfied are the remaining options considered (ranked) according to the importance of attributes such as cost.
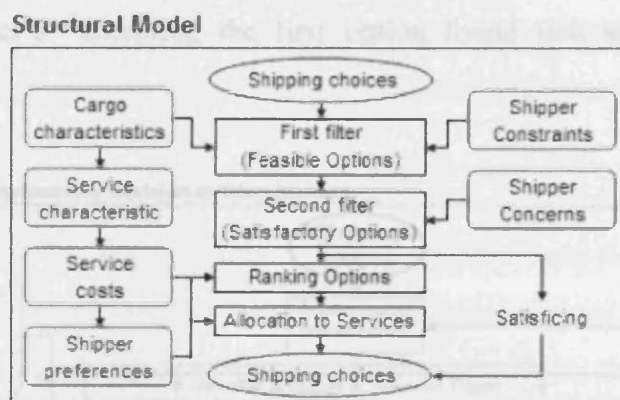
Structural Model

Source: Adapted from D'Este & Meyrick (1992)

Figure 3.25 – Structural model (E10)

This is the part of the structural model that distinguishes the D'Este and Meyrick (1992) approach from other possible models. At this point the model branches on the one side (left) into a *maximizing* strategy, and on the other (right) a *satisficing* approach. This is the area that should most clearly differentiate the cognitive types. The types that favour maximizing strategies will lean towards methodical information methods such as Stank and Goldsby's (2000) "transportation carrier database", together with detailed analysis techniques, such as of Beresford's (1999) cost model, or even an inventory theoretic approach (Ballou, 1999; Tyworth 1991). Those preferring a satisficing

strategy may, for example, apply the principles of Simon's (1976) approach to Stank and Goldsby's (2000) mode/class/carrier selection model.

The D'Este and Meyrick (1992) model (see Figure 3.26) has been modified here to take account of the theoretic approach, the buying, information gathering strategies and decision-making styles of three types of decision-maker. The strategies are assumed to be a continuum where, at one end of the scale, Explorers tend towards maximizing strategies and, at the other end of the scale, Conformers tend towards satisficing strategies. This accords with the observations made by Henderson and Nutt (1980) regarding the cognitive preferences of the four Myers Briggs' types. From this, the rest of the argument follows. Conformers are likely to adopt a rebuy strategy as, given that the existing supplier exceeds the basic requirements, buy/rebuy is the prime example of the satisficer's "accepting the first option found that satisfies the basic criteria."

Structural model emphasising decision-making process
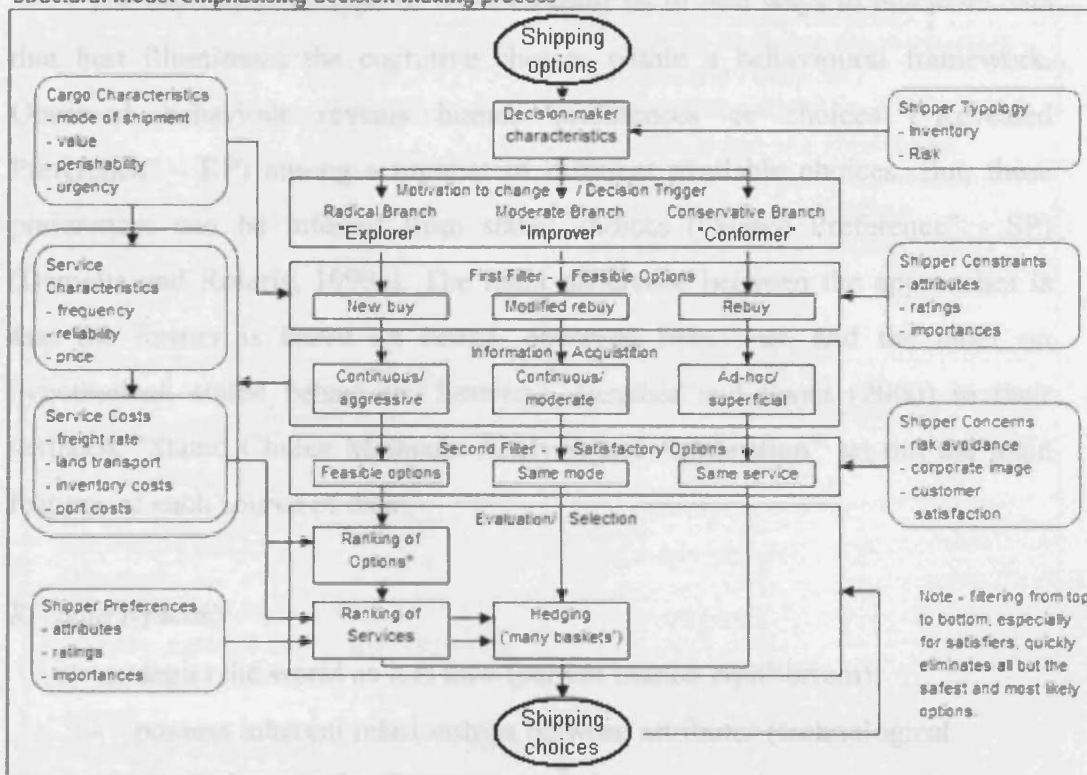
Source: Modified from D'Este and Meyrick (1992)

Figure 3.26 – Structural model emphasizing the decision-making process (F)

Explorers, on the other hand, applying a maximizing strategy, relying on and analyzing hard data, are far more likely to identify a "new buy" opportunity. The information gathering strategies follow on logically from this. Explorers not only prefer hard data but it is necessary for exploring a wider number of possibilities. Conformers, on the other hand, require much less information to confirm their rebuy preference. The final ranking of options, and the ultimate decision, follows on naturally from the previous filters and is absolutely in line with D'Este and Meyrick's (1992) original specification of a maximizing and satificing strategy at this point.

3.6.5   Stated Preference

Although various methods of observation (data collection) have been employed in this experiment, some background is provided regarding Stated Preference because it is the method used to elicit the actual modal choice.

The object of this type of research must be to find ways to elucidate data that best illuminates the cognitive choices within a behavioural framework. Observed behaviour reveals human preferences or choices ("Revealed Preference" - RP) among a number of different available choices. But, these preferences can be inferred from stated choices ("Stated Preference" - SP) (Danielis and Rotaris, 1999a). The main difference between the approaches is that the former is based on actual, observed behaviour, and the latter on hypothetical, stated behaviour. Louviere, Hensher and Swait (2000) in their textbook "Stated Choice Methods: Analysis and Application" set out the main features of each source of data:

RP data typically:

- depict the world as it is now (current market equilibrium);
- possess inherent relationships between attributes (technological constraints are fixed);
- have only existing alternatives as observables;
- embody market and personal constraints on the decision-maker,
- have high reliability and face validity;

− yield one observation per respondent at each observation point.

SP data typically:

− describe hypothetical or virtual decision contexts (flexibility);

− control relationships between attributes, which permits mapping of utility functions with technologies different from existing ones;

− can include existing and/or proposed and/or generic (i.e. unbranded or unlabelled) choice alternatives;

− cannot easily (in some cases, cannot at all) represent changes in market and personal constraints effectively;

− seem to be reliable when respondents understand, are committed to and can respond to tasks;

− (usually) yield multiple observations per respondent at each observation point.

Revealed Preference Vs. Stated Preference

Revealed Preference Method	
Advantages	**Disadvantages**
- Actually made, observed, "real" choices	- Only some attributes are measurable - Needs many costly data - Data hard to collect (e.g. prices are confidential and of a commercial nature): scarce availability of data - Correlation among attributes - Insufficient variability to allow robust estimate - Measurement errors - Unspecified choice set
Stated Preference Method	
Advantages	**Disadvantages**
- Hypothetical "stated" choice in controlled experiments - Ability to analyse reaction to future, non-existent options - Low cost - Precisely specified choice set - Multiple answers from each respondent - Multiple choice formats (choice, ranking/ rating) - Capability of analysing trade-offs among qualitative attributes	- Hypothetical bias

Source: Adapted from Danielis and Rotaris, 1999

Table 3.17 − Revealed Preference vs. Stated Preference

The advantages and disadvantages of the two approaches (see Table 3.17), as a basis for analysis and policy decision-making has been discussed widely in the literature (Kopp and Smith, 1993 and Louviere, 1996), not just in the context of transportation but across other areas of investigation such as market research and environmental evaluation. The interest in hypothetical stated preferences in market research is readily justifiable, especially in situations where products have not been launched or are not well known by consumers in the market. In environmental impact studies, such as in the case of the Exxon Valdez, contingent valuation methods (CVM), a variation of stated preference, were used (Carson et al. 2003). Even so, some of the literature indicates that the use of stated preference techniques is not so easily defendable in transportation research, because in many cases traffic flows exist.

This is a very narrow view. Maggi and Bolis (2001) use an adaptive stated preference technique to conduct an experiment of transport mode choice for various European freight routes. Citing Tweddle and Fowkes (1996), they argue that for the scope of their study (there are only four respondents), and specifically the limited use of the maritime alternative for certain routes and products, revealed preferences is an unsuitable technique. They point out that the existence of an alternative which is not sufficiently used is analogous to analysing the choice of a new alternative. They go on to say that stated preference data overcomes these problems but caution, referring to Cullinane and Toy (2000), that questionnaire design, and the choice and specification of relevant attributes play a major role in their efficacy.

In another example, where the availability of revealed preference data is limited, Shinghal and Fowkes (2002), in their study on mode choice for freight-services in India, advocate the use of stated preference methods:

> "Presently, intermodal services are at an early stage of development in India and the volume of domestic traffic carried by these services is not very large. Consequently, little data were available on this mode, restricting the use of revealed preference (RP) methods for the analysis. Instead it was decided to use stated preference (SP) methods."

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This is the situation that prevails here. Although there are a variety of different routes and modes available for freight transport from the UK to Russia, some of them are not used extensively (e.g. rail transport), or used to a limited extent (Barents Sea routes). In such circumstances, stated preference is clearly an appropriate method of data collection for this study.

3.7 Conclusion

The literature confirms that the transportation choice is an extremely complex subject involving different actors making decisions against a variety of contextual backgrounds. The primary objective of this study is to examine modal choice and whether it is influenced by the decision-maker's psychological typology. The literature review has had to be wide ranging, dealing not just with other studies on modal choice, including carrier and route choice, but also the research methodology, cognitive styles and influences, appropriate psychometric instruments and decision-making models (both discrete choice and behavioural).

In terms of the research philosophy it was concluded that a micro-economic approach should be applied, investigating individual responses at a disaggregate level, using a combination of qualitative and quantitative methods (triangulation). There are several psychometric tests that, on face value, may be suitable for revealing the key traits in the decision-maker's personality. Notably, the Big Five appears to be favoured by the academic community, especially educational psychologists. However, the more business-oriented MBTI (Jungian typology) test was selected based of its application in other similar studies, availability and cost. Although various taxonomies were explored to provide categorizations that could be used to translate the typology into the behaviours being explored, none were found that were suitable. It was considered that some of the existing taxonomies might have underlying specifications corresponding to group or corporate behaviours that would lead to confusion if applied in the context of this study. Thus, a metaphorical taxonomy that adopted similar descriptions to those already in use, was devised and the classifications of "Conformer", "Improver" and Explorer" were specified.

One of the most important cognitive processes relating to decision-making is the predecisional information gathering strategies used by different cognitive styles or typologies. The principle of predecisional search strategies was introduced with a discussion regarding Limited Search Strategies (LSS). The concept of search strategies will be developed further in the next chapter, in terms of the horizontal component (search across alternatives) and a vertical component (depth of search).

Other studies on modal choice were reviewed. To benefit from the experience of previous work, the literature review was expanded to include carrier and port choice as well as choice of intermediaries (forwarders etc.). A comprehensive list of potential determinants of choice was assembled. In order to isolate those that might be relevant to this research, eighty-eight different studies were scanned for occurrences. The incidence of these was then ranked in order to guide the list of determinants used as a basis for this experiment.

The intention of the decision-making model in this experiment is to explore the decision-making process used by different types of decision-maker. Some of the previous literature suggests that certain typologies prefer a maximizing approach and others a satisficing approach. Thus, the structural model for this experiment has to be able to accommodate both systems within the decision-making framework. Various models were considered as a progression towards specifying a suitable theoretical model for this experiment. The most suitable model found was that of D'Este and Meyrick (1992), which could be modified to incorporate some of the important concepts of the other models (including stated preference techniques).

In the next chapter the principles and information gained from the literature review are used to construct a theoretical model suitable for exploring the constructs that define the decision-making process for modal choice.

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Chapter 4

4 CHAPTER 4 - MODAL CHOICE: THEORETICAL MODEL

4.1 Introduction

Structure of Chapter 4 - Theoietical Model (original)
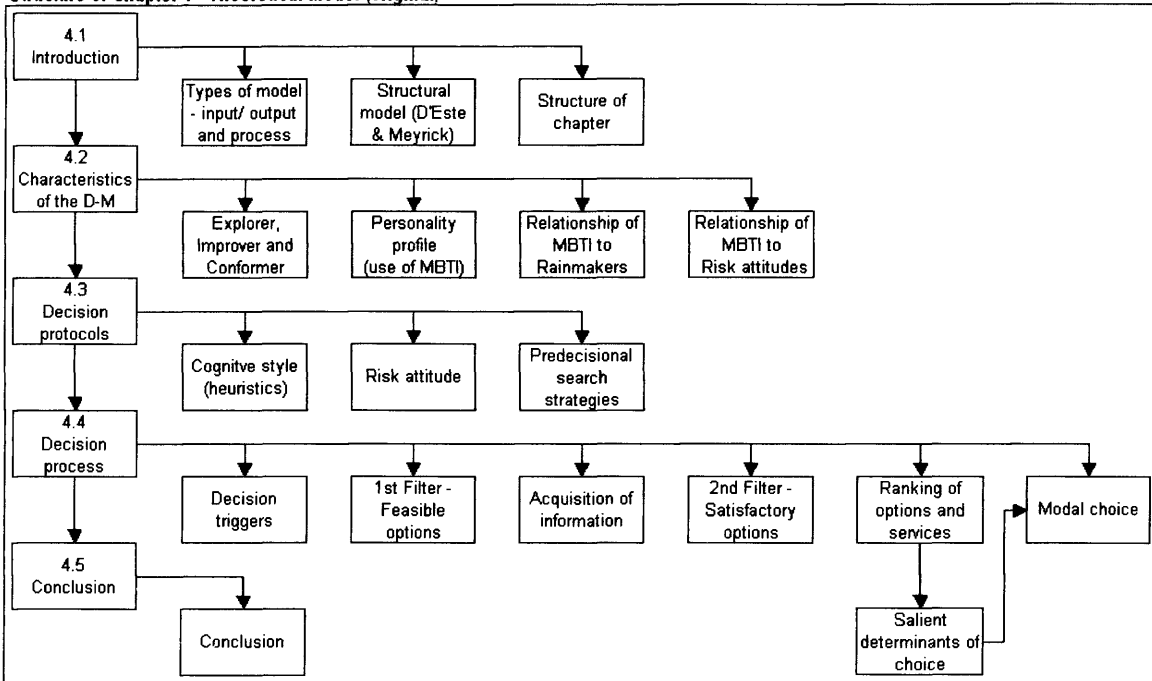
Source: Author

Figure 4.1 – Structure of Chapter 4 – Theoretical model

This chapter describes the construction of the model used to explore the decision-making process with regard to modal choice. The basic principles of the model to be used are described. The characteristics of the decision-maker are considered using the taxonomy specified in Chapter Three (Explorer, Improver and Conformer), and a description provided of how the corresponding typologies are established through the MBTI personality test. The way each of the three types approaches the decision process, in terms of cognitive style, risk attitude and information gathering strategies, is discussed. Finally, using this as background, six propositions are used to define the decision-making process. The remainder of the chapter is set out as follows (see Figure 4.1):

- Introduction (model used);
- Characteristics of the decision-maker;
- Decision protocols;
- Decision process.

From the literature review it can be seen that there has been a wealth of studies on transportation choice embracing a wide variety of models. Mangan, Gardner and Lalwani (2001) use D'Este and Meyrick's (1992) categories to discuss the merits of the different approaches, *viz*:

- Input-oriented models;
- Outcome oriented models; and
- Process oriented models.

Input-oriented models concentrate on the range of potential determinants of choice and their relative influence on transportation decision, whether this is mode, carrier, port etc. The weakness of this approach is that little consideration is given to the actual decision-making process.

Outcome-oriented models attempt to predict the effect of a particular decision situation and, according to D'Este and Meyrick (1992), tend to be broad-brush and mechanistic. Gray (1982) further categorise the outcome-oriented models as "economic positivist" that assumes that a firm is a profit maximiser, "technological positivist", concentrating on relationships between the physical aspects of the cargo and the characteristics of the transportation system and the "perceptual approach" which is similar to the technological positivist but includes shipper's subjective perceptions. These outcome-oriented models typically rely on their predictive power rather than their ability to improve understanding of transportation choices. Gray (1982) notes:

> *"... better results would be achieved if greater effort was devoted to understanding how shippers and other interested parties behave, rather than developing more sophisticated mathematical models."*

Process-oriented models are designed to improve understanding of the transportation decision process. D'Este and Meyrick (1992) divide them into sociological and structural models. Sociological models focus on the hierarchy of needs of the decision-maker whilst structural models use a generic structure involving stages through which the decision process evolves.

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The model described here combines the key concepts from each of the approaches described in Chapter Three in order to better "understand how shippers and other interested parties behave" (see Chapter 3 for a full discussion of the different models considered). The process-oriented aspects of the model are based on the work of Maslow (1970), Davies and Gunton (1983) and D'Este and Meyrick (1992). From Figure 4.2 it can be seen that these latter two models are not vastly different, with similar characteristics of the shipper and attributes of the cargo being evaluated in both. Each of the models is valid in its own way, as one is descriptive and shows conceptually how a decision is taken, whereas the other is normative and reflects the decision process (even though the actual mechanism of filters and decision heuristics may be unconscious). The structural model is more explicit in terms of how the factors fit into an orderly decision process and is, thus, more useful here.

Sociological and structural models for freight purchasing and shipping choices
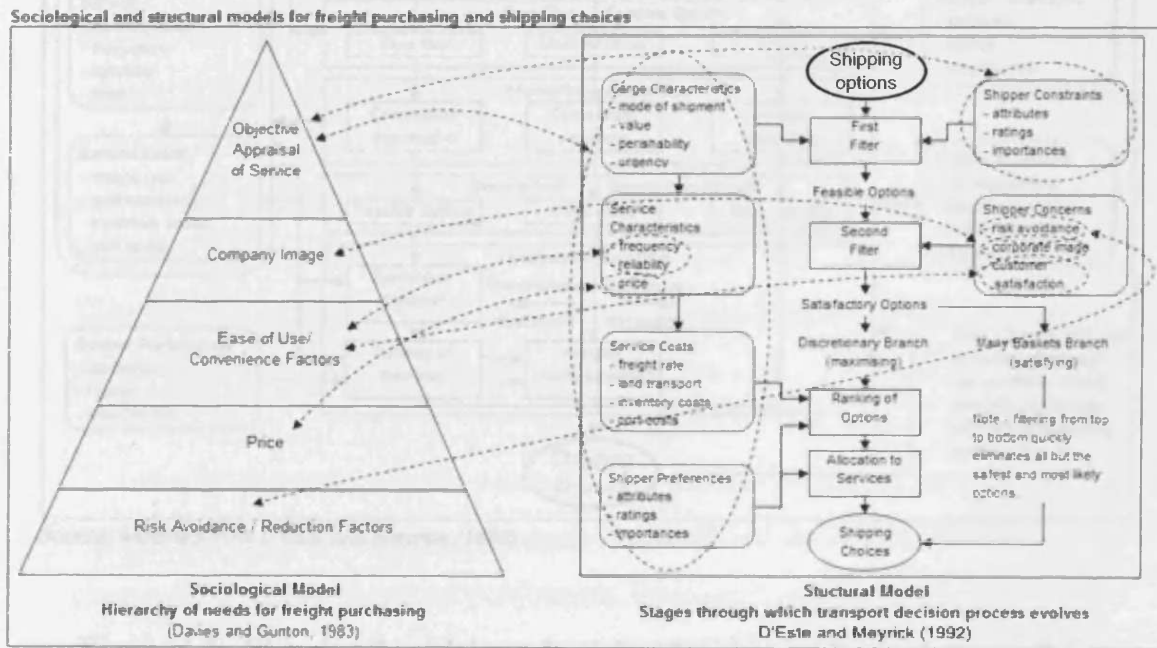
Source: Modified from Davies and Gunton (1983) and D'Este and Meyrick (1992)

Figure 4.2 - Sociological and structural models

The structural model, in particular, reflects Maslow's (1970) hierarchical concept of the decision-making process, whereby certain criteria have to be satisfied before others are used to rank the remaining options. In D'Este and Meyrick's (1992) interpretation, they use two filters followed by two ranking processes. This implies the use of different decision-making heuristics at

different parts of the process. The objective of this study is to examine the decision-making process and, in particular, the influence which the individual characteristics of the shipper have on the outcome of that process. This involves understanding the psychology of the decision-maker in terms of processing information, decision-making capability, risk attitude and the way these translate into buy-class and, thus, to transportation choice. In order to do this, a structural model is proposed that is similar to D'Este and Meyrick's but places greater emphasis on decision-maker characteristics (see Figure 4.3).
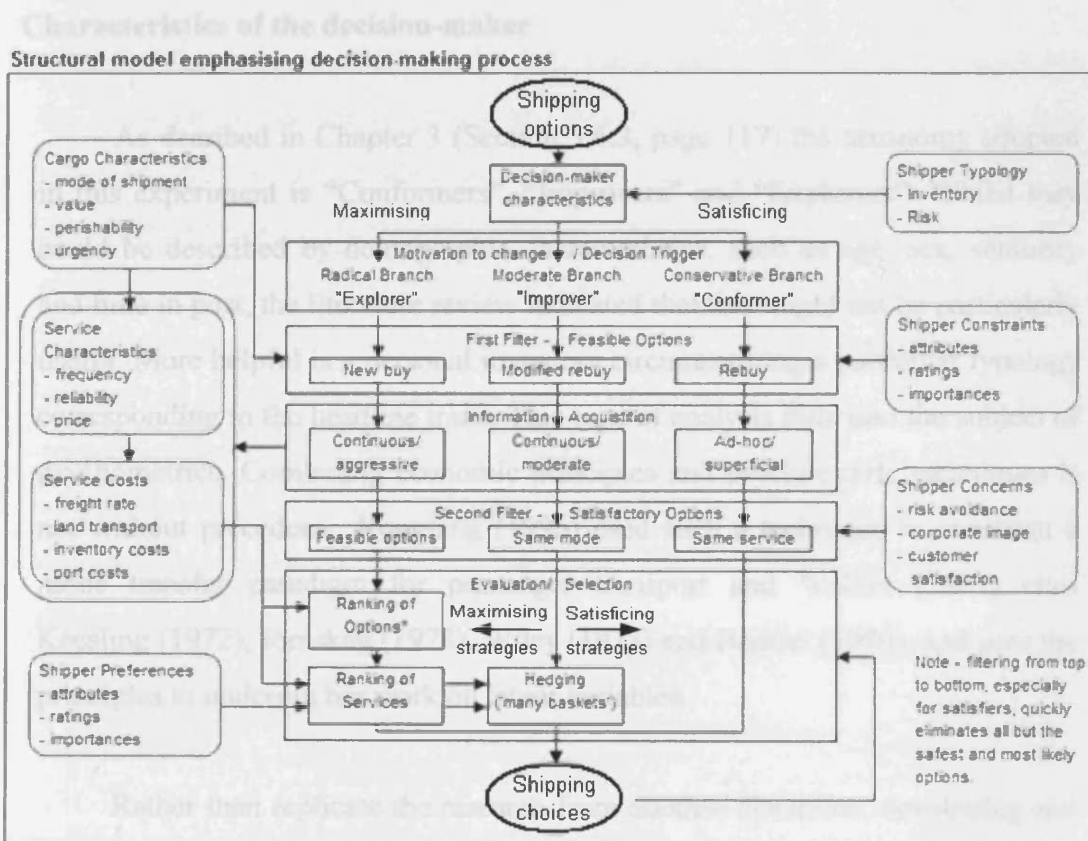
Source: Modified from D'Este and Meyrick (1992)

Figure 4.3 - Structural model emphasizing decision-maker's characteristics

The central process of the D'Este and Meyrick model is split into three separate channels representing, on the left the maximizing approach and, on the right, the satisficing approach. As the difference between the two is a continuum, with the middle ground representing a combined (or compromising) strategy, this is shown as a separate channel. The concept of the difference between maximizing and satisficing is already foreshadowed in the original D'Este and Meyrick specification.

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The main objectives of the model are to provide a framework to verify the relationship between a particular characteristic of the decision-maker, the methods of information acquisition and evaluation, the decision heuristics employed and, ultimately, the modal choice decision that is taken. Other aspects are considered, such as the determinants of choice, in order to exemplify the way that they are collected and dealt with by different classes of decision-maker.

4.2   Characteristics of the decision-maker

As decribed in Chapter 3 (Section 3.6.3, page 117) the taxonomy adopted in this experiment is "Conformers", "Improvers" and "Explorers". Whilst they could be described by demographic characteristics, such as age, sex, seniority and time in post, the literature review indicated that this might not be particularly useful. More helpful is a personal inventory circumscribing a particular typology corresponding to the headline traits. This type of analysis falls into the subject of psychometrics. Combining economic principles and psychometric techniques is not without precedent. Rongfang (1996) used such a technique to construct a mode transfer paradigm for passenger transport and Walker (2001) cites Keesling (1972), Jöreskog (1973), Wiley (1973) and Bentler (1980), and uses the principles to underpin her work on latent variables.

Rather than replicate the research from another discipline, developing and testing a new questionnaire, this study is based on the MBTI and uses it to circumscribe the taxonomy of Conformers, Improvers and Explorers. The Myers-Briggs Type Indicator (MBTI), based on the work of Carl Jung, has been chosen as an instrument in this study because, as detailed in Chapter Three, it is well documented and used universally in business, e.g. as a negotiating aid (Reynolds, 2006), and other areas of research, e.g. information technology (Chandler et al., 2004). The MBTI looks at eight possible human preferences organised into four bi-polar scales (see Figure 4.4). The Myers-Briggs indicator combines four of the preferences that most closely resemble the characteristics of an individual into a particular personality type (Rogers, 1997). This gives sixteen possible combinations.

MBTI bi-polar scale

Extraversion	E	-	I	Introversion
Sensing	S	-	N	iNtuition
Thinking	T	-	F	Feeling
Judging	J	-	P	Perceiving

Source: Rogers (1997)

Figure 4.4 – MBTI bi-polar scale

For the purpose of this study, only two of the bi-polar scales, comprising the cognitive or mental functions, are thought to be significant because they relate to the way information is processed (Sensing/iNtuition) and the way decisions are made (Thinking/Feeling). A third scale, Judging/Perceiving, has some bearing on risk attitude (discussed later). Of the two cognitive scales, the first (Sensing and iNtuition) is nominated as the primary indicator. For the purpose of this study, Explorers are considered to have "T" (Thinking) preference scores. This corresponds with research in other areas of business, which shows that people with high NT type preferences are the individuals in organisations most likely to generate commercially profitable ideas (Rainmakers).

Cognitive MBTI types

Perceiving	Sensing (S)	iNtuition (N)
	Preferring to take information through the five senses, liking the concrete and practical; tolerating detail	Preferring to take information through a sixth sense of what might be; liking the big picture; tolerating change
Unconscious preoccupation	Evidence	Possibilities
Decision making	**Feeling (F)**	**Thinking (T)**
	Structuring decisions through an emphasis on personal values, people-needs	Structuring decisions through objective balance; emphasising logic and reason, truth and fairness
Unconscious preoccupation	Harmony with others	Truth

Source: Author based on Rogers (1997)

Table 4.1 - Cognitive MBTI types

Table 4.1 shows the cognitive MBTI types. These are generalisations intended to translate the taxonomy developed in Chapter 3 (see Table 3.16, page 126), based on the literature review, into the business environment (Rogers, 1997). The "unconscious preoccupation" is particularly important as it provides a headline behaviour that indicates how particular typologies approach the decision making process.

As a further illustration of the kind of behaviour associated with the two opposing types, Conformers (SF) and Explorers (T), reference is made to the positive and negative aspects highlighted by Rogers (1997) in the management development environment (see Table 4.2). It is not intended by showing this table to be judgmental in terms of implying better or worse performance, the purpose is merely to inform the discussion that follows by referring to some of these traits.

Theoretical typology of Conformers and Explorers (positives and negatives, alphabetically sorted)

Conformers (S/F)	Explorers (T types)
- Appearing manipulative	- Ability to brainstorm
- Avoiding challenging poor performers	- Analysing thoroughly
- Being able to accept that many points of view are legitimate	- Appearing intimidating
	- Appearing over-critical - always spotting the flaws
- Being able to tackle conflict in a team or in a relationship and get win-win outcomes	- Being able to dip into useful theoretical ideas
- Being realistic and pragmatic	- Being able to tackle difficult performance issues in others
- Being warm, approachable, sensitive to the people	- Connecting ideas to make new patterns
- Distrusting hunches	- Coolness under pressure
- Insisting on gathering proper data	- Dreaming up ideas which are impractical and
- Not being able to stand back from a situation and analyse it	- Explaining thoroughly
	- Finding it difficult to work with detail, e.g. of budgets
- Only seeing part of the bigger picture	- Generating challenging ideas for large-scale change
- Resisting change	- Going off on tangents
- Seeing leadership as being about managing systems	- Independence
- Sticking with what works	- Missing the simple because of the liking for complexity and theory
- Taking things step by step	
- Understanding the importance of tradition	- Over-analysing
- Waiting too long for proof	- Tending to forget or underplay the impact on people of organisational decisions
- Wanting others and bosses to like you at all costs	
	- Toughness
	- Underestimating the amount of time and energy
	- Valuing fairness
	- Visionary thinking which focuses the organisation on the future

Source: Adapted from Rogers (1997)

Table 4.2 - Theoretical typology of Conformers and Explorers

D'Este and Meyrick (1992) suggest that the shipper objective can be one of either satisfying or maximizing. This, to some extent, differentiates the various

types of decision-maker. D'Este and Meyrick also note that shipping managers are "conservative" and are not averse to intuitive methods of evaluation. Using the conceptual approach described in Chapter Three as background, three distinct categories of decision-maker have been proposed. These are "Conformer", "Improver" and "Explorer". It is postulated that the Conformist decision-maker, at the satisficing end of the continuum, relies on tradition and what others think, and is content with an option that may be less than optimum in some respect. The Explorer, in contrast, at the maximizing end of the continuum, seeks a radical solution that is optimum in all respects. Thus, the classification defines two types of person at opposite ends of the corporate spectrum. In this continuum, the third category, "Improver", occupies the middle ground and, applying a strategy that combines the two approaches achieves a solution that improves on the current performance (but may not be the best available). For the purpose of this study, Conformers, Improvers and Explorers are accorded certain cognitive attributes. This approach may not correspond precisely with what D'Este and Meyrick had in mind in their original model but provides a vehicle for illuminating the various characteristics of the decision-maker and the way the transportation decision is taken. Full responsibility for the analogies used is taken here.

4.3   Decision protocols

There are four aspects of the decision-maker's approach to decision-making that are explored in this experiment: The main principles applied are:

- Cognitive style;
- Risk attitude;
- Predecisional search strategies;
- Buy class.

The key assumption in this experiment is that maximizing or satisficing strategies (see Simon, 1945, Friedmann, 1953 and Simon, 1976) determine how the various levels of the decision-making process are approached. The evidence detailed in the literature review supports this premise. Thus, in terms of cognitive style, at one end of the scale, Explorers should tend towards a maximizing approach, analyzing the problem and basing their decisions on hard evidence.

Conformers, at the other end of the scale will tend towards a satisficing approach, relying on experience, making use of various heuristics and accepting the first solution that meets the basic criteria.

It is proposed that Explorer types, because of their analytical approach, weighing the probabilities associated with possible outcomes (consequences), are likely to tolerate quantifiable risk. Conformers, on the other hand are, by nature, generally more risk-averse (see Walsh, 2005). The perception of risk is heightened by reliance on heuristics, particularly the vividness heuristic that can cause disproportionate weighting of previous dissatisfying experience. Smallman (1996), in his work on organizational types, identifies the proactive type of organization with the risk-taking end of the continuum, and fatalistic (reactive) behaviour with the risk averse end (See Figure 3.7, page 76). It is argued here that the behaviours of the individual decision-makers are influenced in a similar manner.

Decision protocols

MBTI	Taxonomy	Cognitive style	Corporate behaviour	Risk	Information gathering	Buy class
References		Simon (1945)/ Friedmann (1953)/ Simon (1976)	Smallman (1996)	Walsh (2005)	Klayman (1983)	Robinson, Faris and Wind (1967)
NT/ST	Explorer	Maximising >>>	Proactive >>>	Risk neutral/seeking >>>	Tendency towards hard evidence >>>	New buy
NF	Improver	Maximising-satisficing >>>	>>>	Risk neutral >>>	Compromise between hard evidence and bounded rationality >>>	Modified rebuy
SF	Conformer	Satisficing >>>	Fatalistic (reactive) >>>	Risk averse/risk neutral >>>	Tendency towards confirming bias >>>	Rebuy

Source: Author (by reference to other studies)

Table 4.3 – Decision protocols

The third element of the decision-making protocol proposed in this experiment is the predecisional information search strategies. Cognitive style governs the way decision-makers gather and evaluate information. Explorers incline towards hard data and thus the information gathering strategies applied should be reasonably comprehensive. Conformers, using bounded rationality are

not so thorough and, it is proposed, may limit their search to such evidence that confirms the first choice that meets the basic criteria (confirming bias).

Thus, it can be seen that these decision-making protocols lead naturally to a buy class (see Robinson, Faris & Wind, 1967) that corresponds to a particular type of decision-maker (See Figure 4.3). In the next section these decision protocols are applied to the transport decision process based on the decision-making model of D'Este and Meyrick (1992).

4.4   Decision process

Human decisions have, in recent years, been seen as based on complex predecision processes. The decision-maker is endowed with a broad repertoire of available strategies, the choice and application of which are dependent on characteristics of the task (Svenson, 1979). Using the concepts discussed above, the structural model proposed by D'Este and Meyrick (1992) is used as a framework for exploring how the three classes of decision-maker, (Explorer, Improver and Conformer) are most likely to behave at each stages of the hierarchical model:

- Decision trigger;
- First filter – feasible options;
- Acquisition of information;
- Second filter – satisfactory options;
- Evaluation/Selection.

4.4.1   Decision triggers

Stock and La Londe (1977) offer various situations that may cause a firm to reevaluate transportation arrangements, in this case specifically to alter modal pattern. Of the eighteen triggers proposed, seven relate to dissatisfaction with the current service, seven are looking for improvements, and four are prompted by changes in the requirement - or new requirements. Of the latter, three relate to internal changes, such as changes in corporate transportation policy. The premise

offered here is that the three proposed classes of decision-maker respond to different stimuli to initiate an investigation into a new mode, route or carrier.

This study diverges from the Stock and La Londe model where they show the modal selection decision triggered by an outside stimulus. Although this may often be the case, this study proposes that reassessment of transportation choices will, in some cases, depend solely on the initiative of the decision-maker. Whereas all classes of decision-maker will probably respond to new requirements and, to a greater or lesser extent, dissatisfaction with the current service, here it is proposed that Explorers and Improvers differ from the Conformers because of their disparate typologies. The particular characteristics of the Explorer (analysing, employing a more visionary approach and challenge current arrangements on the basis of theoretical paradigms) make it more likely that Explorers will initiate their own reassessments of transport arrangements (whether continuous, periodic or ad hoc). Conformers, on the other hand, with their more conservative typology (sticking with what works, resisting change, and low risk tolerance) are generally less likely to initiate a reassessment. Improvers are deemed to take more of a middle line, monitoring the performance and making continuous minor improvements.

Some may say there is a potential flaw in this approach. Decision-makers within an organisation rarely operate in isolation and, thus, it could be argued that it is unlikely that the psychological predisposition of one person can unilaterally determine the way that transportation and logistics arrangements are reviewed – especially with the trend towards group consensus and multi-disciplinary teams. The arguments for conducting research at individual level are offered as part of the literature review in Chapter 3 (Section 3.2, page 54). However, three further points are made with regard to the design of this particular experiment.

Firstly, it is acknowledged that there is no significant difference between the way classes of decision-maker respond to new requirements (e.g. changes in corporate transportation policy, extensions into new territories, new product lines) and dissatisfaction manifest from other departments (e.g. insurance and

claims, customer services, warehousing, finance). All classes of decision-maker simply react to such outside stimuli as proposed by Stock and La Londe (1977).

Secondly, it is suggested that the way the typologies are likely to influence or be influenced in group situations is important. For example, where Explorers find themselves in a "Conformist" group it is argued they will act on their own volition (proactive) to gather evidence and substantiate a particular course of action in line with their own typology. Conversely, in the less likely event, where Conformers find themselves in Explorer or Improver groups, their passive approach is unlikely to be tolerated and, in the medium to long run, they will be expelled (Thomason, 1988). This aligns with Myers and McCaulley (Briggs-Myers & McCaulley, 1985) who say that environment can cause a falsification of type but that, in this case, emotional difficulties [presumably, stress] would follow, i.e. they expel themselves.

In the third case, it is argued that the corporate culture is representative of the organisation's composite typologies. This is because recruitment and selection policies developed over time by an organisation have a tendency towards a particular type of person e.g. as in Schneider's (1987) Attraction-Selection-Attrition (ASA) model. A number of authorities support this view that organisations exhibit a corporate personality of their own (see Hambrick and Mason, 1984; Kets De Vries and Miller, 1986; Miller et al. 1986; Miller and Toulouse, 1986; Schneider, 1987; Organ, 1994; Schneider et al, 1995; Judge and Cable, 1997; Schaubroeck et al., 1998; Schneider et al, 1998 and Van Vianen, 2000). Thus, the organisation as a whole develops a "corporate homogeneity" representative of its employees and, of which, the decision-maker becomes a reasonable facsimile.

Despite the above, whatever the exact mechanics, all that is intended in this study is to establish a relationship between the psychological profile of the decision-maker (respondent) and the probability of certain behaviours in the transportation choice process. The first behaviour, which it is believed sets the course for the subsequent steps in the decision process, is the way in which

different types of decision-maker are motivated to change the transport arrangements.

From the literature review it can be seen that an interpretation of the various earlier studies (see Section 3.3.2, page 72) puts Conformers (SF type) towards the reactive or fatalistic end of the continuum (Miles & Snow, 1978; Smallman, 1992, Royal Society, 1996 and Rogers 1994) and Explorers (T types) towards the proactive end.

The first proposition in this study is that <u>all</u> decision-makers will respond to reactive triggers to review transport arrangements but only Explorers and (possibly) Improvers will be proactive seeking improvements or new solutions.

4.4.2   First Filter – feasible options

Referring back to Figure 4.3 (page 171), the first filter of the structural model is concerned with identifying what the decision-maker considers to be feasible options. At this level of the decision process hierarchy, theoretically at least, the decision-maker interacts knowledge of the cargo characteristics with inherent perceptions of the transport choices available (modes and routes). This initial judgment is made on the basis of information (cargo characteristics and the decision-maker's own perceptions of mode attributes, ratings and importances) within the decision-maker's own experience (availability heuristic). The cargo characteristics play an important part at this stage, such that certain cargo carrying units, and hence, mode, will be excluded by virtue of being physically or chemically incompatible (e.g. 30 metre long boiler steam drums do not fit into 6 metre ISO containers) or economically unsound (e.g. bulk coal by airfreight). In this case, the conjunction rule (conjunctive or disjunctive) or elimination by aspects are probably the most often used heuristics for evaluating feasible options (possibly unconsciously).

Even at this level, it is argued that the cognitive profile of the decision-maker will create a predisposition towards certain decision-making protocols. For example, the Explorer (T types), liking the big picture and structuring

decisions through objective balance (Rogers, 1994), is likely to set aspiration levels for selecting feasible options based on perceptions of what is truly feasible (physically possible and economically sound). If anything, the N/T type is more likely to weigh towards "blue sky" solutions than exclusion ("Dream up ideas that are impractical and unrealistic"). This does not mean that the Explorer is immune from decision biases but at this stage at least, they are probably not significant. In fact, the preference for "useful theoretical ideas to make new patterns" makes the Explorer quite likely to consider a broad range of feasible options.

Although, in terms of Buy-class (see Robinson, Faris & Wind, 1967 and Sparks & Lillie, 1993, in Section 3.3.2, page 83), a new buy is defined as completely different from previous buying situation, the description is thought to reflect the Explorer's approach (because of the substantial amount of research and evaluation) even if the eventual outcome is actually a modified rebuy or a rebuy. For the purpose of this study, however, a modal choice that has not previously been used is deemed to be a new buy.

The approach of the Conformist is likely to be significantly different. The conservative nature of the S/F decision-maker, and an aversion to change, limits the availability of "feasible" options in two ways. Sensing personalities prefer the concrete and practical, require evidence and tolerate detail. The only concrete evidence available to them, especially at this first filtering stage, is the performance of the existing supplier(s). In addition, because of the anchoring heuristic and confirming bias, the Conformist's interest in alternative routes (availability heuristic) and modes is likely to be constrained by lack of detailed understanding. What knowledge that is available is more likely to be representative (as opposed to N's intuitive, theoretical approach), assigning to other potential choices perceptual paradigms (conjunctive and confirming bias) that are not necessarily accurate. Although the Conformist may use the conjunctive (different from conjunctive bias) or elimination by aspects heuristics to narrow the choices, it is argued that the aspirations used to define the criteria may be heavily influenced by a tendency to pose questions in favour of answers supporting the existing mode (confirmation bias). Thus, the probability of the

Conformist confining the feasible options to the existing mode and carrier (straight rebuy) is far higher than the other classes of decision-maker - even at this stage.

The Improver, although possibly sharing the Conformer's unwillingness to make radical changes (anchoring heuristic), is credited here with adopting a middle-line approach between maximising and satisficing. Thus, because of the desire to improve, and a potentially better "informed" availability heuristic, is more likely to consider a broader spectrum of options available and evaluate them objectively. Therefore, a risk neutral approach, tempered by the confirming and anchoring heuristics, is likely to lead the Improver towards some form of modified rebuy.

The second proposition in this study is that Explorers tend to be in the new buy-class, Improvers in the modified rebuy class and Conformers in the rebuy class.

4.4.3 Acquisition of information

Following on from the above, it is argued that the logical allocation of the three categories of transportation decision-maker into particular buy-classes is very important in determining the predecisional search strategies employed. All decision-makers potentially have the same body of information available to them but the investment (in terms of time, knowledge, attention and money spend) weighed against the perceived benefit will differ for each buy-class.

In order to support the next stage of the decision-making process, the decision-maker has to find out information (cues) on which to compare the alternatives. D'Este and Meyrick (1992), in their structural model, suggest the following categories of information are required for the second filter[12]:

    − **Service characteristics:**

        − Frequency;

- Reliability;

- Price;

- Marketing.

- **Service Costs:**

  - Freight rate;

  - Land transport;

  - Inventory costs;

  - Port costs.

This information, necessary to support the choices made in the second filter, falls into three source categories:

- Internal (measures of past performance, formal or informal);

- External (statistical data or perceptions regarding potential performance);

- Transportation options available.

Internal measures of performance can be formal or informal, depending on whether systems have been set up with the intention of monitoring specific matrices. These Key Performance Indicators (KPIs) may lie within the control of the transportation decision-maker or with some other department. The various types of data that may be used have been identified by Brand (1987), Stock and La Londe (1977) and Burdg and Daley (1985). The composite list developed from these previous studies is arranged, by source, type and reliability (assigned by the author). In the context of source, "transport" is used to describe the transportation or logistics' functional departments:

- On-time pickup and/or delivery service (transport/formal/objective);

- Analysis of customer complaints (customer services/formal/objective);

- Review of claims and loss experience (insurance and claims/formal/objective);

- Shipment tracing (transport/informal/subjective);

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[12] Although D'Este's model is specifically oriented towards choice between ferry services, and consequently ignores, for example, possible modal differentiators, the discussion of determinants of choice in this study is dealt with after the decision process itself has been illuminated.

- Distribution cost studies or audits (transport or finance/formal/objective);

- Last experience with mode (various/informal/subjective);

- Own experience and advice from others (various/informal/subjective).

Some studies (e.g. Bruning and Lynagh, 1984) have associated objective procedures of evaluating performance information with age and experience. D'Este and Meyrick (1992) on the other hand note, "... shippers did not appear to exhibit a bias against intuitive decision-making" and that "... choice of carrier is often made quickly using information on-hand [personal knowledge and experience]" (availability heuristic). D'Este and Meyrick's view of a conservative[13] decision-maker using informal, subjective information and making mildly intuitive type choices suggests, in their survey at least, that shipping managers are Improvers (slightly N and mildly F). The weakness of the study by D'Este and Meyrick is that it examined a very narrow market (ro-ro operators on the Bass Strait trade) indicating a buy-class choice only between rebuy and modified rebuy. Even so, it does imply that in this situation, at least, a very small band of the available information is used.

A more exhaustive test of information and evaluation methods used by different classes of decision-maker would be where, as well as different carriers, different modes are available and actively in contention (e.g. in the UK to Russia trade). Here, it is more likely that the decision-maker is unfamiliar with at least one, if not two of the available modes. In this case, the acquisition and evaluation of information is potentially more demanding. Internal information about the current mode is still available but in order to support a decision to make a radical change in transport arrangements, the data needs to be formal and objective. A more significant issue is that external information is required about modes (and the services available in those modes) that have not been used before. As Hills and King (1979) observed, "Choice relies upon perception of options available. In other words, there are only valid choices if the decision-

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[13] The description "conservative" is normally used to describe SJ (sensing/judging) types such as, for example, accounting audit partners (Jacoby, 1980) and so suggesting conservative shipping managers make "mildly intuitive choices" may be slightly misleading.

maker is aware of them." Determining what options are available is dealt with below but, again, turning to Brand (1986), Stock and La Londe (1977) and Burdg and Daley (1985), an interpretive, composite list is produced of the type of *external information* available (using similar notations as above):

- Tenders, proposals, quotations (prospective carriers/formal/objective);
- Market Research (consultants/formal/objective);
- Journals (own research/formal/objective);
- Tariff bureaux (own research/formal/objective but unreliable[14]);
- Trade directories etc. (own research/formal/subjective);
- Trade associations (own research/formal/subjective);
- Media/trade press (own perception/informal/subjective);
- Carrier marketing (own perception/informal/subjective);
- Other users of the mode (others' perceptions/informal/subjective).

It is argued here that the more objective methods would appeal to the T aspect of the S/T and N/T (Explorer) decision-maker. Conversely, the Conformer (S/F), because of the importance placed on interpersonal relationships and reputation, will incline towards information provided by the media, carrier marketing (friendly sales representatives) and the (possibly misguided) recommendations of others.

Awareness of the options available is an important aspect of choice (Hills and King, 1979). Such information is gleaned by a general awareness of what is going on, not just in the transportation industry (e.g. modal shifts, road congestion and growth in the transport sector) but the world at large. This includes political developments (e.g. emergent economies), ecological issues (e.g. global warming, lower emission more energy efficient transport solutions), technological advances (e.g. high-speed ferries, use of Internet for shipment tracking) as well as general economic evolution (e.g. globalization). These factors combine to create both threats and opportunities to business. Relying on

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[14] Tariff bureaux provide filed rate data. Sometimes this is an unreliable source of information as, in the case of the Federal Maritime Commission, for example, substantial notice must be given by shipping companies for rate increases, whereas only short notice is required for decreases. As a result, shipping lines tend to publish high tariff prices which, as a matter of course, are then discounted on very specific criteria on a quote by quote basis.

Hambrick's (1982) suggestion, that executives tend to scan for information according to their own personal or functional interest, it is likely this form of data will appeal (see Nisbett and Ross's "vividness criterion" above – Section 3.3.2, page 74), and thus be more readily assimilated by Explorers and Improvers than Conformers.

General information gathering accords closely with the way the Explorers seek their points of reference, e.g. visionary thinking which focuses the organisation on the future, generating challenging ideas for large-scale change and being able to dip into useful theoretical ideas. On the other hand, Conformers, tend to see only part of the bigger picture, consider their role simply as managing systems and procedures and, resist change. Thus, it is argued, Conformers not only prefer to maintain the status quo, in Hambrick's terms, they are less likely to take an interest in the broader picture and be aware of potential opportunities for change.

In summary, this study attributes the following typical information gathering and evaluation behaviours to the respective classes of decision-maker:

- *Conformers:* Superficial/ad hoc evaluations based on limited (mainly subjective) performance monitoring, combined with scanning of trade press for potential threats. This limited search strategy (LSS) relies on only a relatively small proportion of the available data (Section 3.3.2, page 80). There are significant differences in the amount of information searched across alternatives and the direction of search is very limited, dominated by satisficing techniques, and is almost uni-directional.

- *Explorers:* Continuous/aggressive evaluation, rigorous assessment of cost and capability measured against (benchmarked) industry standards, combined with a dogged quest for new/better alternatives. This approach accords closely with the more comprehensive search strategies (CSS). A high proportion of the available data is searched, ultimately there is little difference in the proportion of data search across alternatives, and dimension wide comparisons are used.

– **Improvers:** Continuous/moderate evaluation based on formal performance monitoring, combined with scanning for potential threats and improvement opportunities. Aspirations for modest levels of improvement set the criterion to be used in satisficing/conjunctive techniques such that the search is limited but not uni-directional.

The third proposition in this study is that a) Conformers tend towards limited search strategies (LSS) concentrating on the current mode and service, b) Improvers also tend to use limited search strategies (LSS) but across all feasible alternatives, and c) Explorers are more likely to use comprehensive search techniques (CSS) across all feasible alternatives.

4.4.4 Second filter – satisfactory options

In the second filter of the structural model, the objective is to identify the most satisfactory options from the 'range' of feasible options that have passed the tests in the first filter. Although the predecisional search strategies identified above, help to predispose the decision-maker towards particular decision heuristics, the criteria against which the alternatives in the second filter are measured are shipper concerns, namely:

– Risk avoidance;

– Corporate image;

– Customer satisfaction.

Risk attitudes

Improver

P = Risk seeking
J = Risk neutral

NF | NT

SF | ST

Explorer

Conformer

P = Risk neutral/averse
J = Risk averse
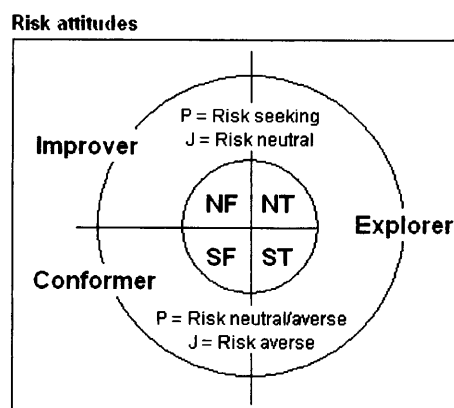
Source: Author (based on Walsh, 2005)

Figure 4.5 - Risk attitudes

As has been discussed above, the three categories of decision-maker in this study are likely to have different risk attitudes (Section 3.3.2, page 77). Conformers (S/F) tend to range between risk-averse and risk-neutral/averse whilst Explorers range between risk-averse and risk seeking (see Figure 4.5).

It can readily be seen that different transport decisions have different levels of risk associated with them. Although these are corporate risks, they tend to be evaluated according to the decision-maker intuitively assigning some form of risk rating (Banomyong and Beresford, 2001), even if this is unconscious. It is argued that this intuitive assessment of corporate risk is governed by the individual's own risk attitude. In the illustration below (see Table 4.4) different corporate risk scenarios are proposed based on the Author's own "intuitive" assessment (relevant experience gained as operations manager of OCL's African Trades Division, logistics specialist for Rio Tinto and other similar appointments).

Risk and ambiguity implications of different transportation choices

Risk scenarios	Example	Risk	Risk level	Ambiguity level
Change in mode	Changing from road transport of bulk minerals waterway (Rotterdam to Mannheim)	Setting up intermediate stock holding points involving commitment to non-readily escapable costs	High risk	High
	Changing from road transport to seaborne/intermodal transport (UK to Moscow)	More complicated to co-ordinate combined with unfamiliararity leading to perceptual uncertainty about ice navigation and delays.	High risk	Very high
	Changing from seaborne mode to road transport	Uncertainty about implications of road transport (border crossings/customs procedures) and carrier capability/ performance. Risk is limited by fully escapable costs.	Moderate risk	Moderate
Change route	Changing from sea route via one Baltic port to sea route via another Baltic port	Implies a change of carrier and port. Uncertainty about both the carrier and the port capabilities and performance - as well as oncarriage arrangements	Moderate risk	Low
Change carrier	Changing from one maritime carrier to another maritime carrier but using the same ports.	Uncertainty about carrier capabilities and performance including ability to arrange oncarriage	Moderate to low risk	Low
	Changing from one road haulier to another road haulier	Uncertainty about carrier capabilities but risk is limited by flexibility and fully escapable costs.	Low risk	Low
Improving carrier performance	Remaining with the same carrier but seeking to improve performance	Minor risk if carrier does not perform.	Low risk	None

Source: Author' own assessment

Table 4.4 - Risk and ambiguity implications of different transportation choices

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At one end of the spectrum there is the high-risk scenario involving capital investment and non-readily escapable costs (radical modal shifts) and at the other the low risk strategy of negotiating better terms with an existing carrier. In between there are a variety of possible scenarios, including changing the route and or the carrier. In the example proposed here, it is suggested that a decision-maker contemplating changing from a road transport operation to Russia, has a number of risk-associated hurdles to overcome. First, changing to different mode implies not only moving into unfamiliar territory in terms of expectation, but also considering the possible capability and performance variables of different elements (carriers) and nodes (ports/container freight stations) in the transport chain. These are ambiguous risks because knowledge is ex-post.

In such circumstances, according to Kahneman and Tversky (1982) "people will tend not to take a risk (be risk averse) if the situation [road transport] is a sure gain [negotiated improvement] even though there is a higher probability of a higher gain [by using sea transport, e.g. shorter transit time/lower generalised cost]". Moreover, in this example, it is probable (whatever the previous research) that the true capabilities and performance of the various carriers and ports making up the new mode/route choice will only truly be known *ex post facto*. Thus if, as Di Mauro and Maffioletti (2004) find in the "fourfold" scenario, ambiguity aversion is more significant than even risk aversion, only Explorers, and possibly the more risk seeking Improvers in the UK to Russia trade are likely to make the modal change from road transport to sea transport. This is a fairly extreme example and there is a range of other scenarios that involve lower risk thresholds.

Many people's perceptions of a situation are governed by the availability of information (ease with which it is recalled), which, as Nisbett and Ross (1980) point out often depends on the vividness of the images they remember. Possibly the most vivid images available to people regarding Russia are literature and other media depicting the retreat of Napoleon, the Nazis 900 day siege of Leningrad (St Petersburg) and the October Revolution (Milner-Gulland & Dejevsky, 1998). All of these (often graphically depicted images) are generally associated with unfamiliarity; danger; winter; and, depending on which side you

happen to promote, failure. Unfortunately, certain typologies may adopt this conjunction (conjunctive bias) of Leningrad, winter and risk as representative (representative heuristic) of the general operating environment and are thus deterred from shipping through St Petersburg (formerly Leningrad). This may be exacerbated further by the fact that research on social influence demonstrates that attitudes and judgments tend to conform to those held by others (Zhang, Hsee & Xiao, 2003). This is potentially more significant for Conformers (S/F types) who may rely on the opinion of others not deeply involved in the decision process and, thus, may be more heavily influenced by subjective cues (marketing and vividness), than the Explorers' and Improvers' greater reliance on hard data and objective analysis.

D'Este and Meyrick (1992) include corporate image in their structural model. This means different things to different typologies. The S/F types (Conformers), for example, "understand the importance of tradition", whereas N/T types (Explorers) want to "focus the organisation on the future" (Rogers, 1997). This will also influence risk perception, as the Conformer will want to avoid risk, especially to himself as an individual, whilst the Explorer will tolerate risk to the organisation (and, thus, himself) if there is a perceived benefit in the future.

The final shipper concern influencing decision-behaviour in the second filter is described by D'Este and Meyrick (1992) as "customer service". Although they do not go as far as some studies which say customer directive is paramount (Ferguson, 1991), they do find that shipping managers are concerned with long-term costs such as market share and loss of customer confidence. This view is supported by a number of other studies that highlight the importance of supply chain issues and customer satisfaction - Burdg and Daley, 1985; Gentry and Farris, 1992; Murphy and Daley, 1994; La Londe and Powers, 1993. Although all typologies will be influenced by customer demands and feedback, S/F types (Conformers) with an inclination to "avoid challenging poor performers", "waiting too long for proof" and "sticking with what works" may be less inclined to look for effective (but possibly more radical) solutions than Improvers or Explorers.

The importance of these conceptual considerations cannot be underestimated. An extreme example of this is a decision theorist who reverses his preference for payoff schemes based on the roll of a die, according to the magnitude of the payoff. When the payoff is measured in hundreds of dollars, the decision theorist behaves rationally and selects the scheme that in the majority of cases (five out of six) yields the more favourable result, despite the fact that in the sixth outcome, the payoff is substantially higher on the other scheme. However, his preference changes to the scheme that is less favourable on the majority of outcomes, if the payoff is measured in hundreds of thousands of dollars. The rationale put forward by the decision theorist (which he confirmed would be his behaviour in real life) is the regret he would feel if he chose the first scheme and the sixth outcome transpired (Howard, 1988).

Illustrative (hypothetical) transit times scenario - days

Probability	1%	29%	31%	39%	Average
Mode A - Road	8.00	9.00	11.00	10.00	10.00
Mode B - Sea	21.00	7.00	9.00	8.00	8.15
Outcome	A < B	A > B	A > B	A > B	A > B

Source: Author

Table 4.5 - Illustrative (hypothetical) transit times scenario - days

This example is cited to illustrate the significance of the anticipation of ex-post regret. Supposing a similar choice situation exists regarding sea and road transport between the UK and Russia. A hypothetical scenario is proposed where, overall sea transport will yield a lower average transit time and, in the majority cases (99%) shorter absolute transit time than road transport. However, in the minority of cases (1%), a substantial delay is likely. This hypothetical scenario is illustrated in Table 4.5. It is argued here that the majority of decision-makers will choose the mode that, ceteris paribus, is substantially better on average and in the majority of cases. However, in this example at least, it is suggested that the risk-averse nature of the S/F types (Conformers) will incline them towards road transport.

The fourth proposition in this study is that a) Explorers, whatever mode they are currently using, are likely to weigh the feasible options and select the

mode most suitable according to the information available (new buy or modified rebuy). b) Improvers will tend to remain with the current mode (not exclusively) but look for service improvements (modified rebuy). c) Conformers will tend to remain with the mode, service and carrier currently used, except if they have inherited an option they perceive to be too risky, in which case they may change to a less risky option (rebuy or, modified rebuy).

4.4.5 Ranking of options and services

Ranking of options and services suggests that, whatever decision heuristic is applied, information is available that can be used to potentially differentiate one service or option from another. This implies that there are specific cues that can be measured against each other – determinants of choice.

Comparison of the occurrence of potential determinants in previous studies

Modal Studies			All Studies	
Rank	Potential Determinant		Rank	Potential Determinant
1	Price		1	Price
2	On-time pickup/delivery		2	Short transit time
2	Loss/damage record		3	Reliability
2	Frequency		4	On-time pickup/delivery
5	Characteristics of goods		5	Loss/damage record
5	Short transit time		6	Shipment information
5	Reliability		6	Flexibility
8	Ecological/Environmental		8	Capability
8	Transit time reliability		8	Frequency
8	Shipment information		10	Location
8	Freight rate stability		11	Reputation
8	Reputation		14	Claims response
8	Flexibility		15	Transit time reliability
8	Capability		17	Characteristics of goods
8	Distance		17	Distance
16	Location		19	Ecological/Environmental
16	Claims response		26	Freight rate stability

Source: Author

Table 4.6 – Comparison of the occurrence of potential determinants in previous studies

The mass of literature on determinants of choice, and their influence on the transport decision, suggests that ranking them in some sort of order is the most important issue to resolve, in order to understand the decision-making process. As can be seen from the above, here we argue this is not necessarily the case. Most studies appear to seek to define the determinants of choice, without actually establishing a correlation between these factors and the actual choice

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made, e.g. port, carrier[15] or route choice. The exception is mode choice studies[16] where relationships between certain determinants and mode can be endogenous. This should suggest that in mode choice studies, a set of potential determinants could be defined that differentiates one mode from another. Table 4.6 shows that the occurrence of potential determinants of choice used in modal studies, and those used in all studies (comprising port, carrier, freight and passenger, as well as modal choice) are broadly similar.

It is argued here that the description "determinants of choice" is a misnomer, as their influence appears to be more in terms of defining dissatisfaction with the current service, than determining the choice of an alternative. In other words, a determinant of choice requires a priori knowledge, which by definition, means without experience; whereas a determinant of dissatisfaction relies on a posteriori data. It follows that a respondent asked to rank determinants of choice (particularly with the bounded rationality approach) will give a response heavily influenced by attributes that have generated the most dissatisfaction based on services they have experienced recently (Stock and La Londe, 1977).

Even if the description "determinants of choice" is accepted on face value, do these determinants truly influence the choice decision? Referring back to Mangan, Gardner and Lalwani (2001), Aaker and Day (1980) and Brooks (1985), just because an attribute is judged to be important by a large proportion of the respondents, does not necessarily mean that it is a 'determinant' of choice – it has to be salient. For an attribute to be salient, the chosen option must be seen to perform better on the particular attribute, than an alternative option. To determine salience the attribute (variable) must be both quantifiable and distinguishable, for both the current option and any alternative. In order to specify salient determinants of modal choice, it is necessary to relate the ability

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[15] Tiwari, Itoh and Doi (2003) and Nir & Lin (2003) do identify specific ports and Shah and Mäntylä, 1995 identify the shipping lines in their survey but do not relate the importance of factors to an actual choice being made.
[16] Mode choice studies include, Garcia-Menéndez et al., 2004; Shinghal & Fowkes, 2002; Cullinane & Toy, 2000; Mathonnet, 2000; Sayed & Razavi, 2000; Meersman & Van de Voorde, 1997; Foster & Strasser, 1990; Jeffs & Hills, 1990; Wilson & Bisson, 1986; Faller, 1985; Lungstrom, 1985; Seidenfus & Van Rens, 1985; Cunningham, 1982; Ogden & Rattray, 1982; Slater, 1982; McGinnis & Corsi, 1979; Oum, 1979; Stock & La Londe, 1978 & 1977 and Gilmour, 1976.

of one mode of transport to perform better at delivering a certain attribute, in terms of utility to the decision-maker, than all the others. For example, the distance between origin and destination per se does not, in terms of one mode delivering better utility than another, qualify as a salient determinant of choice. The measurable deliverable may, on the one hand, be a shorter transit time and, on the other, a higher cost.

Salient determinants of choice

Determinants of Choice		
Explorer	Improver	Conformer
(Radical change)	(Marginal change)	(Maintain status quo)
- Perceived threats (X)	- Perceived threats (S)	- Perceived threats (S)
- Loss damage record (I)	- Loss damage record (S)	- Loss damage record (S)
- SCP (S)	- SCP (S)	- SCP (X)
- Flexibility (S)	- Flexibility (S)	- Flexibility (X)
- Shipment information (S)	- Shipment information (S)	- Shipment information (X)
- Capability (S)	- Capability (S)	- Capability (X)
- Location (S)	- Location (S)	- Location (X)
- Reliability (S)	- Reliability (S)	- Reliability (X)
- On-time record (I)	- On-time record (S)	- On-time record (S)
- Transit reliability (I)	- Transit reliability (S)	- Transit reliability (S)
- Customer service (I)	- Customer service (S)	- Customer service (S)
- Back load potential (S)	- Back load potential (S)	- Back load potential (X)
- Price (S)	- Price (S)	- Price (X)
- Reputation (S)	- Reputation (X)	- Reputation (S)
- Short transit time (S)	- Short transit time (S)	- Short transit time (X)
Salient determinant = S Extraneous determinant = X Impotent determinant = I Supply Chain Performance = SCP		

Source: Author

Table 4.7 – Salient, Impotent and Extraneous Determinants of Choice

Although some of the determinants of choice may cross this hurdle (e.g. price, transit time, schedule, frequency, etc.) others do not (e.g. customer service, reliability, flexibility, on-time record, loss/damage record, claims performance, etc) (see Table 4.7). There appears to be two categories of data that are not salient, i.e. that cannot actually influence the decision (see Section 3.5, page 92 for a detailed explanation of salience). The first category is information for which accurate/objective (measurable) a priori information is unlikely to be available (e.g. KPIs etc.) and, hence, the determinant is "impotent". The second category is information that is extraneous because, for some typologies (Conformers and, to a certain extent, Improvers) the decision has already been taken based on factors occurring at a higher hierarchical level. The determinant

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(as a true determinant rather than as a trigger) is thus "extraneous" to the decision-making process. The principle applied here is similar to Kotler's grid used in the context of buyclass (see Table 3.4, page 84).

Structural model showing decision-making protocols
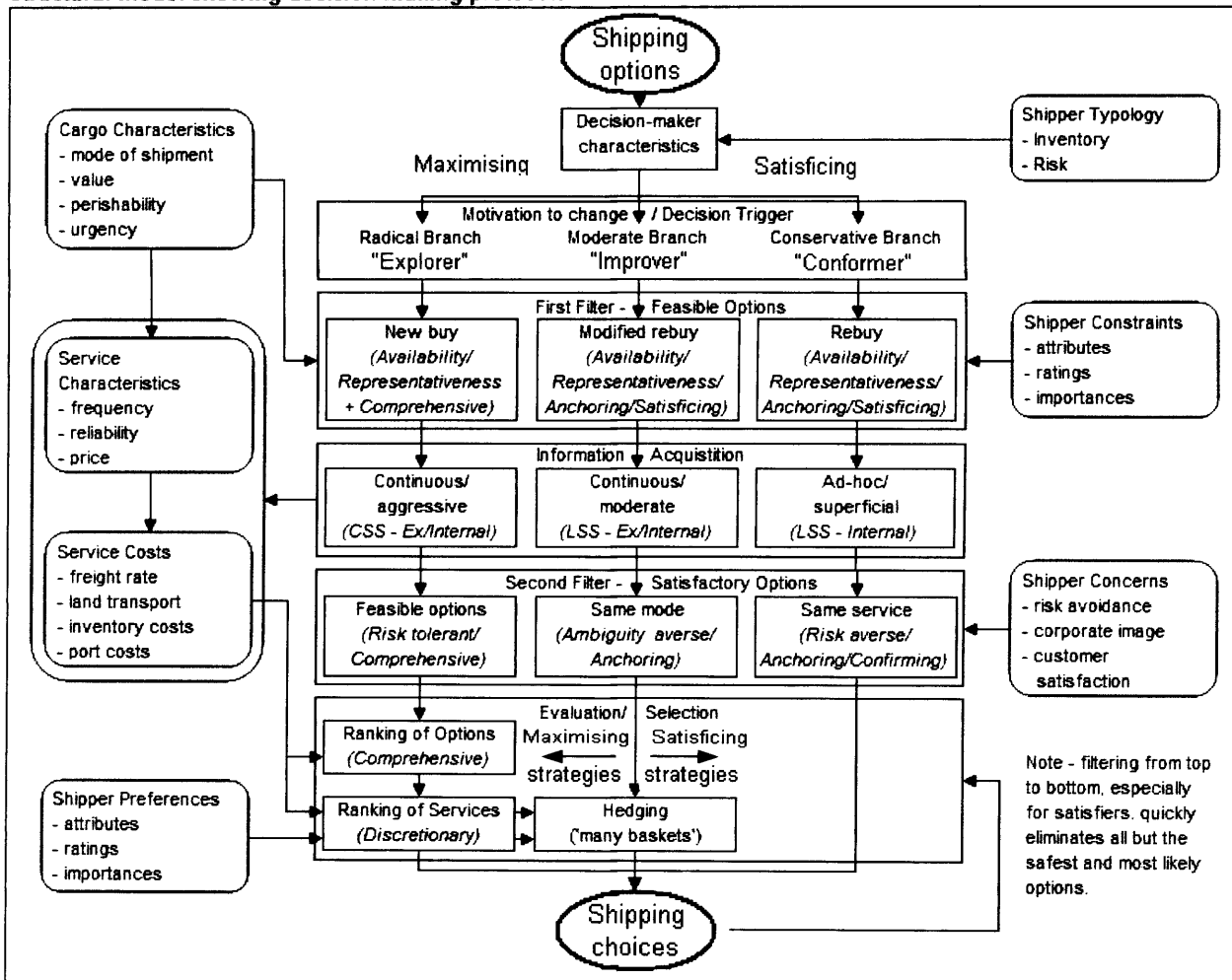
Source: Adapted from D'Este and Meyrick (1992)

Figure 4.6 - Structural model showing decision-making protocols

True determinants of choice, it is argued, are those that define the feasible options in the first filter, namely the characteristics of the cargo (mode, value, perishability and urgency) and, in the second filter, perceived data measured against risk attitudes, corporate image and customer service considerations. Only in the final stages of ranking options and services, will Explorers and Improvers differentiate between those still in contention by assessing other attributes (see Figure 4.6):

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- *Decision triggers (quest for improvement/dissatisfaction with current service):* Reliability, on-time pick up and delivery, loss/damage record, flexibility, claims response, customer service and changes in technology, etc.

- *First filter (feasibility) based on shipper constraints (attributes, ratings, importances):* Capability, characteristics of the goods (modal suitability - value, perishability, urgency), location, distance, ecological/ environmental, ability/expertise, equipment availability and route options, etc.

- *Second filter based on shipper concerns (risk avoidance, corporate image and customer service):* Reputation, risk of delay, security, intermodality, lifts in transit, courtesy and neatness of vehicle operators and customer service (purchaser requirements and feedback), etc.

- *Evaluation and selection based on shipper preferences (attributes, ratings and importances):* Frequency, price, short transit time, shipment information, ability/expertise, schedule and equipment availability, etc.

Davis and Gunton (1983) claim that objective appraisal methods are used to differentiate between suppliers once two or more suppliers have satisfied the basic criteria. Stock and La Londe (1977), Bruning and Lynagh (1984) and (particularly) Malchow and Kanafani (2004) are not so optimistic. Given the difficulty of comparing objective data across the potentially suitable options, possibly a compensatory approach (strong performance in one factor can compensate for poor performance in another factor) is used even at this stage (D'Este & Meyrick, 1992). If this is the case, perhaps even the choice decision of the Explorer is taken based on one or two headline attributes that are appealing because of dissatisfaction with the current service.

The fifth proposition in this study is that determinants of choice are actually determinants of dissatisfaction arising from the most recently used transportation choice.

4.4.6 Evaluation/selection

It is hypothesized that the decision-making process for transportation choice is heavily influenced by the psychological profile of the decision-maker, both in terms of cognitive preferences and attitude to risk. Because of this, certain transportation options are excluded by some typologies very early in the decision process such that, for them, the classically accepted determinants of choice are actually largely irrelevant.

It is hypothesised that, based on the evidence contained in the literature review and the results of the small exploratory exercise (see Appendix 4), that risk aversion, to a greater or lesser degree, play a large part in the transport decision-making process. Corporate risk cannot be disassociated from personal risk attitudes. Explorers, employing maximizing strategies, using probabilistic methods based on analysis and hard data should be less influenced by personal risk attitude than the Conformers tending to base decisions on past experience and decision heuristics.

If, as described by Di Mauro and Maffioletti (2004) ambiguity (i.e. uncertainty or lack of information) is even more significant than risk, then the Russian trade probably exemplifies such a situation. Road based options are generally thought to be less risky (i.e. more separate vehicles and consequently less chance of them all suffering a major or arbitrary delay). Thus, the more risk averse decision-maker (Conformer) is going to be inclined towards a road-based option. Explorers are associated with being slightly more tolerant towards risk and, based on their maximizing preference, should be inclined towards a sea-based option. Improvers, tend to be risk neutral (but may be tipped towards risk averse by ambiguity), combine maximizing strategies tempered by bounded rationality. Thus, it is proposed that Improvers will select the mode that is most appropriate for the cargo and the conditions prevailing at the time, i.e. D'Este and Meyrick's (1992) "Many Baskets" strategy.

The sixth proposition in this study is that, for shipments between the UK and Russia, a) Explorers are most likely to prefer a sea based option, b)

Improvers are most likely to use a "Many Baskets" approach, and c) Conformers are most likely to limit themselves to one option, most probably road based.

4.5   Conclusion

The theoretical model proposed here takes into account the decision-making protocols that have been identified in the literature review, and applies them to the structural model specified by D'Este and Meyrick (1992). The structural model allows investigation of the process in a hierarchical format where cognitive style, risk attitude and information gathering can be exposed in a way that highlights the differences between maximizing and satisficing strategies. For the purpose of the investigation a taxonomy has been applied that associates the Myers Briggs typologies with three separate channels, namely Explorer, Improver and Conformer. It is not intended that this taxonomy is pejorative (any more so than the underlying MBTI specification) but it is, never the less, metaphoric for the types of behaviour encountered and which are strongly supported by other research in similar areas. In any event, the classification used is not revealed to the respondents.

Thus, the theoretical model is designed to test whether associations exist between the three types of decision-maker and the parts of the decision process as detailed in Propositions 1 to 4 and 6. Proposition 5 is an exception insofar as, part of the evaluation process, it is intended to measure the relationship between determinants of dissatisfaction and choice.

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Chapter 5

5 CHAPTER 5 – METHODOLOGY AND INSTRUMENT DESIGN

5.1 Introduction

This chapter accounts for the research methodology and instrument design used in this study for collecting and analysing data. The chapter is set out as shown in Figure 5.1.

Structure of Chapter 5 - Instrument Design

Source: Author
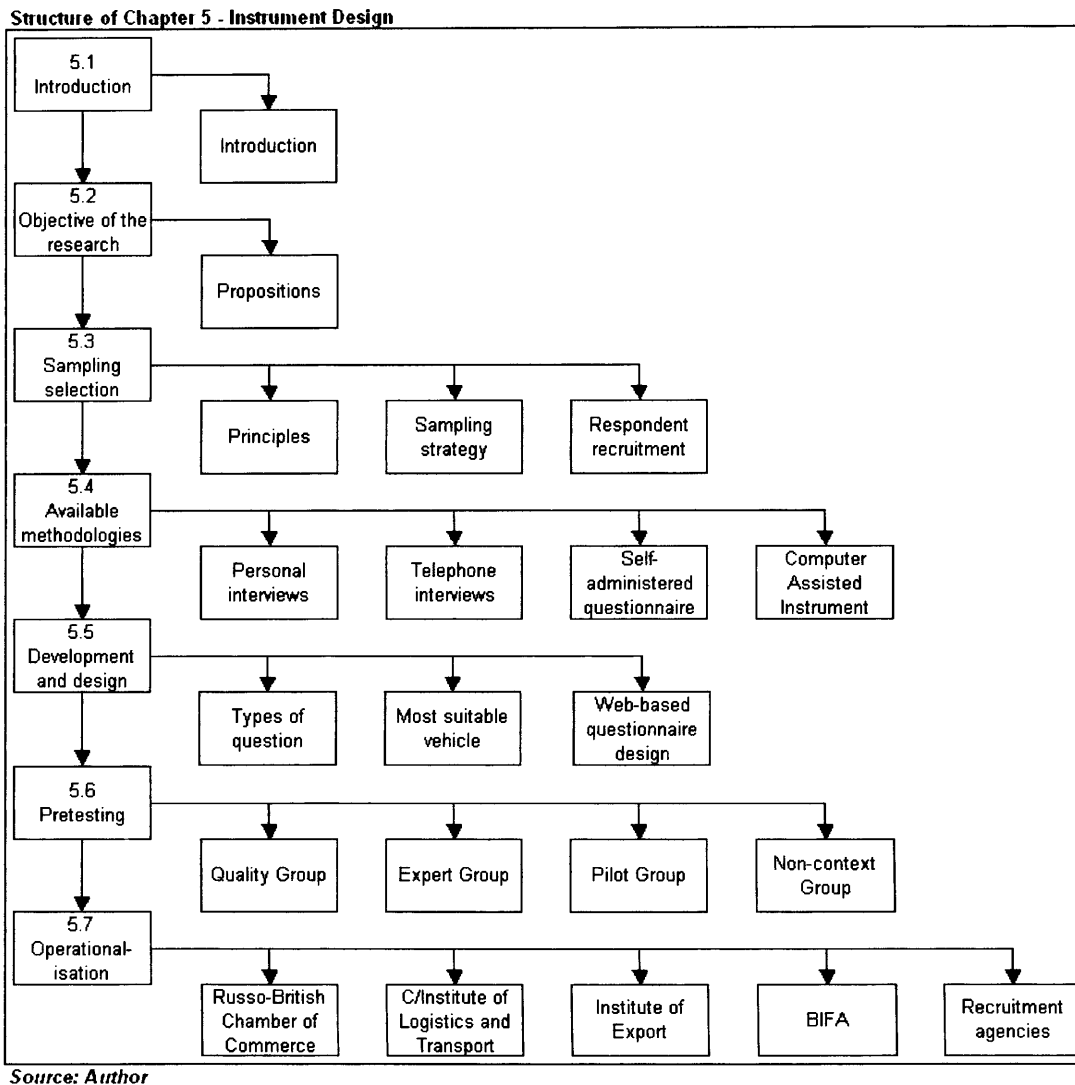
Figure 5.1 – Structure of Chapter 5 – Methodology and Instrument Design

5.2 Objective of the research

The primary objective of the research instrument in this study is to establish correlation between the typology of the respondents and their decision-

making process with respect to freight transportation choices. In order to achieve this objective the survey instrument has to solicit sufficient relevant data to support or disprove the propositions set out in Chapter 4. In summary, the propositions are:

- *First* - All decision-makers will respond to reactive triggers to review transport arrangements but only Explorers and (possibly) Improvers will be proactive seeking improvements or new solutions.

- *Second* - Explorers tend to be in the new buy-class, Improvers in the modified rebuy class and Conformers in the rebuy class.

- *Third* - Conformers tend towards limited search strategies (LSS) concentrating on the current mode and service, Improvers also tend to use limited search strategies (LSS) but across all feasible alternatives, and Explorers are more likely to use comprehensive search techniques (CSS) across all feasible alternatives.

- *Fourth* - Explorers, whatever mode they are currently using, are likely to weigh the feasible options and select the mode most suitable according to the information available (new buy or modified rebuy). Improvers will tend to remain with the current mode (not exclusively) but look for service improvements (modified rebuy). Conformers will tend to remain with the mode, service and carrier currently used, except if they have inherited an option they perceive to be too risky, in which case they may change to a less risky option (rebuy or modified rebuy).

- *Fifth* - Determinants of choice are actually determinants of dissatisfaction arising from the most recently used transportation choice.

- *Sixth* - For shipments between the UK and Russia, a) Explorers are most likely to prefer a sea based option, b) Improvers are most likely to use a "Many Baskets" approach, and c) Conformers are most likely to limit themselves to one option, most probably road based.

5.3   Sampling selection

The most elementary sampling question is, "who is the population of interest?" (Czaja and Blair, 1996a). The context chosen for this study is UK

exporters employing surface freight transportation to Russia. The ideal respondents are the transportation decision-makers employed by exporting firms in that trade. Because the United Kingdom to Russia is a relatively narrow market, at the present time, the overall population is quite small. Thus, to attain a sufficiently large sample to produce reliable results, both the response rate and the quality of the data solicited from each respondent have to be high.

Marshall and Rossman (1999a) observe that well developed sampling decisions are crucial and should be based on logical judgments and well-presented rationale. There are three steps in the sampling decision:

- Assess the number of valid responses required reliably to prove or disprove the propositions – statistically adequate sample size;
- Identify and select respondents that are sufficiently representative of the entire population such that the results may be generalised;
- Gain access to the target population in a manner consistent with the previous two.

The decision regarding sample size entails the usual trade-off between cost and rigour. Factors that have to be taken into account are (Pearce & Özdemiroglu, 2002):

- Variance in the underlying population (which shows how varied the data is relative to the average, i.e. the bigger the variance, the bigger the sample needs to be);
- The precision required in the estimates - the 95% confidence interval is a widely used benchmark;
- The likely response rate;
- The need for any disaggregated information - the more sub-samples, the larger the overall sample required; and,
- The resources available for the study.

The more homogeneous the population under study, the smaller the sample needs to be, to accurately reflect the characteristics of that population (Adams & Schvaneveldt, 1985a). Unfortunately, the target population in this study is likely to be diverse (e.g. geographically dispersed across the UK and different

commodity groups), defined by variables not necessarily measured as part of the study (extraneous variables). Thus, this variance dictates a larger sample size is required than might otherwise be the case. However, offsetting the potential variety in the population is the size of the sample in relation to the total population. As the total number of firms shipping freight between the United Kingdom and Russia is quite small, even a modest number of respondents will constitute a reasonably large proportion of the total population.

The limited number of available respondents creates its own problems. Unless fairly certain methods are employed to, a) identify as many of the total population as possible and, b) ensure a very high response rate from those targeted, the impact of any attrition on the population available will severely impact the validity of the survey. Given this limitation, and the normal financial constraints on this type of study, different methods of sampling were considered.

There are two distinct categories of sampling techniques, namely probability sampling and non-probability samples. Probability sampling is where there is the same probability that a given element will be included. There are four different subcategories:

- *Simple random sampling* – all elements or groups of elements have the same chance of being included.
- *Systematic random sampling* – every nth unit of the population is included.
- *Cluster sampling* – simple or systematic sampling is carried out within a preselected group or unit in order to reduce the logistics problem of sampling across the whole population.
- *Stratified random sampling* - the population is divided into parts or strata according to some characteristic.

Random sampling implies that the researcher, by using any method to select a proportion of the target population, deliberately denies himself access to some potential respondents. It can be seen that given the size of the overall population in this market, any method that precludes potential respondents

would be inappropriate. Hence, only the different methods of non-probability samples were examined:

- *Snowball sampling* – obtaining a sample by identifying a primary range of subjects and using these to refer on to other subjects with like or similar characteristics (Bailey, 1978 and Eckhardt and Ermann, 1977).

- *Convenience sampling* – the main features are availability, convenience and accessibility. Unfortunately, this method is not likely to be truly representative of the total population and is sometimes referred to as accidental (Selltiz, Wrightsman and Cook, 1976) or incidental (Meyers and Grossen, 1974).

- *Purposeful sampling* – a sample based on cases, individuals or communities judged to be appropriate or very informative for the purpose of the research in question.

- *Quota sampling* – a special edition of stratified sampling which attempts to include various elements in the population sometimes, but not always, in the proportion to which they are believed (or known) to occur in the whole population (Adams & Schvaneveldt, 1985b).

Following the same principle for dismissing probability methods, no form of sampling that excludes any potential respondents in the United Kingdom to Russia trade were considered appropriate. Thus, a decision was made to attempt to identify as many of the target population as possible (purposeful sampling), recognizing that even with this approach it was going to be difficult to achieve sufficient responses to validate the research, and be able to generalise the findings beyond the confines of this very specific trade route. Under such circumstances, in order to optimise the effectiveness of the research, multiple data sources were used to identify potential respondents (Marshall and Rossman, 1999a; Robson, 2002a):

- Government sponsored sources (UK Trade and Investment Section, Foreign Office and British Embassy in Moscow);

- Commercial market research databases identified through BRAD (British Rates and Data) (Thomas, 2004);

- Trade directories and other hard copy resources using OCR (Optical Character Recognition) and speech recognition software (Robson, 2002b);

- Trade associations (Harding, 1994);

- Conference organisers in the Russian market (Scholes, 1997);

- Referral from carriers (road and sea transport) identified through the trade press and other sources;

- Advertising for respondents in the appropriate trade press;

- Internet research (Nancarrow et al., 2001);

- Snowball referrals (Bailey, 1978 and Eckhardt and Ermann, 1977).

The UK Trade and Investment Section of the Foreign Office keep a directory of British Businesses operating in Russia (total of 220 of which 186 were valid). These companies (based in Russia) were contacted by email and seven referrals to UK based exporters were achieved. The Section head was not prepared to divulge the list of companies based in the UK that subscribe to the Quarterly Bulletin on Russia (about 400 subscribers).

Commercial market research databases should provide a readily accessible source of data for this type of research. A shortlist of possible providers was compiled using BRAD (British Rates and Data) directory. The original list was extracted from the BRAD CD (See Table 5.1) but is now available on line from Intellagencia (http://www.intellagencia.com) at a subscription cost of £1,200. The information sources contained in the databases identified from the CD version are reported to be of high quality. For example, the description for the Dun and Bradstreet reads (BRAD, 1998):

"Extracted from the D&B European Marketing Database, comprising some 3.5 million actively trading businesses in eighteen countries. Maintained and updated locally by 500 business analysts across D&B's European network of offices, through telephone research, postal questionnaires, company accounts and press reports."

Such databases would be of use if the relevant data could be extracted economically. Unfortunately, in the context of this study, no field in the

databases reviewed, specifically identified companies exporting from the UK to Russia. The cost of using such databases is also a problem as the suppliers typically charge £250 per 1,000 entries identified (for example, "exporting companies" based in the UK). Further costs are anticipated because, in order to avoid users selling the lists on, the supplier generally insist that their own mail contractor distributes the mailing, rather than providing access to the vanilla database. For the research in question, and because it was not possible to narrow the criteria sufficiently (based on the fields available) the cost of this approach was considered prohibitive.

Summary of BRAD analysis

Supplier	Database	Area
Market Monitor	Exporters and Importers	UK
Marketscan	Exporters by their export sales	UK
Dun and Bradstreet	Exporters	UK
Newman Books	Exporters	UK
Acxiom	Exporting companies database	UK

Source: Author (extracted from BRAD CD)

Table 5.1 – Summary of BRAD analysis

Trade directories (hard copy) obtained through libraries etc. can be a useful method of identifying potential respondents. Extracting data from such sources is time consuming if it is not possible to obtain electronic versions. The Dun and Bradstreet European Directory (D&B, 1999) was analysed to see whether sufficient firms could be identified for this study. Both Optical Recognition and Speech Recognition techniques were used to extract the data and build a database. Of 1,687 exporting companies (80 per cent or more export business), only 35 companies in the UK qualified and only 16 responded to a pilot mailing – none of which were valid).

Several trade organisations were identified that were considered relevant to this study:

- Russo-British Chamber of Commerce;
- Institute of Export;
- Chartered Institute of Logistics and Transport;
- Road Haulage Association;

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– British International Freight Association (BIFA).

Some of the associations contacted were reluctant to provide information about their members, while others were prepared to make referrals on an individual basis. Some, BIFA for example, provide search facilities in order that customers can make contact with member organisations in their area (searched by post code) in order to book freight. Quite useful data can be harvested from such Internet sites using copy and paste functions and reasonably simple MS Excel search and string editing techniques. This method of respondent identification was used to email forwarding agents to obtain indicative market rates, transit times and snowball referrals to customers.

Conference delegate lists (freight and industry sectors) are a useful source of contacts in freight shipping. In the past, such lists have been made freely available to delegates attending conferences and, occasionally, on the Internet (with the objective of demonstrating who is attending and attracting more bookings). Recently, however, such lists have been more difficult to obtain (because they have been used by other marketing organisations to "spam" delegates), although some conference organisers have been quite helpful providing lists when the objective of the study has been explained. In this latter case, although it is usually explicit that delegate information is not commercially confidential, some of the conference and exhibition organisers who did assist asked not to be identified.

One source that has not been mentioned in the literature is recruitment agencies. One agency approached provided access to the "Monster.com" recruitment database. Using key words to define organisational roles, about 70 potential respondents were identified. Care was taken, particularly with this source of information to explain to potential respondents 'how' and 'why' they had been contacted.

In order to remain within recognized ethical guidelines for Internet research (see Appendix 5), strict principles were applied. Only sources where respondents, when divulging their contact details, might reasonably expect to be

contacted for research/market research purposes were used. Specifically, every effort was made to avoid use of techniques such as agents, baiting, buddy letters, cookies (although IP addresses were temporarily recorded to ensure respondents did not attempt to claim multiple incentive payments), scamming, sifting, spamming, spoofing and surreptitious sampling (Market Research Society, 2006)[17].

The trade press, both hard copy and Internet versions proved quite useful to identify carriers operating in the general trading area (sea, road and rail). Using Lloyds Loading List (LLL, 2006) and Containerisation International Yearbook 2006 (Containerisation International, 2006), all the maritime carriers to Western Russia were identified. Road, rail and sea transport carriers to the Baltic region and Russia were identified from the Web site "FreeCargo.com" (FreeCargo, 2006). Transport carriers (sea and road) actively operating in the UK to Russia trade were approached for referrals to customers. Despite the assurances that individuals and firms would not be identified, and that the data would not be used commercially, very few actually agreed to provide any information about customers. Some did consent to pass on the details of the study to customers for them to participate independently if they wished. Confidentiality (see Appendix 6 – Privacy Policy), and the perceived sensitivity of customer related information is a major problem for real-world researchers (Robson, 2002c) and particularly in shipping which is highly competitive and with a very perishable commodity.

One strategy was to advertise in the trade press with known readership in the trade between the UK and Russia. Several publications were identified as being relevant:

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[17] 1. Agents: The use of "agents" (e.g. spambots, GIFs, spiders and sniffers) that collect information without the respondents' informed consent. 2. Baiting: Misleading newsgroup postings to trick potential respondent into giving personal data that will be used for future research or other purposes. 3. Buddy letters: Chain letters that are disguised as being for a "good cause" which are for the purpose of list building. 4. Cookies: Small file downloaded onto the computer to enable the originator's Website to recognize users when they return. 5. Scamming: Selling under the guise of research. 6. Sifting: Collection of respondent emails from Websites, portals, etc. without specifically notifying individuals that the data will be used for research. 7. Spamming: Unsolicited email recruitment of potential respondents. 8. Spoofing: The practice of putting an incorrect address for respondents to request their removal from a list. 9. Surreptitious sampling: The purchase of bulk email addresses from sources that have not provided verifiable documentation on the validity of the collected data.

- International Freighting Weekly (general);

- World Cargo News (general);

- Lloyds Loading list (maritime);

- Rail Freight Group Newsletter (rail) -
  www.rfg.org.uk/news/newsletter/;

- Rail Freight Online (rail) - www.railfreightonline.com;

- Railnews.co.uk (rail) - www.railnews.co.uk;

- Roadway (road) - www.roadway.co.uk.

Unfortunately, with the exception of International Freighting Weekly and Lloyds Loading List, the audience for these publications tends to be parochial, in the sense of being a forum for exchanging information between the service providers themselves, rather than potential customers. Even so, this method did generate some interest and contributed on a referral basis.

Internet research covers a whole range of potential sources, including some of those mentioned above (conference delegate lists, trade association membership lists, trade directories, etc.). In addition, general searches identified potential respondents through press articles, consultancy reports, tenders and other documents. The main sources of readily usable data for this study came from freight exchanges and trade opportunity Web sites, of which nearly one hundred were identified[18]. Many of these sources were obviously not relevant to the trade in question, or the validity of the collected data could not be verified (as voluntarily submitted), but others appeared to be of interest on face value, and these were investigated further.

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[18] 1. 01Wholesale; 2. AaronAble Enterprise Service; 3. AfaceriOnline; 4. Africa Trade; 5. AllactionTrade; 6. allesHandel-allTrade; 7. Allproducts; 8. Arab Trader Network-TajerNet; 9. Asia Goods; 10. AsianNet Trade InfoCenter; 11. Asia's Marketplace; 12. BISNIS; 13. Biz-Channel; 14. Bizviet; 15. BORZA; 16. Business Netvigator; 17. BusyTrade; 18. Chamber Trade; 19. China Exporter Online; 20. Chinapages; 21. ChinaTradeZone; 22. CountryWeb; 23. Czech Info Center; 24. Eastern European Trade Board; 25. EC Plaza; 26. ECeurope; 27. Eurocommerce Australaia; 28. EXIMTURK; 29. Export 61; 30. Export Drive - Europe Export portal; 31. Extrem; 32. FOB-China.com; 33. Free Trade Front; 34. Global Arts and Crafts Online; 35. Global Trade Networks; 36. Global-Trades-Ltd; 37. Handicraft Exchange; 38. Holland@TradeNet; 39. IDS; 40. Import - Export Bulletin Board; 41. Import and Export Trade Leads; 42. Importers and Exporers of Auto and Transportation; 43. IndiaMart; 44. INDOBIZ; 45. Info-Business Trade; 46. InterMeding; 47. International Business Forum; 48. International Trade Corner; 49. International Traders Bulletin Board; 50. Italbiz; 51. JETC - International Trade Leads Management; 52. Marketz; 53. Marketz.com; 54. MBendi; 55. MBL Sales; 56. Mediterranean Trade Board; 57. Netglobaltrade; 58. Offer 21; 59. OneTrade; 60. Peach21; 61. Petrosilicon; 62. Planet Business; 63. RusBiz; 64. Seckin Net; 65. ShipLink; 66. Taiwan Commerce; 67. Tenderseek; 68. ThaiPost-Trade Bulletin Board; 69. ThaiTradePoint Business Board; 70. The Seven Seas Business; 71. Trade Zone Suppliers Manufacturers Directory; 72. Trade-India.com; 73. TradeMatch; 74. Trader Listing; 75. TradeWeb; 76. Tramatch; 77. TubeNet; 78. vCanvas; 79. VenExport; 80. Venezuela Export Directory; 81. Vorras Trade Leads; 82. WebBusiness; 83. WebIndia; 84. WholesaleNet Australian Saleboard; 85. WisBen; 86. Wood-me; 87. World Trade Exhibition; 88. World Trade Forum; 89. World Trade Point Federation; 90. World Trade Search; 91. Worldbid; 92. WorldbidBeauty; 93. WorldTradeAA; 94. WTCA On-Line; 95. WTN Trade Center; 96. Ypage BBS; 97. YU Trade Leads

- **Freight Exchanges:**
  - FreeCargo (http://www.freecargo.com);
  - Cargonet (www.cargotrans.net).
- **Trade opportunities:**
  - World Trade Point Federation (http://www.wtpfed.org);
  - Worldbid (http://www.worldbid.com);
  - 01Wholesale (http://01wholesale.com);
  - ECeurope (http://www.eceurope.com);
  - CountryWeb (http://www.countyweb.co.uk);
  - TradeMatch (http://www.tradematch.co.uk);
  - JETC (http://www.jetc.com);
  - Global Trade Networks
    (http://www.globaltradenetworks.com);
  - Tramatch (http://www.tramatch.com);
  - RusBiz (http://www.rusbiz.com).

Some of these sites were found to be unsuitable because of the trading area (e.g. Tradematch – Netherlands or JETC with no leads to Russia) whilst others require quite impressive monthly subscriptions (ECEurope and RusBiz at $65 and $70pcm respectively). Even so, between all of them some quite useful potential respondents were identified.

One of the problems with all Internet based research is that because the information is readily available, and easily harvested, it is overused. This is particularly true of email addresses posted on the Internet that are not subject to auditable cleanliness and integrity criteria of the commercially available lists. The following problems are known to occur with Internet researched email lists:
- Old and "dead" addresses;
- Typing errors on entry (e.g. petr@hotmial.com);
- Missing or mistyped operators (e.g. peter'hotmail.com);
- Inadvertent spaces (e.g. peter@hot mail.com);

– Bogus entries, and retired domains (e.g. asdf@asdf, test@hotmail.com);

– Duplicates;

– Spamtrap addresses (e.g. abuse@yahoo.com);

– Spam filters (manual and intelligent).

Internet based research typically has lower response rates than, for example, mail surveys (Czaja and Blair, 1996b). In an exploratory study addressed to carriers (see below), of the 3,107 emails sent, 1,360 (44%) were returned as undeliverable and one as suspected "spam". Following a clean up of the email database (based on the known problems listed above) the failure rate was reduced below 20% for the two follow-up messages.

Ultimately, it was decided to use both random and purposeful sampling methods. Suitable respondents were identified for the main survey using qualifying criteria:

– The respondent should work for an organisation that has shipped freight from the UK to Russia (road, rail or sea) in the past twelve months;

– The respondent should be part of the transportation decision-making process within the organisation.

Using all the available resources identified above, and applying the qualifying criteria, the following classes of respondent were contacted:

– Exporting companies identified through UK Trade and Investment Section and conference delegate lists – 220 letters sent;

– Chartered Institute of Logistics and Transport (random stratified sampling) – Approximately 300 emails forwarded by the Secretariat;

– Institute of Export (random stratified sampling) – Approximately 400 emails forwarded by Secretariat;

– Recruitment agencies (purposeful sampling) – Approximately 70 personal phone calls facilitated;

– Referrals from Company Secretaries of identified export companies (purposeful snowball sampling) – 230 letters sent.

The results of these contacts, together with the respective response rates, are reported in Chapter 6.

5.4   Available methodologies

There are broadly three alternative research methodologies that can be employed for this type of study. These are (Czaja and Blair, 1996c):

- Personal interview;

- Telephone interview;

- Self-administered questionnaire.

Various hybrids of these methods involve the use of computers to present information to respondents and/or to facilitate data collection and analysis. These are collectively known as Computer Assisted Instruments (CAI).

5.4.1 Personal interviews

Given unlimited resources, personal interviews, whether computer assisted or not, probably offer the most reliable way of collecting survey data. Personal interviews have a number of important advantages (Hill, Bierley & MacDougall 2003a):

- The ability to build a rapport with respondents face-to-face;

- Easier to achieve total respondent understanding, by explanation and answering queries or correcting misunderstandings as they arise;

- Visual prompts such as display cards or computer-generated images can be used for clarification or, for example, rating scales;

- Complex questions can be more easily explained;

- Supplementary information can be gathered by the interviewer that can be used to illuminate the answers to direct questions;

- Personal interviews can be carried out in impromptu situations, without detailed planning or having to obtain contact information for the target population, e.g. captive audience on passenger trains, football supporters or in some cases, at the respondent's place of work.

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Not withstanding the above, personal interviews do have disadvantages:

- The interviewer should be able to relate to the person being interviewed on both a personal and intellectual level, i.e. they need to be able to hold a proper conversation with the people they are interviewing. This may be achieved through selection and/or training;

- Personal interviews typically take more time because of the very interactive and iterative elements that create some of their advantages;

- Interviews generally have to be scheduled for the convenience of the respondents such that they may not be able to be arranged in the most orderly fashion for the interviewer;

- In addition to the issues of time and scheduling, respondents may be scattered over a wide geographical area involving the interviewer in time consuming and potentially expensive travelling time between interviews.

For non-funded research, especially where respondents are geographically dispersed, personal interviews, despite the advantages are, generally, not a practical option.

5.4.2 Telephone interviews

Telephone interviews share some of the advantages of face-to-face personal interviews (Czaja and Blair, 1996d; Hill, Bierley & MacDougall, 2003b):

- They are a very quick way of gathering survey data;

- They are relatively low-cost, especially in comparison with personal interviews;

- The two-way communication means that the interviewer can still explain anything that is not fully understood, and thus minimize the risk of misunderstanding;

- Complex questions can be explained;

- Supplementary information can be gathered by the interviewer that can be used to illuminate the answers to direct questions;

- Geographical location is not a major problem (even worldwide) particularly as international call costs are now relatively cheap.

Telephone interviews still have some significant disadvantages:

- Generally, telephone interviews have to be quite short – possibly no more than 15 minutes for business type interviews;

- Questions have to be quite short and straightforward and there are certain types of questions that cannot be used on the telephone, i.e. ungraded scales (Hill, Bierley & MacDougall, 2003c);

- Scheduling of telephone interviews can be difficult, even when prior appointments have been made, as respondents are frequently detained or called away to more pressing business. Telephone appointments are more easily escapable than face-to-face interviews because the commitment is perceived to be lower. It is recommended that, in business markets, up to five call-backs should be made to ensure good sampling reliability (see Table 5.2);

- As well as the communications demands placed on personal interviewers, telephone interviewers need to be sufficiently authoritative to persuade respondents to participate in the interview, whilst being relaxed and friendly enough to build a rapport with respondents.

Multiple callbacks for accurate sampling

Average number of attempts required to make contact in telephone surveys	
1 attempts reaches	24% of the sample
5 attempts reach	75% of the sample
8 attempts reach	89% of the sample
17 attempts reach	100% of the sample

Source: Hill et al. (2003)

Table 5.2 – Multiple callbacks for accurate sampling

5.4.3 Self-administered questionnaire

Self-completion questionnaires are typically administered in the form of a postal survey. Other methods of distribution, such as fax, email or even Internet

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can be used. The critical feature that differentiates self-completion questionnaires from other methods of survey is that they are performed entirely by the respondent without any intervention from the researcher. For this reason, they have some distinct advantages and corresponding disadvantages. The main advantages are (Hill, Bierley & MacDougall, 2003d; Robson, 2002d):

- They are usually cheaper to administer than any other form of survey, although, because of hidden costs, such as printing and distribution, the differential is not always as much as may be imagined. Costs of distribution may be reduced by using email, but because the cost is lower, "email fatigue" means that response rates can be factorially more dismal than the 50% or less response rate for postal surveys (Barnett, 2002a);

- There is absolutely no risk of interview bias (although framing becomes an even more important issue);

- Self-completion surveys are highly suitable for surveying large numbers of respondents who are geographically widely separated;

- Self-completion surveys engender a perception of anonymity that encourages frankness where sensitive information is concerned;

- A hybrid of the postal self-completion survey is the drop-and-post-back. The advantage this form of survey has over other self-administered surveys is that, because the questionnaires are delivered personally, they are more likely to engender interest and co-operation; they allow identification of otherwise inaccessible respondents and they provide an opportunity for queries to be sorted out face-to-face. For these reasons, better response rates and reliability are typically achieved than with pure self-administered methods (Barnett, 2002b).

Self-completion surveys have some serious disadvantages:

- Questions may be ignored or only partially completed;

- If any queries or uncertainties arise, they have to be resolved by the respondent without any guidance from the researcher;

- Cognition, literacy, language and other potentially unknown or unforeseen factors may impair the ability of the respondent to complete questionnaires fully and accurately (high abandonment rates);

- The ease with which self-completion questionnaires can be distributed and their consequently widespread use (and often poor quality) may lead to "question fatigue", which can result in surveys not being fully completed, or completed without adequate thought as to the accuracy of the answers.

5.4.4 Computer assisted instrument (CAI)

Computer assisted methods can be used to enhance the effectiveness of several of the above sampling techniques. Electronic questionnaires were first used in the USA in the 1960s, where respondents to a medical survey were offered questions on screen and entered answers directly into a university computer (Evans and Miller, 1969). Since then, various computer-assisted techniques have been developed. These include Computer Assisted Telephone Interview (CATI) (Bonnel and Le Nir, 1998), Computer Assisted Personal Interview (CAPI), Computer Assisted Self Administered Interviewing (self-completion questionnaire), Audio Computer Assisted Interviewing (ACASI) (Tourangeau and Smith, 1996) and Computer Assisted Web Interviewing (Fricker et al., 2005).

Computers can be used in a variety of ways to assist with the collection of survey data. The following list illustrates the scope, but is by no means exhaustive:

- Information can be displayed to respondents to provide background explanations or illuminate questions (Couper, et al., 1998a);

- In CAPI interviews, by turning the screen to face the respondent, questions can be displayed which the respondent can then answer on screen (Couper, et al., 1998b);

- In CATI environments computer technology can be used to provide contextual scripts or vignettes so that the interviewer can tailor the interview in a structured manner (Presser, et al., 2004a);

- Computers may be used to provide the underlying technology to support Web-based interviews – CAWI (Jones and Stopher, 2003);

In both CAPI and CAWI contexts, computers may be used to provide the underlying functionality for Computer Adaptive Tests (CAT) such as adaptive stated preference (ASP) / adaptive conjoint analysis (ACA) experiments (Wainer and Dorans, 2000; Presser et al, 2004b).

A comparison of the various methods of surveying data is shown as Table 5.3.

Comparing survey types

	Mailed	On-line	Telephone	In person
Characteristics	Paper and pencil	Internet based (CAWI)	Can be done with written script or computer assisted (CATI)	Can be done with written script or computer assisted (CAPI)
Advantages	Can reach large geographic areas People are used to completing paper-and-pencil surveys Can take the survey with you and complete it anywhere	Worldwide Order of questions can be preprogrammed Only "legal" answers are accepted Can give respondent links that explain unfamiliar words and help with difficult questions Data are automatically entered and can be automatically analysed	Can explore answers with respondents Can assist respondents with unfamiliar words	Can explore answers with respondents Can assist respondents with unfamiliar words
Disadvantages	Need a motivated sample to return survey. Many people think they have too much to do without also having to complete surveys Respondents must be able to read and write	Need reliable access to the Internet Respondent must be able to use a browser Browser must support survey graphics and functionality	Need trained interviewers Need to make sure respondent is in office If using computer assisted interviews will need technical expertise to program them	Need trained interviewers Must find suitable place to conduct the interview
Special needs	Up-to-date address list Follow-up mailings Incentives	System can go down or be unreliable Technical expertise Convincing method of ensuring privacy and confidentiality	Up-to-date telephone numbers Schedule for reaching respondents May need sampling expert for random digit dialing	If on-site, need space and privacy May be difficult or dangerous to go to person's home
Costs	Printing, paper, envelopes, stamps, incentives	Mainly technical (e.g. someone who is experienced designing on-line surveys)	Training, incentives, telephones and telephone charges. Computers and technical expertise, sampling expert	Training, space, travel, incentives

Source: Adapted from Fink & Kosecoff (2005).

Table 5.3 – Comparing survey types

5.5 Instrument development and design

There are three key issues addressed as part of the instrument development and design:

- The type of questions to be asked, and the best techniques to use in order to elicit responses that support or disprove the six propositions;

- The most suitable instrument to use as a vehicle for those questions and techniques;

- The design and implementation of the instrument itself.

An outline of the approach used to develop appropriate survey questions to test the propositions is given in Figure 5.2. Although the questionnaire is Web based, and incorporates both branching and interactive functionality (particularly the adaptive stated preference section), a hard copy version has been produced as Appendix 7.

Instrument Design - Overview

Objective	Framing	Type	Questions	Analysis
Decision-maker's Typology	Psychometric test	Ex/Cl/Proprietary	7. Jungian Typology Test	
Qualifying	Decision-maker	Ex/Cl/DC	1.1 Who initiates transportation reviews?	
		De/Cl/DC	1.2 What is Decision-maker's influence?	
			1.4 Who implements KPIs??	Measures of association
- First proposition - Trigger	Determine trigger	Qu/Cl/DC	1.3 What triggers transportation review?	
- Second proposition - Buy Class	Determine buyclass	Qu/Cl/DC	2.1 How many shipments UK/Russia?	
		De/Cl/DC	2.2 How many different SEA carriers?	Measures of association
			2.3 How many different ROAD carriers?	
			2.4 How many different RAIL carriers?	
- Third proposition - Information	Determine strategy	De/Cl/MC	3.1 Internal data gathering strategy?	Measures of association
			3.2 External data gathering strategy?	
		Ex/Cl/DC	3.3 Which gathering strategy is used?	Measures of association
- Fourth proposition - Risk	Determine attitude	De/Cl/DC	4.1 Have arrangements changed?	
			4.2 Did you inherit arrangements?	
- Fifth proposition - Determinants	Compare factors	Ex/Cl/Ra	5.1 Determinants of dissatisfaction?	Probability
		Ex/Cl/ASP	5.2 Determinants of choice?	
- Sixth proposition - Modal choice	Contrast factors	Im/Cl/ASP	6.1 Service Choice preferences?	Part- worths
		Im/Cl/ASP	6.2 Route Choice preferences?	
Contact details	Minimum details	Optional	8. Respondent's details?	
Demographics	Supplementary data	Ex/Cl	9. Decision-maker/organisation?	
Acknowledgements	Housekeeping	Ex/Cl/DC	10. Incentives/recognition?	

Key: ASP = Adaptive stated preference CI = Closed DC = Discrete Choice De = Deductive Ex = Explicit MC = Multiple Choice Qu = Qualifying Ra = Ranking

Source: Author

Figure 5.2 – Instrument Design - overview

5.5.1 Types of questions to be asked

The core objective of this study is to relate the various stages of the transport decision-making process, as well as the ultimate modal choice, as described in Chapter 4 (page 168), to the decision-makers typology. In order to do this, the questionnaire is split into five types of question:

a) Questions that screen out respondents who are not qualified to participate;

b) Questions that determine the respondent's typology;

c) Questions that link the respondent as the key decision-maker to observable transport decision-making strategies;

d) Questions that expose the decision-making process and outcomes;

e) Personal information (optional), demographic and housekeeping questions.

a) Screening - There are two qualifying questions in the questionnaire. The first determines whether the respondent works for an organisation that ships freight to Russia and the second if the respondent is part of the transportation decision-making process within that organisation. If respondents answer "no" to either of these questions, they are advised not to proceed with the questionnaire (Schonlau, Fricker & Elliott, 2002a).

b) Typology - In order to determine the respondent's typology they are asked to complete a short psychometric test. There are various psychometric tests that can be used to establish a person's preferences, including inventory profiling, the Big Five and the Myers Briggs Typology Index[19]. The psychometric analysis identified as the most suitable for the purpose of this study was the Jungian Typology Test which produces comparable results with the MBTI (Domino and Domino, 2006a and Bayne, 1997). Rather than develop a completely separate instrument for this study, requiring highly specialized knowledge of psychology, a proprietary test was identified that was suitable for the purpose. The test was selected due to it being slightly shorter than other instruments of a similar type and because it lent itself to the technology contemplated for the rest of the survey. Permission to use the test was obtained from the proprietors, Humanmetrics, together with validation data (see Appendix 8). The typology test comprises 72 questions that require a "yes" or a "no" answer. The questions are quite short and reasonably easy to evaluate from readily available information. For validation and mapping of the test (showing the impact of answers on the bipolar scales) see Appendices 8 and 9 respectively.

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[19] Other psychometric tests available, include: The Four Temperaments/Four Humours, Carl Jung's Psychological Types, Myers Briggs personality types theory (MBTI model), Keirsey's personality types theory (Temperament Sorter model), Hans Eysenck's personality types theory, Katherine Benziger's Brain Type theory, William Moulton Marston's DISC personality theory (Inscape, Thomas Int., etc), Belbin Team Roles and personality types theory, The 'Big Five' Factors personality model and Firo-B Personality Assessment model. A comprehensive review is included in Section 3.6.2, page 113.

c) Decision-maker - There are four questions that relate to the role of the respondent in the decision-making process. These are in Section 1 of the questionnaire. Question 1.1, 1.2 and 1.4 determine whether the respondent is directly responsible for making transportation decisions within the organisation or, if indirectly, how the decisions are influenced. Question 1.3 elicits the type of trigger that is likely to initiate a transportation review within the organisation and is an observable part of the construct that tests the first proposition.

d1) Proposition 1: Trigger – Question 1.3 of section 1, as well as helping to illuminate the respondent's role as the decision-maker, also explores the key trigger for initiating a review of transportation arrangements.

d2) Proposition 2: Buy-class - The questions in Section 2 explore the respondent's buy-class corresponding to the first proposition. The first question qualifies the following three by classifying the shipper by the number of overall surface shipments to Russia in the last twelve months. The next three questions determine the number of shipments made by sea, road and rail respectively. By analysing the questions in conjunction with each other, it is possible to determine the buy-class. If the answer to the first question is plural and the answer to one of the three following questions is singular, the buy-class is rebuy. If, on the other hand, the answer to only one of the following questions is plural then the buy-class will be modified rebuy or new buy. Plural answers to the first, and one or more of the following three indicates a "Many Baskets" strategy.

d3) Proposition 3: Information - Section 3 tests the respondent's predecisional information gathering strategies. Question 3.1 specifies various sources of internal information and 3.2 identifies possible sources of external information. The respondent is invited to indicate which predecisional information sources are used and whether informal, or formal methods of evaluating are applied. The use of the descriptions formal, and informal are explained on the questionnaire. In 3.1, relating to internal information, formal information gathering is said to mean contemporaneous record keeping and objective evaluation. In 3.2, relating to externally available information, informal

information gathering is said to imply scanning (reading) texts, whilst formal methods are specified as extracting and analysing quantitative data. From the number of boxes ticked in each category, an assessment of whether Limited Search Strategies (LSS), Limited strategies across alternatives - Moderate Search Strategies or extended LSS (MSS) or Comprehensive Search Strategies (CSS) are used.

Question 3.3. asks the respondents to make their own assessment of their search strategies using a multiple-choice selection. Two dimensions define the breadth of the search (horizontal), i.e. across the possible range of carriers, and the depth of the search (vertical), i.e. the level of detail that is explored for each carrier. The background to the definitions of LSS and CSS, given in Section 4.4.3, page 182, are defined in more detail as follows:

Horizontal dimension

- *Feasible* - A review of feasible alternatives implies a search across all alternatives, not precluded by the physical characteristics of the goods, without any preconception of whether they are suitable for the specific requirements.

- *Suitable* - A review of suitable alternatives implies a search across the alternatives considered potentially suitable for the specific requirements.

- *Limited* - A review of limited alternatives implies a search across only those alternatives are known from experience to meet the specific requirements.

Vertical dimension

- *All* - A search of all information implies a comprehensive, in-depth study of an option involving all possible determinants of choice.

- *Some* - A search of some information implies a structured study of an option based on the determinants of choice that have been identified as potentially significant for the requirements.

- *Relevant* - A search of relevant information implies an assessment of any option concentrating only on determinants of choice that have

triggered the transportation review (i.e. on desired service improvements or where the current carrier is failing).

d4) Proposition 4: Change - Section 4 deals with inertia, the respondent's tolerance towards changing transportation arrangements. The construct in proposition four is that some typology personalities are more likely to change transportation arrangements than others. The first question, 4.1, explores whether the organisation has changed transport arrangements in the previous twelve months. The second question, 4.2, refines this to see whether transportation arrangements have changed since the respondent came into post. The demographic data qualifies this information by specifying the respondent's time in post, thus defining the context of the answer to the question.

d5) Proposition 5: Determinants - The fifth proposition is slightly different from the others, as it does not necessarily rely on the respondent's role as the key decision-maker or typology. It is proposed that determinants of choice are actually determinants of dissatisfaction, i.e. the factors with which the respondent was most dissatisfied in the past freight transportation experience. The question is separated into two parts dealing with eight determinants identified as common in Chapter 4. The first question, 5.1, is explicit and requires the respondent to rank the three most unsatisfactory items. The second part of the question, 5.2, is in an adaptive stated preference format and inquires into the respondent's determinants of choice. The choices are presented in such a manner that they cannot be readily related to the factors in part 5.1. The construct survives independently of the other constructs in the study insofar as the proposition is tested simply by regressing the answers to the first part of the question (5.1) with those of the second (5.2).

d6) Proposition 6: Modal Choice - The sixth proposition examines whether modal preferences are related to the respondent's typology. The question is again separated in two parts, both using an adaptive stated preference technique. The first, 6.1, offers the respondent choices between service options, presented two at a time. The services are defined by such factors as price, transit time, reliability, etc. There is no information regarding route or mode. The

second part of the question, 6.2, presents the same choices (in a different order), but this time, in addition to the previous information, details of the route and mode are included, e.g. "One nominated sea carrier, shipment by sea from a UK port to St Petersburg then delivery by road/rail to Moscow." For the proposition to be supported, little or no correlation should be found between the respondent's typology and the preferences in 6.1, but there should be a strong correlation with the preferences in question 6.2.

e) Personal information and demographics - The final three sections of the questionnaire deal with personal details, demographics and housekeeping. The provision of personal details is optional and, if provided, is used solely for administration and validation. The questions on demographics are mandatory and simply inquire into the industry sector of the respondent's organisation, the size, trading pattern and freight type. Classification questions and personal information are left until the end of the questionnaire because they are disconnected with the subject matter and respondents do not always understand why the information is needed (Brace, 2004).

5.5.2 Most suitable vehicle for questions

Three of the questions in the questionnaire are based on an adaptive stated preference format. Although stated preference techniques can be administered using pencil and paper type questionnaires, because they often use cue cards or prompts to create a scenario, they are more readily suited to personal interview formats, whether face-to-face or by telephone (given that the visual prompts or cues can be provided, for example, by post in advance). Adaptive stated preference techniques, such as the Leeds Adaptive Stated Preference – LASP (Fowkes & Tweddle, 1988), MINT and TRIO (e.g. Fridstrøm & Madslien, 1994, 1995) use computer technology to provide both the prompts and the adaptive functionality.

Consideration was given to using Computer Assisted Personal Interviews (CAPI) for the survey, but the geographical dispersal of the target population (even though exclusively based in the UK) made this unattractive (from both a

time and cost point of view) to achieve an acceptable level of valid responses. This meant that some form of Computer Self Administered Questionnaire (CSAQ) was the only solution if the adaptive format questions were to be retained. CSAQ surveys can be delivered via a number of different types of media, including e-mail attachments, downloading from the Web, or via diskette (Schonlau, Fricker & Elliott, 2002b and Couper et al., 1998c). Large files attached to emails or sent through the post in the form of diskette or CD are generally viewed with suspicion because of the risk of virus contamination (because they will, almost certainly, contain some form of "exe" or "ini" file recognized by virus protection software as a potential virus). Moreover, although it is possible to use interactive multimedia functionality, there still remains the problem of transmitting the data back to the researcher.

This left the option of some form of Web-based computer assisted technique, to be delivered either in a self-administered form, or as a Computer Assisted Telephone Interview. Although Question 5 could be framed in a different form such as a ranking matrix, an adaptive stated preference format was considered essential to explore the route and mode choice in question 6. For this reason a decision was taken to design a Web-based instrument as a self-administered questionnaire, whilst maintaining the option to use it as part of a Computer Assisted Telephone Interviewing tool to lift response rates and reduce questionnaire abandonment if, at a later stage, this was deemed necessary (Kotzab et al., 2005).

5.5.3   Web-based questionnaire design

In order to host the questionnaire a Web site had to be set up. A name was selected that was both short (quicker to type in) and neutral - p5ec.com (pilot) and p5ec.co.uk (main survey). These URLs (Uniform Resource Locators) were registered by Namecheap.com for $8.88 per annum and hosted by Freeservers.com at costs of $1.99 per month. Smart FTP provided file transfer software. Several Web page design packages were considered, including Macromedia Dreamweaver MX 2004, Adobe GoLive 6.0, CoffeeCup HTML Editor 9.7 and Microsoft FrontPage 2003, FrontPage was selected for ease of use

and because it was suitable for low end applications. Macromedia (or one of the other more professional options) may have been more suitable for the higher end, interactive functionality that was eventually required.

Transportation Study - Web-based questionnaire - Site Map (www.p5ec.com)

Home - Index (Main frame)	Index (Left frame)	Index (Right frame)		
Typology Report	Qualify 1 (Main frame)	Introduction (Main frame)	Introduction (Left frame)	Introduction (Right frame) — Context Help (Loading time)
	Qualify 2 (Main frame)	Terms (Main frame)	Terms (Left frame)	Terms (Right frame) — Contex Help (One trigger)
		Survey (Main frame)	Survey (Left frame)	Survey (Right frame) — Context Help (Feasible)
		Thanks (Main frame)	Thanks (Left frame)	Thanks (Right frame) — Context Help (5.2 How?) — Context Help (5.2 Results)
		Contact (Main frame)	Contact (Left frame)	Contact (Right frame) — Context Help (5.2 Error) — 5.2 Excel spreadsheet
		Link (Main frame)	Link (Left frame)	Link (Right frame) — Context Help (6.1 How?) — Context Help (6.1 Results)
		Risk Profile (Main frame)	Risk Profile (Left frame)	Risk Profile (Right frame) — Context Help (6.1 Error) — 6.1 Excel spreadsheet
		Pilot feedback (Main frame)	Pilot feedback (Left frame)	Pilot feedback (Right frame) — Context Help (6.2 How?) — Context Help (6.2 Results)
		Help (Main frame)	Help (Left frame)	Help (Right frame) — Help (6.2 Error) — 6.2 Excel spreadsheet
			Ethical Policy (Document)	Context Help (Information)
			Privacy (Document)	Help (Demographic)

Source: Author

Figure 5.3 – Web-based questionnaire – site map

The Web sites were designed (see Figure 5.3) to host the questionnaire, taking advantage of the multimedia functionality to provide links and context help pages. The first page to open, the home or index page, had a welcome message that introduced the survey. From here, there are essentially three elements to the sites. The questionnaire itself, information pages and context help pages. Navigation around the site is facilitated by indexes contained in the left frame and buttons on the respective pages.

- *Survey* – comprising two qualifying (screening) pages and the questionnaire;

- *Information* – including an introduction to the survey and its objectives – "Introduction", basic terms and conditions of use for the Web site – "Terms", acknowledgements to key people who have assisted with the study – "Thanks", contact details for the researcher –

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"Contact", links to other relevant sites – "Link", and a frequently asked questions page – "Help". Three documents are linked to the site, namely, an Ethical Policy outlining the ethical standards by which the study is conducted (see Appendix 5), A Privacy Statement (see Appendix 6) ensuring the confidentiality of the Respondent's information and a sample Typology Report.

– *Context help* pages were provided that are linked to the main questionnaire to assist respondents with the navigation and technology, as well as understand the questions, e.g. defining the difference between "Feasible" and "Suitable" for question 3.3.

Note: Context help pages are designed to allow respondents to "drill" down (using interactive buttons with hyperlinks) to more detailed explanations if they deem it necessary. The basic (short) instructions and explanations needed to answer the questions are provided at the top of each question.

In addition to the above, there was an optional Risk Attitude Profile page, and two feedback forms for use in the Pilot study.

The most important part of the Web site is the questionnaire. The questionnaire can be accessed from the Home page via a qualifying screen and is linked to various Context Help pages. The path linking these operational parts of the questionnaire is shown as a solid line on the site map (see Figure 5.3).

The questions in the survey are presented in the sequence outlined in Section 5.5.1 (page 223) of this Chapter except for the typology test. Although, logically, the typology test should appear chronologically at the beginning of the survey (as it does in Figure 5.3), taking into account face value validity and respondent fatigue - the test comprises 72 questions (Presser et al., 2004c) - it was decided to locate the typology test after the specific transportation questions Thus, the sections of the survey are as follows:

– Section 1 - Transportation Decision (4 questions);
– Section 2 - Existing Transport Arrangements (4 questions);

- Section 3 - Information Gathering (3 questions);
- Section 4 - Change Management (2 questions);
- Section 5 - Determinants of Choice (2 questions);
- Section 6 - Modal Choice (2 questions);
- Section 7 - Typology (72 questions);
- Section 8 - Respondent Details (5 questions - optional);
- Section 9 - Demographics (6 questions);
- Section 10 - Acknowledgements (2 questions).

All the questions in the survey are multiple-choice questions (with the answer selected by radio buttons initialized unchecked) with the following exceptions:

- Questions 3.1 and 3.2 (Information gathering) – Checkboxes;
- Question 5.1 (Determinants of dissatisfaction) – Ranking matrix;
- Questions 5.2 (Determinants of choice), 6.1 (Service choice) and 6.2 (Route choice) – Adaptive stated preference panels;
- Questions 8 (Personal details) – text boxes;
- Question 9 (Demographics) – drop-down boxes and text boxes.

When designing the adaptive stated preference questions, various Web-based solutions were considered, including automatic conditional branching (Norman, 2001) and calculated variables (Presser et al., 2004d). Conditional branching was discounted because of the number of permutations generated by fully determining the ranking of eight factors. The Web design program selected (MS FrontPage) did not provide the functionality to calculate variables on the form. The solution adopted was to build the algorithms to facilitate the adaptive functionality required for questions 5.2, 6.1 and 6.2 in a MS Excel spreadsheet and embed this within the MS FrontPage form. The spreadsheet fully determined the ranking of factors based on a "knockout" competition format. By using the same background, and hiding the Excel specific components the spreadsheet was indistinguishable from the rest of the questionnaire.

At the end of the questionnaire, the respondent was required to click on the "Submit" button to transmit the coded answers to the questions, to the researcher. Before transmission, the form is validated and the respondent asked to complete or revise any answers that do not pass the validation tests. The information to help the respondent to do this appears on a pop-up screen. When the researcher receives the questionnaire, a program is used to decode the answers to the questions, provide the analysis (and also to automatically produce the typology report which is returned to the respondents).

It can be seen that Web-based questionnaires offer many facilities for design that are not available in traditional, paper-based formats, such as the use of drop-down menus, pop-up boxes, skip patterns, calculation facilities, transmission of the data and automatic analysis. However, the very flexibility of such designs creates opportunities for design errors, which may, in turn affect response rates. In order to avoid such pitfalls a checklist of Web-based questionnaire design criteria was used, summarized from Website notes and recommendations made by Dillman, Tortora, & Bowker (1998), Dillman (1999), Norman, et al., (2000) and Norman (2003). Rather than reproduce the full checklist, only areas where a conscious decision was made to deviate from the guidelines, or where explanation is deemed necessary, are highlighted here:

- Although extensive indexing is discouraged, an index was provided at the beginning of the questionnaire to provide a completion horizon and facilitate navigation between sections (hypertext links);

- Because the questionnaire was designed to be self-administered, to avoid lengthy embedded instructions on the page (which distract respondents from their main task), "Context Help" buttons were provided that linked to pages with more detailed explanations and help (Brink, Gergle & Wood, 2002);

- Pop-up windows (which may disturb respondents) were only used at the end of the questionnaire to assist respondents correct or amend any answers that did not pass the validation tests);

- To enable respondents to report problems a help line number (020 7691 7348), email address and feedback form were provided;

- Although colour is recommended to provide visual cues that simplify the Web-based survey process, grey was used as a background colour for the survey to give it a "business-like" appearance and to differentiate it from commercial or entertainment type surveys (Schonlau, Fricker & Elliott, 2002c);

- Graphics were avoided on the main questionnaire page because this would have increased the loading time. Graphics are used to illustrate the advice provided on the Context Help pages;

- Complex matrix response formats are not recommended. However, a simple grid was used for Question 5.1 as this provided the most efficient method of elucidating the information required;

- All the radio buttons used were initialized unchecked to avoid questionnaire bias;

- Single page questionnaire designs are not recommended. The single page design used in this questionnaire was necessary to ensure that the information in the form was encoded and transmitted as a discrete package;

- By using bookmarks, navigation buttons and "white space" the illusion was created that the different sections were on separate Web pages;

- In order to maintain the confidentiality of information the data in the questionnaire was encoded before transmission. Links were provided on the questionnaire to the Ethical and Privacy Policies assuring confidentiality and outlining how respondent's information was to be handled).

5.6   Pretesting

The purpose of pretesting is to enhance the efficiency and effectiveness of the survey instrument by evaluating reliability and validity, as well as determining possible sources of ambiguity in the questionnaire, poor distractors (response option that may distract a test taker from the correct answer), and events which may produce an unusual response. Pretesting is particularly important with Web-based surveys where different environments or Web

browsers may generate unexpected results or disrupt intended functionality (Groves et al., 2004b).

There are a number of strategies that can be used to pretest a questionnaire (see Oksenberg, Cannel, and Kalton, 1991). The amount of pretesting required and the design of the pretesting model are governed by a number of factors, including the questionnaire itself, the researcher's experience, and the nature of the research project. The more complicated the questionnaire, or the more sophisticated the technology used, the greater the need for extensive pretesting. The experience of the researcher, the intrinsic knowledge of the subject matter, the understanding of the method of administration, as well as acquaintance with the target population, are all factors that have to be taken into consideration. Finally, the more critical a questionnaire is to the outcome of the research project, or the more novel or unique a research hypothesis, the greater the need for extensive pretesting (Peterson, 2000).

It is clear that on a number of counts extensive pretesting of the instrument was required, although the researcher does have experience in three key areas, namely shipping between the UK and Russia, the nature of the target population and Web-based functionality.

The pretesting programme was conceived to address several of the issues at the same time. This included informal as well as formal methods (Czaja and Blair, 2004e) and, as far as possible moved sequentially from the low-cost, easy-to-execute approaches to the sophisticated and expensive approaches needed to address the more technical issues (once lesser aspects of the design were resolved). Four focus groups were used to assist with the testing (some of the participants were willing to help but wished to remain anonymous):

- **Quality Group (Professional group of consultants and academics):**
  - Dr Martin West;
  - Ian Crawford;
  - Anon.
  - Anon.

- **Expert Group (Industry professionals):**

  - Andrew Goltz;

  - Anon.

  - Anon.

- **Pilot Group (Road, rail and sea carriers):**

  - Various.

- **Non-context group:**

  - Random sample of UK to Europe shippers.

Transportation Study, Validity Assessment - Index page only

Source: Validity Assessment Booklet used by Expert and Quality Groups (devised and written by Author)

Figure 5.4 – Transportation Study - Validity Assessment Index

The Quality Group was used whilst the questionnaire was being designed and as a tool to test the draft questionnaire and to provide both formal and informal feedback (Czaja and Blair, 2004e) on question design, including any ambiguities, and the presentation and technical operation of the Web site. The Expert Group carried out the more formal reliability and internal validity evaluations. The Pilot Group took part in the test-retest consistency evaluation.

In order to test the cognitive, presentational and technical aspects of the questionnaire, the Quality and Expert groups were provided with an evaluation (feedback) booklet to assist them with their evaluation. The booklet runs to 40 pages (see Figure 5.4) and so is not reproduced here. The issues addressed within each section are summarized in Appendix 10.

As a result of the feedback from the Quality Group, several changes were made to both to the style of some of the questions and the format of the questionnaire. In terms of face validity, three of the Quality Group rated both the individual questions as relevant and the overall questionnaire addressed the respective propositions. One member of the group had reservations about Questions 5.1 and 5.2, these concerns were accounted for, and minor semantic amendments made.

The Expert Group was asked to make a formal evaluation of content validity of the questionnaire against a construct domain inventory (see Table 5.4). The domain inventory shows the concept or construct that the instrument purports to measure and the observations proposed that facilitate the measurement. The Expert Group was invited to agree (Yes) or disagree (No) whether the proposed observations illuminated and effectively tested each of the constructs.

The results of the construct domain inventory were positive. Although there were initial conceptual problems (mainly to do with items 11 and 12), these were resolved. All respondents marked items 1 to 10 positively at the first attempt. Items 11 and 12 were marked affirmatively once they had been clarified.

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Construct Domain Inventory					
No.	Concept/Construct	Method of observation	Yes	No	Comment
1	The respondent has a typology preference	Section 7 - Aggregate of all questions			
2	The typology preference can indicate risk profile, or	Optional Risk Profiler (or by inference)			
3.	The risk profile is separate	Risk profiler			
4	The respondent is the influential decision-maker	Section 1 - Questions 1 1. 1 2. and 1 4 with 1.3			
5	The typology of the respondent, who is the decision-maker, is indicative of proactive or reactive behaviour in terms of initiating transportation reviews	Compares Section 7. qualified by Section 1. with Section 1 - Question 1.3			
6	The typology of the respondent, who is the decision-maker, determines a tendency towards a particular buy class	Compares Section 7. qualified by Section 1. with Section 2 - Question 2 1 analysed in conjunction with questions 2 2. 2 3 and 2 4.			
7	The typology of the respondent, whether the decision-maker or not, inclines towards particular predecisional search strategies	Compares Section 7. qualified by Section 1. with Section 3 - Question 3 1 in conjunction with Question 3 2. confirmed by Question 3 3			
8	The decision-maker's determinants of choice, regardless of typology, are strongly influenced by any dissatisfaction with previous transport experience	Section 5 - Question 5 1 compares with Question 5 2 (Construct is independent of other variables)			
9	The typology of the respondent, who is the decision-maker, tends to govern the attitude to change (inertia)	Compares Section 7. qualified by Section 1. with Section 4 - Question 4 1. qualified by Question 4 2			
10	The typology of the respondent, whether the decision-maker or not, directly or through links in the process, determines the most likely modal choice decision	Compares Section 7. qualified by Section 1. with Section 6 - Question 6 2 (6 2 is the observable variable and 6 1 is the control)			
11	The results may be influence by the variable "Age".	Compares questions in Sections 2 to 4. plus 6 with Question 9 5. Evaluated with Greco-Latin Square			
12	The results may be influenced by the variable "Experience".	Compares questions in Sections 2 to 4. plus 6 with Question 9 6 Evaluated with Greco-Latin Square			

Source: Author

Table 5.4 – Construct Domain Inventory

The Pilot Group was identified from the list of carriers developed. Eight responded to the email requesting assistance with the study. The pilot test (first half of the test-retest process) was administered between 17th April 2006 and 21st April 2006. Although the details of the pilot test questionnaire were sent out on 17th April, not everybody who agreed to participate responded immediately (there was also a slight technical problem with the Web site). The last response, that had to be chased, was submitted on 15th May.

As a result, the second half of the test-retest process could not be initiated until 8th May (applying the two-week rule). Seven of the original group submitted their retest by 12th May (one mortality occurred due to working overseas – in Kazakhstan). The results showed strong positive correlation between the first and second administrations (0.83) (see Chapter 6).

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5.7   Implementation

The main survey proved more difficult to administer than the pilot survey (as the pilot group eventually used was solicited through personal contacts or introduction). The first approach to the main survey was to use the conference lists and data provided by the UK Trade and Investment Section to identify companies exporting from the UK to Russia. However, of the 220 letters which were sent to the "Export Manager" there was not a single positive response. A second attempt was made, having identified a particular named individual within the organisation (Export Manager, Logistics Manager or, even in some cases, the Company Secretary). This approach eventually produced six valid responses (although two were anonymous through the Web site and could not be positively identified).

Having spoken to the Director General of the British International Freight Association, 2,200 emails were sent to members requesting referrals to customers exporting between the UK and Russia. No positive responses were received (Colin Beaumont of the Association advised that this was not unusual).

Several industry specific recruitment agencies were approached for referral to either clients or applicants. One agency provided access to the "Monster.com" database. From this source, about seventy potential respondents were identified and contacted by phone. Of these, sixteen agreed to participate in the survey and, ultimately, fifteen valid responses were received.

Three industry associations were contacted, namely, the Russo-British Chamber of Commerce, the Institute of Export and the Chartered Institute of Logistics and Transport. Initially (at an early stage in the study) all three were reluctant to assist. Ultimately, partly due to changes in senior personnel, and partly due to persistence, all three agreed to participate by sponsoring the study to their members (although, unfortunately, in the case of the Russo-British Chamber of Commerce, this was unsuccessful). The response from the members of both the Institute of Export and Chartered Institute of Logistics was impressive in terms of speed of response, the helpfulness and the quality of

responses. Between the two organisations, twenty-six responses were received, of which twenty-four were valid.

Part of the reason for the improved response to the later approaches may have been due to the medium used for the questionnaire. In the case of exporting companies and referrals from BIFA members, potential respondents were simply referred to the Web site. Those people contacted through recruitment agencies and trade associations were provided (by email) with an electronic file on which to complete the survey. Although the electronic file had the same functionality as the Web site version, the validation procedures were slightly more "user friendly", insofar as the users would be gently guided back to unanswered questions. In the Web-based version the built-in functionality simply used pop-up boxes advising respondents that the questionnaire had failed to validate due to, for example, "Invalid response to Question 6.1". This may have caused respondent attrition (which would not be apparent) because the electronic form had failed to submit.

A further problem with the Web-based questionnaire was the technology supporting the adaptive stated preference elements of questions five and six. It transpired that the embedded program was not compatible with the browsers used on some (older) computer systems. Ironically, the firewalls on more sophisticated networked systems also caused problems. Although these issues were identified during the validation stages, it was not possible to implement a universal system other than a separate electronic file (either sent by email or downloaded from the Web site).

A small incentive had been included from the beginning (£5) in order to try and improve the response rate (Groves et al. 2004c). In fact, in the majority of cases, this was found unnecessary. Of the forty-five valid respondents only four selected the option for the incentive payment. In addition, one of the pilot group also claimed this token! The remainder preferred the alternative, to receive a copy of their typology report.

In most cases the questionnaire was totally self-administered. Only in one instance was assistance given by phone during completion. In this case, care was taken to avoid interviewer bias by confining the input from the researcher to gentle encouragement and technical advice.

The total number of valid responses received was forty-four. Validation, and analysis of the responses is provided in Chapter Six.

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Chapter 6

6   CHAPTER 6 – ANALYSIS

6.1   Introduction

Chapter Six presents the general findings of the study, the result of the statistical analysis exploring the six propositions, and consideration of other variables that may have influenced the results. The structure of the chapter is set out as shown in Figure 6.1.
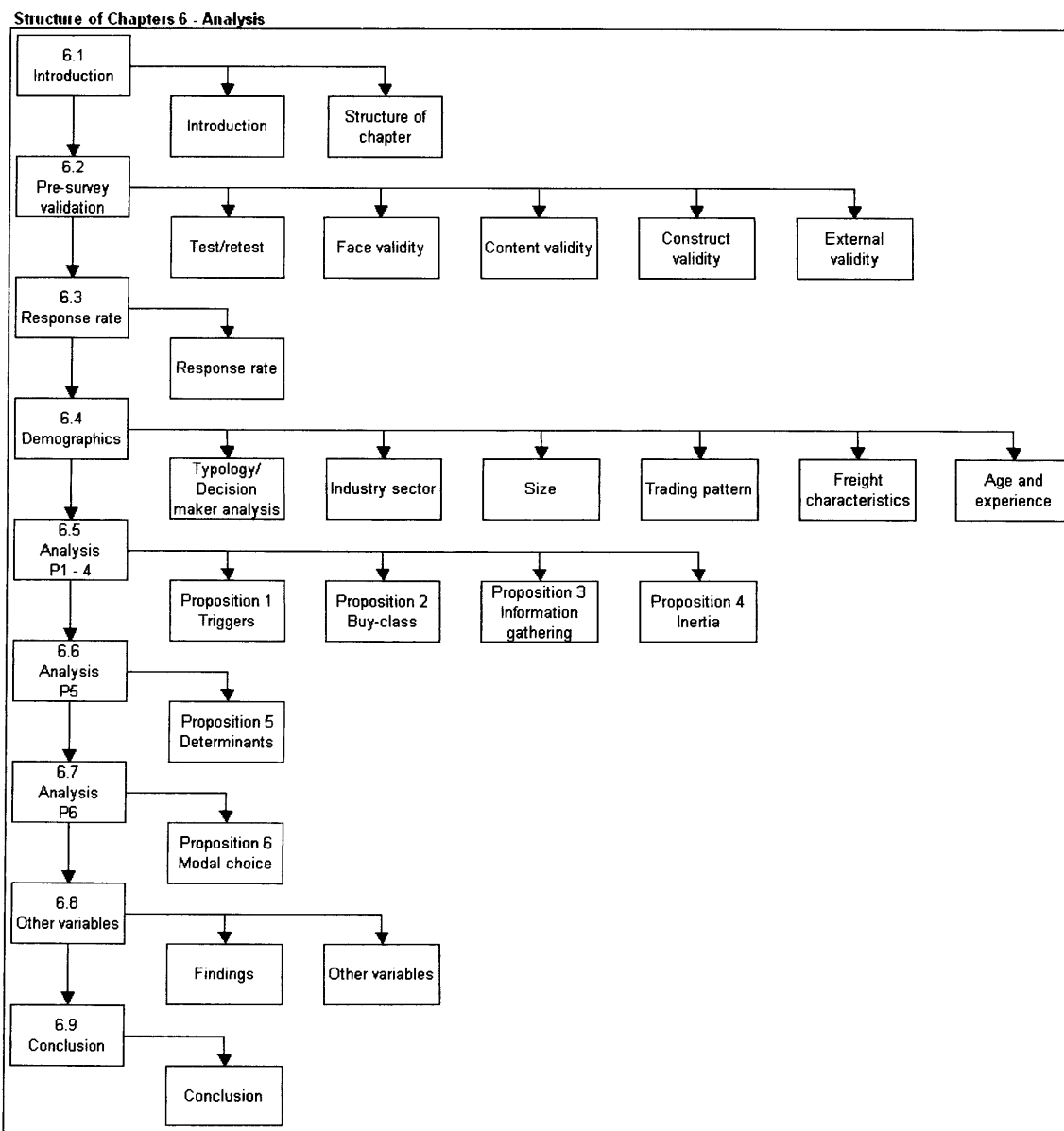
Figure 6.1 – Structure of Chapter 6 – Analysis

6.2   Presurvey validation

This section deals with the presurvey validation of the instrument. Predictive validity and generalisability are discussed in Chapter Eight. The methods of validation are detailed in Appendix 11 together with the composition of the three validation groups, namely Quality Group, Expert Group and Pilot Group. The results of the various measures of validation are detailed as follows:

- Reliability (test/retest);
- Face validity;
- Content validity;
- Construct validity;
- External validity (Concurrent).

6.2.1   Reliability (test/retest)

Test Retest results

Respon dent	Interval	Jungian			Non Jungian			All			Original	Retest
	(days)	Number	Same	Coeff.	Number	Same	Coeff.	Number	Same	Coeff.	typology	typology
1	Invalid response											
2	13	72	63	0.742	55	39	0.898	127	102	0.887	ISFJ	INFJ
3	13	72	66	0.830	55	34	0.796	127	100	0.805	ISFJ	
4	15	72	64	0.752	55	49	0.983	127	113	0.963	ISFJ	
5	13	72	65	0.768	55	34	0.768	127	99	0.777	INFJ	
6	25	72	65	0.731	55	27	0.618	127	92	0.627	ISFJ	
7	27	72	57	0.582	55	30	0.687	127	87	0.691	ISFJ	ISTJ
8	4	72	72	1.000	55	48	0.984	127	120	0.986	ENTJ	
9	12	72	57	0.576	55	31	0.869	127	88	0.857	ENFJ	
10	13	72	62	0.724	55	39	0.885	127	101	0.878	ENTP	
11	18	72	69	0.916	55	47	0.985	127	116	0.982	INFJ	
12	12	72	57	0.553	55	33	0.670	127	90	0.681	ISFJ	
13	No response											
14	No response											
15	No response											
Average	15	72	63	0.743	55	37	0.831	127	101	0.830		

Source: Author

Table 6.1 – Test/Retest results

The test/retest was administered to 15 respondents. Unfortunately, of the fifteen, one response (through the Web site) failed to validate (Respondent 1) and three failed to respond at all (Respondents 13, 14 and 15). The target interval for the retest was fourteen days but it can be seen from Table 6.1 that this did not work perfectly, with one responding after four days (because of late submission

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of the first test) and two at almost a month. In keeping with theory (Domino and Domino, 2006) the low response interval (Respondent 8) reproduced the Jungian questionnaire precisely, although the similarity for the general questions were not as striking. The longer intervals produced correspondingly poor results.

Validation for the Jungian typology test is shown in Appendix 8. However, it was included in the test results here (see Table 6.2) because other factors, including the method of administration, might be significant. In fact, although relatively high coefficients were achieved for correlation between the answers, in two cases of the twelve (17%) a different typology was returned. To make interpretation of the results easier, the different preferences manifested in the retest are shown in **bold italic** in the retest column. It can be seen that both respondents moved classification in the retest. Respondent 2 was very weakly Sensing (almost neutral) in the original test (Conformer) and mildly iNtuitive in the retest (Improver). Other than the change of classification, this is not considered particularly significant. Respondent 8 changed from mildly Feeling in the original test (Conformer) to mildly Thinking in the retest (Explorer). Because of the implication for the main survey the changes did caused some concern. Thus, it was decided to explore the significance of the results further.

Bi-polar scale shifts in retest group

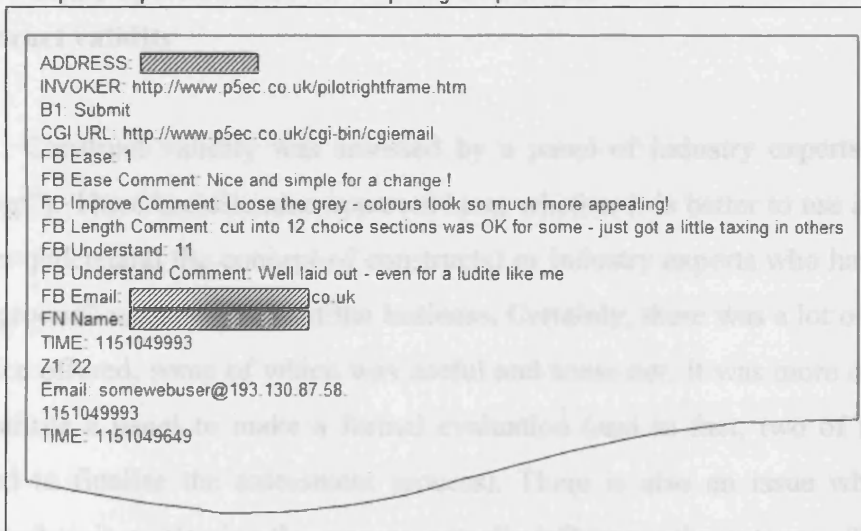| Respon dent	Non Jungian validity		TEST					RETEST					
		Tax	Type	I/E	S/N	F/T	J/P	I/E	S/N	F/T	J/P	Type	Tax
1					Invalid response								
2	0.898	Con	ISFJ		S=1%				N=34%			*INFJ*	*Imp*
3	0.796												
4	0.983												
5	0.768												
6	0.618												
7	0.687	Con	ISFJ			F=33%				T=34%		*ISTJ*	*Exp*
8	0.984												
9	0.869												
10	0.885												
11	0.985												
12	0.670												
13					No reponse								
14					No reponse								
15					No reponse								

Source: Author

Table 6.2 – Bi-polar scale shifts in retest group

Table 6.2 shows the strength of the preferences indicated on each of the bi-polar scales. Starting from the top, Respondent 2 moves from just tipping into the Sensing side of the scale (1%) to 34% on the iNtuitive side of the scale. It should be noted that in the analysis, a neutral point does not actually exist. In real terms there is no significant difference between 1% S and 1% N. Thus, if the first result had been shown as 1% N, no change would have been registered. More significantly, Respondent 7 moved from 33% on the Feeling side to 34% on the Thinking side of the scale. It can be seen from Table 6.2 that the overall result for the non-Jungian validity is poor and, referring back to Table 6.1, corresponds with the largest interval between tests (27 days instead of the intended 14).

Overall, it appears the instrument is reliable in terms of the general questions but there is a danger that relatively small shifts on the preference scales can move Respondents from one classification to another. The implications of such shifts should be noted when interpreting the results of the analysis.

6.2.2 Face validity

Example of respondent feedback after completing the questionnaire


```
ADDRESS: ////////////////
INVOKER: http://www.p5ec.co.uk/pilotrightframe.htm
B1: Submit
CGI URL: http://www.p5ec.co.uk/cgi-bin/cgiemail
FB Ease: 1
FB Ease Comment: Nice and simple for a change !
FB Improve Comment: Loose the grey - colours look so much more appealing!
FB Length Comment: cut into 12 choice sections was OK for some - just got a little taxing in others
FB Understand: 11
FB Understand Comment: Well laid out - even for a ludite like me
FB Email: ///////////////////co.uk
FN Name: /////////////////
TIME: 1151049993
Z1: 22
Email: somewebuser@193.130.87.58
1151049993
TIME: 1151049649
```

Source: Author

Figure 6.2 – Respondent feedback

The Quality Group considered face validity. The main concern of this group was that the questionnaire should be appealing to respondents (to avoid respondent attrition) and readily understandable (plain English). Using the

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booklet (originally intended for the Expert Group to evaluate content and construct validity) this group made numerous suggestions regarding semantics and framing of the questions. Most of these were adopted (except for the background colour for the Web site where there were conflicting views) and changes made to the questionnaire accordingly. A feedback form was provided on the Web site and a testament to the hard work of this group is shown (redacted) as Figure 6.2.

6.2.3 Content validity

Selected members of both the Quality Group and the Expert Group evaluated content validity. Although there were problems initially (because some of them thought they needed to read the entire study in order to provide feedback on the questionnaire) eventually they used the scoring form for the Construct Domain Inventory (see Table 5.4, page 238). Using this, and the Instrument Design Overview illustrated at Figure 5.2 (page 223), it was agreed that all the issues raised in the propositions (summarised in the booklet) had been addressed.

6.2.4 Construct validity

Construct validity was assessed by a panel of industry experts ("Expert Group"). There is a dilemma apparent here, whether it is better to use academics (who understand the concept of constructs) or industry experts who have an "on the ground" understanding of the business. Certainly, there was a lot of informal advice offered, some of which was useful and some not. It was more difficult to constitute a panel to make a formal evaluation (and in fact, two of the group failed to finalise the assessment process). There is also an issue whether the researcher, in explaining the process, actually influences the outcome. The expert group concluded that the constructs were viable and (in two cases) completed the evaluation.

The overall comment was that whilst the process shown at Figure 4.6 (page 196 and included in the booklet – Appendix 10) was logical, in real life the evolution is not as formal as that shown and many of the processes described are

skipped (as would be the case with a satisficing approach). However, the survey as constituted does meet the requirement of convergent validity, as the instrument does accumulate evidence against well-defined constructs. The instrument also discriminates between constructs that are not supposed to be associated, although there may be some association between buy-class and inertia. In terms of nomological analysis (Appendix 10), it was agreed by the group that the way that each of the constructs is explored does preclude subjective judgments.

6.2.5 External validity

This study, as far as can be determined, is the first study of its kind in the freight transportation market that attempts to associate the typology of the decision-maker to modal choice. There are precedents in other industries where such decision-making associations have been investigated successfully, namely, selling computers (McBride & Cline, 1989), the tourism industry (Gountas, & Gountas, 2001) and the financial services industry (Pompian, 2006). Folkman, Curasi, and Kennedy (2002) explored the preferences of customers in services marking with regard to customer loyalty and retention.

There have been hundreds of studies on modal choice, or related areas (carrier, port, intermediary choice etc.). Eighty-eight studies identified in the literature review alone (Table 3.9 – page 111) deal with thirty-four of the most popular determinants of choice, whilst other researchers have explored such diverse aspects as "neatness of vehicle operators" (McGinnis, 1989), "product value-to-weight ratio" (Gilmour, 1976) and "promotional material" (Whyte, 1993) as potential determinants of choice.

In terms of methodology, the design of this experiment is within the gambit of the other studies of this nature. The most contemporary of these is the modal choice experiment of Garcia-Menendez, Martinez-Zarzoso and Pinero De Miguel (2004) carried out with 157 exporting firms located around Valencia. There are distinct similarities between this experiment and the study here. All three main modal options are available on the Spanish Peninsula but, possibly

because of a similar rail gauge problem, the study concentrates on a comparison between road and sea. The study here starts from the premise that exporters from the UK to Russia do not always appear to make logical transportation choices. Garcia-Menendez, Martinez-Zarzoso and Pinero De Miguel take the view that transportation decision-makers "do not always follow perfectly rational and predictable rules". The findings in terms of determinants of choice in the Garcia-Menendez, Martinez-Zarzoso and Pinero De Miguel experiment, namely – "Cost, transit time and frequency of shipment" are reflected in the findings here. The same comparisons can be drawn with Damas (2000), Lambert, Lewis, and Stock (1993), Jeffs and Hills (1990), Chow and Poist (1984), Bardi (1973) and Saleh and La Londe (1972).

For the typology experiment, there has been very little work done in this area of research to which this study can be compared. However, the typology splits identified in this study are not wildly dissimilar from those found in either the UK adult population norm OPP (2006) or middle managers (Lewis and Margareson, 1989). Even the higher proportion of NT and J types found in this study can be explained by the trends in both the Cranfield (Lewis, Margareson, 1989) and Cambridge (Rogers, 1997) surveys. For studies using typology to predict decision-making and thus segment the market it is necessary to refer to McBride and Cline (1989), Grant (1993), Gountas and Gountas (2001), Folkman, Curasi and Kennedy (2002) and Pompian (2006).

Based on the studies identified here, together with those in the literature review, it is considered that the criteria for concurrent validity of this experiment are satisfied.

6.3   Response rate

The figures shown in Table 6.3 are approximate in terms of split, because some of the Web-based submissions were not positively identifiable to particular channels. The anonymity of some of the Web-based returns to the survey, meant that it was difficult to accurately assess the response rate (and thus, the response rate bias) even from the site statistics (statistics showing the pages accessed and

time browsing the site by IP address). Some of the respondents required telephone assistance and, from this information and other feedback, certain deductions could be made. However, they are as close as can be estimated from the timing of submissions and various telephone calls.

Response rate

	UK Trade and Investment	Conference delegate lists	Recruitment Agencies	RussoBritish Chamber of Commerce	Institute of Export	Institute of Logistics + Transport	Total
Valid	3	1	14	-	13	13	44
Invalid	1	1	1	1	1	1	6
Total	4	2	15	1	14	14	50
Population	78	150	70	20	500	300	1,118
Response rate	5.1%	1.3%	21.4%	5.0%	2.8%	4.7%	4.5%

Source: Author

Table 6.3 – Response rate

Because the survey was partly Web-based, and stringent validation controls were applied, all submissions should have been valid. There were six exceptions. The first (telephone assisted) contained wildly inconsistent responses. One had incorrectly transcribed the code for the adaptive stated preference panels (and was unwilling to revisit this part of the survey) and one abandoned the questionnaire half way through. The one who abandoned the survey advised that his computer had "crashed". This was part of a telephone-assisted interview and it is suspected that the respondent had "defensive" problems with question four. The other three invalid responses arose from disqualification due to the trading area (electronic file based returns) and were subsequently excluded.

The response rates achieved through the Chartered Institute of Logistics, Institute of Export and the Russo-British Chamber of Commerce are difficult to assess precisely. Here, the exact mechanics of distribution of the survey were not fully under the control of the researcher. Although there was supposed to be a degree of mass distribution, it is suspected that the final identification of potential respondents was achieved through the membership secretaries, or "heads of faculty" (CILT), and relied largely on personal knowledge of members, their trading area and, almost certainly, the likelihood of them responding.

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The overall response rate was 4.5% (excluding BIFA members). This is a dismally low response rate for any form of survey (postal, email or Web-based) in research terms, although in marketing the cut-off level is deemed to be 2% (Shepard, 1998). There is a risk that high non-response rates can bias the research, where the conclusions drawn from statistical analysis would be in danger of systematically overestimating the responses from the entire sampling frame (Groves, et al., 2004). However, in this case, no evidence could be found that particularly differentiated those companies that responded (size, type of company, area of activity, geographic coverage), from those that did not. Thus, it can be argued that the high non-response rate can be ignored (Jain, 2003). Although there was no compelling evidence of major anomalies, the analysis shown in Table 6.11 (page 260) suggests some very small inconsistencies do arise in terms of the type of organisation.

The willingness, or otherwise, of individual decision-makers to respond to surveys can create a bias. Such bias is only a major problem if the responses provided by those that are willing to respond, are likely to be different from those that do not respond (O'Leary, 2004). Unfortunately, in this instance, because of the nature of this study, where the typology of the person is a key variable; if there is any correlation between a potential respondent's typology and their willingness to respond to surveys of this type, then regardless of how the questionnaires are distributed, a critical bias is likely to be introduced. The risk of this phenomenon occurring was considered unavoidable in this case and, consequently, means that the findings should be qualified with an appropriate caution.

Several recruitment agencies were approached to identify transportation decision-makers in the export trade to Russia. This approach was completely non-random as it relied totally on the ability of the recruiters to select respondents that prequalified for the survey. Of the two recruitment agencies that assisted, fifteen of the seventy candidates identified provided valid responses. Here, the motivation to respond is thought to be gratitude to the agency that placed them in their current role and, ironically, probably meant they were less susceptible to bias than some of the other channels (the respondents accessed

through recruitment agencies were more diverse in terms of company size and other demographics due to the fact that that the sample size was far greater than, for example, conference delegate lists or those accessed through the UK Trade and Investment).

The two issues of non-response bias and any bias introduced by the difference between those willing to respond and those that are not, are potential flaws in this study. However, The number of different channels used has, as far as is possible, sought to access a sufficiently diverse sample of the total population of decision-makers, in which case the final results should be considered to be statistically valid.

6.4 Demographics

6.4.1 Typology analysis

Mapping of Jungian Typology Test

Bi-polar scale	Lever on typology	Questions
Introvert/ Extrovert	Introvert inclined	8. 16. 24. 32. 40. 48. 56. 64 and 72.
	Extrovert inclined	3. 11. 19. 27. 35. 43. 51. 59 and 67.
Sensing/ iNtuition	Sensing inclined	1. 9. 17. 25. 33. 41. 49 and 57.
	iNtuitive inclined	14. 22. 30. 38. 46. 54. 62 and 70.
Thinking/ Feeling	Thinking inclined	2. 10. 18. 26. 34. 42 and 50.
	Feeling inclined	5. 13. 21 .29. 37. 45. 53. 61 and 69.
Judging/ Perceiving	Judging inclined	4. 12. 20. 28. 36. 44. 52. 60. 68 and 6.
	Perceiving inclined	7. 15. 23.31. 39. 47. 55. 58. 63 and 71.
Neutral	No impact	65 and 66.

Source: Author (Based on analysis of 191 test results)

Table 6.4 – Mapping of Humanmetrics typology test

The results of the typology questions were initially analysed using the functionality developed by Humanmetrics. Although Humanmetrics were very helpful regarding the validation information, they were naturally reluctant to make the underlying calculations available. Consequently, the mapping of the psychometric test was carried out by analyzing 191 separate sample cases (1 x

vanilla "Yes" case/72 "No" variations, 1 x vanilla "No" case/72 "Yes" variations and 45 case-by-case comparisons). From this analysis the movement of the bipolar results on their respective continuums was assessed, for the impact on position on the bi-polar scales (see Table 6.4 and Appendix 9).

Typology Analysis

Jungian typologies

	IT	IF	IF	IT	
SJ	ISTJ	ISFJ	INFJ	INTJ	NJ
SP	ISTP	ISFP	INFP	INTP	NP
SP	ESTP	ESFP	ENFP	ENTP	NP
SJ	ESTJ	ESFJ	ENFJ	ENTJ	NJ
	ET	EF	EF	ET	

Results (valid reponses)

	IT	IF	IF	IT	
SJ	3 = 7%	8 = 18%	4 = 9%	6 = 14%	NJ
SP	0 = 0%	1 = 2%	2 = 5%	1 = 2%	NP
SP	0 = 0%	1 = 2%	2 = 5%	1 = 2%	NP
SJ	1 = 2%	1 = 2%	3 = 7%	10 = 23%	NJ
	ET	EF	EF	ET	

Typology specification

	IT	IF	IF	IT	
SJ	Explorer	Conformer	Improver	Explorer	NJ
SP	Explorer	Conformer	Improver	Explorer	NP
SP	Explorer	Conformer	Improver	Explorer	NP
SJ	Explorer	Conformer	Improver	Explorer	NJ
	ET	EF	EF	ET	

Risk profile specification

	IT	IF	IF	IT	
SJ	Risk-averse	Risk-averse	Risk-neutral	Risk-neutral	NJ
SP	Risk-neutral/averse	Risk-neutral/averse	Risk-seeking	Risk-seeking	NP
SP	Risk-neutral/averse	Risk-neutral/averse	Risk-seeking	Risk-seeking	NP
SJ	Risk-averse	Risk-averse	Risk-neutral	Risk-neutral	NJ
	ET	EF	EF	ET	

Source: Author

Table 6.5 – Typology results and specification

By applying this information the complete algorithm for the test was divulged. There were minor variations with the original results because the web site appears to have been constructed using conditional branching, and some errors were introduced by the web developers (e.g. transposing "%" signs and numbers indicating "text strings" rather than calculated results). Consequently,

the results of the Jungian analysis were reassessed using the calculated algorithm.

Table 6.5 shows the responses categorised by their respective typology groups and risk profile. The classification specified in Chapter 4 thus defines the respondents as, Conformers, Improvers or Explorers. The breakdown of respondents into these categories is shown in Table 6.6. It is interesting to note that the largest class of respondents was "Explorers".

Typology Analysis

	Conformers	Improvers	Explorers	Total
Valid Responses	11	11	22	44

Source: Author

Table 6.6 – Typology analysis

None of the respondents completed a separate risk profile questionnaire and thus the risk profiles used were those defined as derivatives of the Jungian typologies. The distribution of risk profiles amongst the respondents is shown in Table 6.7 (based on Walsh, 2002 – Figure 3.13, page 120).

Risk Profile Analysis

	Risk-averse	Risk-neutral/averse	Risk-neutral	Risk-seeking
Valid Responses	13	2	23	6

Source: Author

Table 6.7 – Risk profile analysis

The analysis of the decision-maker distribution (see Table 6.8) is based on the answers to Question 1 of the Questionnaire, dealing with whether the respondent is the key decision-maker or part of a decision-making team (see Appendix 7 for a hard copy of the questionnaire):

- Question 1.1 – Answer "You" = "Decision-maker";

- Question 1.1 – Answer "Transport Team..." and Question 1.2 – Answer "Yes" = "Decision influencer";

- Question 1.1 – Answer "Transport Team..." and Question 1.2 – Answer "No" = "Part of decision team".

Decision-makers

	Conformers	Improvers	Explorers	Total
Decision-makers	7 = 63.6%	5 = 45.5%	14 = 63.6%	26
Decision-influencers	1 = 9.1%	2 = 18.2%	5 = 22.7%	8
Part of decision-team	3 = 27.3%	4 = 36.4%	3 = 13.6%	10
Total respondents	11	11	22	44

Source: Author

Table 6.8 – Decision-makers

Of the people providing valid responses to the survey, according to the specific questions asked (1.1, 1.2 and 1.4), twenty-six specified themselves to be the key strategic transportation decision-maker (Table 6.8), eight decision-influencers and ten as part of the decision-making team. This analysis compared accurately with question 1.4, relating to transportation review triggers (Table 6.15, page 265) which also implied twenty-six decision-makers, although the distinction between decision-influencers and being part of the decision team may have been slightly blurred by the way the question was defined. It is interesting to note the same proportion of Explorers (64%) and Conformers (64%) in Table 6.8 are the decision-maker.

6.4.2 Industry sector

Demographics - Sector

Industry Sector	No.
Exporter from the UK	25
Forwarding agent from the UK	6
Broker from the UK	3
Forwarding agent from another area	4
Broker from another area	1
Broker	2
Other	3
Total respondents	44

Source: Author

Table 6.9 – Demographics - Sector

The intention of this research was to draw the sample from exporting companies operating between the United Kingdom and Russia (see Table 6.9). In the original questionnaire, some flexibility was allowed to permit participation by intermediaries such as forwarding agents and brokers, where these were deemed to be sufficiently close to the exporting firm that their responses could

be considered surrogate for those of the exporting firms they represent. In sixteen cases, responsibility for responding to the questionnaire was devolved in this way (forwarding agents, brokers etc.), and subsequent checking did confirm that such a close relationship did exist.

One respondent classified himself as a commodity broker from another area but it transpired that he was also an exporter from the UK to Russia, and transport decision-maker in his own right.

6.4.3 Size

The size of firms was observed in case it was necessary to put the answers from Question 1 (decision-maker) into this context (see Table 6.10). For example, Danielis and Rotaris (1999) specify company size as a potential variable in their stated preference study on the Friuli-Venezia Giulia Region, and Bellizzi (1981) argues that organisational size is a factor, which helps to determine patterns of buying. Most of the firms taking part in this survey were either global or multinational companies. Otherwise there is a reasonably representative split across the other different categories specified.

Demographics - Size

Size of enterprise	No.	%
Global	12	27%
Multinational	14	32%
Pan European	3	7%
Large UK based	9	20%
Medium UK based	2	5%
Small UK based	4	9%
Total respondents	44	100%

Source: Author

Table 6.10 – Demographics – Size of firm

As a check on the representativeness of the sample frame, an analysis was made of the organisations identified by the UK Trade and Investment Section as "British Companies" operating in Russia (240). This list, it was discovered, contained companies with offices in Russia (addresses supplied), which had identified themselves to the British Embassy. The list was analysed and, making

judgments based on information provided on the Web sites disclosed, or through Companies House, categorised (see Table 6.11). After excluding the firms that were unlikely to be exporting firms (travel agents, financial services, etc.), those that were Russian-based with no apparent UK connection, and those that could not be identified at all (14), the remaining organisations were categorised using the same descriptions as were used in the questionnaire.

Comparison of responses from different organisational types

Organisations	Identified from UK Trade and Investment				Overall	
Exporters	Identified	%	Responded	%	Responded	%
Global	23	29%	1	33%	12	27%
Multinational	25	32%	1	33%	14	32%
Pan European	0	0%		0%	3	7%
Large UK-based	28	36%	1	33%	9	20%
Medium UK-based	2	3%		0%	2	5%
Small UK-based	0	0%		0%	4	9%
Total exporting organisations	78	100%	3	100%	44	100%
Consultancy	23					
Education and training	14					
Entertainment	5					
Financial services	16					
Freight services	21					
Legal/professional services	28					
NGO	2					
Property services	11					
Recruitment	5					
Russian	16					
Travel services	7					
Not identified	14					
Total other organisations	162					
Total	240					

Source: Author

Table 6.11 – Comparison of organisational types

A comparison was made between the analysis of the British Embassy list and the respondents to the questionnaire. The responses based on the companies actually identified from the list were so meagre that no real conclusion could be drawn except that the responses were in roughly the same proportion as the overall population. What was clear was that there was no crossover between the British Embassy list and the responses obtained through other sources implying that the British Embassy list is not exhaustive.

6.4.4 Trading pattern

The trading patterns of the responding firms were considered to be fairly important as it was thought likely that both the decision-making process and the determinants of choice might influence the decision. For example, Gentry (1992) finds that geographic coverage is a significant consideration when selecting a carrier and several other studies allude to this (Mangan, Gardner & Lalwani 2001; Tiwari, Itoh & Doi, 2003 and Pearson, 1980). The trading patterns of the firms relating to the respondents in this study are shown in Table 6.12. Only one of the respondents deals exclusively with Russia, and three trade exclusively to the Baltic area. The greater majority of respondents involved in the study trade internationally. Seven responded as "UK domestic firms", but subsequent telephone enquiries revealed that the answer to this question related to their majority business. The firms confirmed they have some trading activities in Russia, even though the respondents did not categorise the organisation specifically as an "Exporter" or "Exporter to Russia".

Demographics - Trading

Trading pattern	Total
UK to Russia	1
UK to Baltic area	1
UK to Europe and Baltic area	2
UK - International	24
UK - Domestic	7
Other	9
Total respondents	44

Source: Author

Table 6.12 – Demographics – Trading pattern

6.4.5 Freight characteristics

Previous literature shows that freight characteristics have occasionally been used as variables in modal choice studies, e.g., Cargo value (Murphy & Daley, 1994 and Dunn, 1982) and commodity groups (Danielis & Rotaris, 2005). This study has tried to avoid such distinctions, but in case they might influence the results materially, very broad classifications were used to identify anything that might cause significant anomalies. In Table 6.13 the data has been combined with the trading pattern and it is interesting to note that, based on the limited

information here, the organisations trading internationally are fairly evenly split between containers and truck/trailer operations. As trailers are not normally associated with deep-sea trades, it is assumed these companies employ different equipment strategies for their long haul and short haul business.

Demographics - Freight characteristics

Trading pattern and freight characteristics	Total	Bulk	Breakbulk	Truck/ trailer	Container	LCL/cons olidated
UK to Russia	1				1	
UK to Baltic area	1				1	
UK to Europe and Baltic area	2			1	1	
UK - International	24	2		8	9	5
UK - Domestic	7	1	1		2	3
Other	9	1	2	2	2	2
Total respondents	44	4	3	11	16	10

Source: Author

Table 6.13 – Demographics – Freight characteristics

6.4.6 Age and experience

The data obtained for age and time in post (substituted here for experience) has been combined into one table (Table 6.14). Bruning and Lynagh (1984) use this variable in their study on physical distribution management and Cullinane & Toy (2000) also rate experience as a factor. Walker (2001) refers to experience amongst a whole host of amorphous concepts, which are relevant to the behavioural type of constructs (relating typology to the decision-making process) used here. Thus, it was considered important to record these details in case they became relevant at a later stage.

Demographics - Age and experience

Age/ Time in post	< 1 yr	> 1 yr	> 5 yr	> 10 yr	> 20 yr	> 30 yr	Total
=>20 yrs		3	2				5
=>30 yrs		4	4	5			13
=>40 yrs		3	1	4			8
=>50 yrs		6	2	5	1	1	15
=>60 yrs				1	2		3
Total		16	9	15	3	1	44

Source: Author

Table 6.14 – Demographics – Age and experience

The primary reason for gathering the information regarding demographics was in case the results of the statistical analysis produced outcomes that could not be explained sufficiently by the constructs proposed. The secondary reason

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was to add richness to the results so that, for example, the relationship between buy-class and time in post (experience) could be explored. There are many other variables that could have been observed, such as value of the cargo, but once started (as has been seen in previous research) the list can be never-ending.

6.5   Analysis of Propositions 1 to 4

Whereas the first part of this chapter sought to present the results of the survey, and report the general findings in terms of validation and the classification of respondents, the next three sections are concerned with analysing the data in a manner that effectively tests the propositions (see Appendix 12 for null hypothesis). Because of the nature of the study, the responses to the questionnaire are, for the most part, qualitative and the results can only be analysed using methods suitable for categorical data. Different methods have been applied according to the type of data elicited from the questionnaire to present the most meaningful interpretation. Where statistical measures are appropriate, these have been used to test the results (see Appendix 13).

Various measures of association are used to evaluate the relationship between the decision-maker's typology and the decision process. In propositions 1 to 4, the relationship between determinants of dissatisfaction and choice has been measured using probability and the chi-squared test of independence. The analysis of data relating to Proposition 6, the transportation decision and the influence of route and mode specification, is probably the most important (but also the most complex) part of the study. The evaluation of this proposition is carried out using a Spearman correlation to compare the results for Service and Route Choice and rank order vectors for determining the part-worths of the individual attributes. In summary, the data is presented and analysed as follows:

Proposition	Construct	Type of analysis
– P1	Triggers	Measures of Association;
– P2	Buy-class	Measures of Association;
– P3	Search strategy	Measures of Association;

– P4	Inertia	Measures of Association;
– P5	Determinants	Chi-squared test and probability theory;
– P6	Modal choice	Spearman's rho (rank correlation), Rank order vector modeling.

Propositions 1 to 4 were tested using Measures of Association. Measures of Association refer to a number of coefficients, which measure strength of relationship between two or more sets of data where at least one of the variables is a dichotomy, nominal, or ordinal. Both axes in all the frequency tables relating to the data from each of the first four propositions are nominal (categorical).

In this study (except for proposition 5), the null hypothesis is that the decision-maker's typology does not influence the decision-making process and that any anomalies in the results can be explained by variations in the general population. The alternative hypothesis, that the typology does influence the elements of the decision-making process, as specified in the propositions, is accepted only at the 95% confidence level, i.e. the mean of the observed behaviour is outside two standard deviations of the population mean (normal distribution) (Stamatis, 2003). A full list of propositions and the corresponding Null Hypothesis is shown in Appendix 12.

6.5.1 Proposition 1 - Trigger for transportation review

All decision-makers will respond to reactive triggers to review transport arrangements but only Explorers and (possibly) Improvers will be proactive seeking improvements or new solutions.

The first proposition relates to the triggers that initiate a review of transportation strategy (modal choice). It is hypothesized that Conformers will orientate towards reactive triggers, Improvers to passive and Explorers to proactive. The bivariate table is set up so that if the proposition is supported there

will be a positive association between the independent (x-axis - typology) and dependent (y-axis - triggers) variables.

Question 1.3 of the questionnaire, which elucidates the responses regarding triggers, used to provide the data for Table 6.15 has two constructs. The first is explicit and seeks to determine the trigger for the transportation review (and forces a binary selection). Later in this chapter, the trigger chosen in this section is compared with determinants of dissatisfaction and choice.

Trigger for transportation review

Specification			Results			
Decision-makers	Implication	Indication	Total	Decision-makers	Decision-influencers	Part of decision-team
Deterioration in KPIs (Key Performance Indicators)	Sets	DM	6 = 13.6%	6 = 23.1%		
	Influences	DI	1 = 2.3%		1 = 12.5%	
Corporate cost review	Influences	DI	7 = 15.9%	2 = 7.7%	1 = 12.5%	4 = 40%
Complaints about performance from another department	Influences	DI	6 = 13.6%	2 = 7.7%	3 = 37.5%	1 = 10%
Complaints about performance from your customers	Influences	DI				
Changes in product type	Implements	DT				
Changes in technology	Implements	DT				
Your desire to improve price/performance	Sets	DM	5 = 11.4%	1 = 3.8%	1 = 12.5%	3 = 30%
Your dissatisfaction with aspects of the service	Sets	DM	16 = 36.4%	13 = 50%	2 = 25%	1 = 10%
Other	None		3 = 6.8%	2 = 7.7%		1 = 10%
Total			44 = 100%	26 = 100%	8 = 100%	10 = 100%

Source: Author

Table 6.15 – Trigger for transportation review

The second construct, in conjunction with question 1.4, seeks to infer from the trigger, whether the respondent is actually the decision-maker (DM), a decision-influencer (DI) or part of the transportation decision-making team (DT) – implements changes forced by product or technology shifts. Although, in its own right, the second construct would probably not be reliable, it provides a useful crosscheck for questions 1.1 and 1.2. Using question 1.4 to further explore whether the person that sets the KPIs is the decision-maker, and the use of the phrases "Your desire..." and "Your dissatisfaction..." infers quite accurately the decision-making role. Unfortunately it is less certain to draw a distinction from the remainder of the questions between decision-influencer and being part of the decision-making team.

Significantly, overall, the dominant trigger for a transportation review was found to be dissatisfaction with the current service (36.4%). The inference is

even stronger for decision-makers where "dissatisfaction" represents 50% of triggers for a transportation review.

Proposition 1 - Triggers (H₃₋₁)

Measures of Association (3 x 3) - Observed				
Trigger	Conformer	Improver	Explorer	Total
Reactive	3	4	4	11
Passive	2	-	5	7
Proactive	6	7	13	26
Total	11	11	22	44
tau-c	0.0465	Concordant pairs		187
Gamma	0.0872	Discordant pairs		157
Chi square	3.5055			
DF	4			
α = 0.05	9.4880			

Probability: p ≤ 0.5
The distribution is significant

Measures of Association (3 x 3) - Hypothesised (H₃)				
Trigger	Conformer	Improver	Explorer	Total
Reactive	11	-	-	11
Passive	-	11	-	11
Proactive	-	-	22	22
Total	11	11	22	44
tau-c	0.9375	Concordant pairs		605
Gamma	1.0000	Discordant pairs		-
Chi square	70.0000			
DF	4			
α = 0.05	9.4880			

Probability: p ≤ 0.0001
The distribution is significant

Measures of Association (3 x 3) - Expected (H₀₋₁)				
Trigger	Conformer	Improver	Explorer	Total
Reactive	2.75	2.75	5.50	11.00
Passive	1.75	1.75	3.50	7.00
Proactive	6.50	6.50	13.00	26.00
Total	11.00	11.00	22.00	44.00
tau-c	-	Concordant pairs		170
Gamma	-	Discordant pairs		170
Chi square	-			
DF	4			
α = 0.05	9.4880			

Probability: p ≤ 1
The distribution is not significant

Source: Author

Table 6.16 – Proposition 1 - Triggers

Table 6.16 shows the statistical analysis of Proposition 1. The analysis is separated into three parts vertically. Each part shows the full frequency analysis of the data from the questionnaires in three by three (Conformers, Improvers and Explorers by reactive, passive and proactive triggers) bivariate tables. Vertically, the table has been split into observed data at the top (H_{a-1}), the expected data if the proposition is supported in the middle (H_a) and, at the bottom, data representing the null hypothesis (H_{0-1}).

Below each table is an analysis showing the results for tau-c, gamma and chi-squared. Also shown is the degrees of freedom relating to the table and the chi-squared value corresponding to a probability of 0.05 or less. The narrative below gives the probability and the conclusion relating to the table.

It can be seen that the results for all the measures are (expectedly) different for the observed data, the hypothesized data and the null data. From the observed data it can be seen that the number of concordant (187) pairs exceeds the number of discordant pairs (157) considerably. As a result, there is a positive result for both the tau-c and the gamma statistics. Although chi-squared has some magnitude it falls below the level of significance required to support the proposition (see Section 5.3, page 207 and Section 6.5, page 264). Thus in the narrative the probability is given simply as "$\alpha \leq 0.5$" (50 % probability) and, consequently, the null hypothesis (H_0) is accepted and the alternative hypothesis (H_{a-1}), Proposition 1, is rejected.

It is worth comparing this result with the null hypothesis at the bottom of the analysis. Here it can be seen that where the number of "x" variables is distributed evenly across the population the results are quite different. The number of concordant pairs (170) is absolutely equal to the discordant pairs (170). Thus, the X and Y-ties are different because the population is not equally distributed between typology types. This is not significant, however, because in the formula for both τ_c and τ_b, a function of the numerator is "$(P - Q) = 0$" and thus the values of T_x and T_y in the denominator are irrelevant. Chi-squared and gamma do not account for T_x and T_y at all. Consequently, it is not surprising that tau-c, gamma and chi-squared are all zero, the probability is specified only as ≤ 1 and the distribution is deemed not to be significant (as would be expected with the null hypothesis).

In the frequencies distributed as one would expect if the proposition were fully supported, the number of concordant pairs is 605 compared with nil discordant pairs. Chi-squared is 70 and in consequence the probability is specified at $p \leq 0.0001$. In this hypothetical example, the distribution is significant and the proposition would be accepted.

These three cases can be represented graphically (Figure 6.3). It can be seen from the graphical representation that the observed results does represent some level of association with H_a.

Graphical analysis of Proposition 1
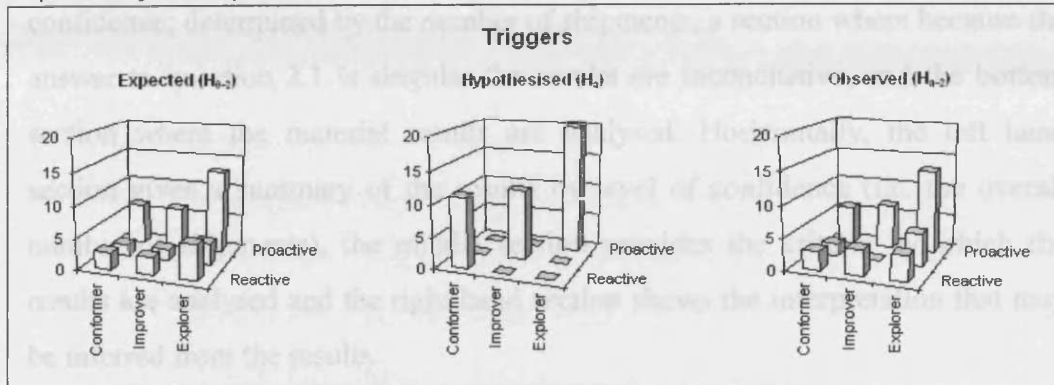
Source: Author

Figure 6.3 – Graphical analysis of Proposition 1

6.5.2   Proposition 2 - Buy-class

Explorers tend to be in the new buy-class, Improvers in the modified rebuy class and Conformers in the rebuy class.

The second proposition relates to the decision-maker's buy-class. For the reasons outlined in Chapter 4 (Section 4.3, page 175), it is proposed that Conformers will tend towards a buy/rebuy strategy, Improvers towards a modified rebuy and Explorers towards a new buy approach.

When constructing the question to explore respondent's buy-class, it was not thought useful to ask respondents to attempt to classify their own buying strategy. There were two reasons for this. First, for respondents to make their own assessment would have meant explaining the concept in general, testing to make sure that it was fully understood, and then relating that concept to the aspirations of this study. This was not considered either practical or reliable. The other problem with the self-assessment approach is that the respondents, perceiving an available strategy better than the one they are using, are more likely to give a response based on future aspiration rather than past fact.

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The question was thus designed to compare the answer to question 2.1 with those of 2.2, 2.3 and 2.4. By comparing the plural and singular responses it is possible to infer the buy-class. This was explained in detail in Chapter 3 (Section 3.3.2, page 81). Table 6.17 is split into three sections, top to bottom, and three sections, from left to right. From top to bottom; the sections are the level of confidence; determined by the number of shipments, a section where because the answer to question 2.1 is singular the results are inconclusive, and the bottom section where the material results are analysed. Horizontally, the left hand section gives a summary of the results by level of confidence (i.e. the overall number of shipments), the middle section provides the criteria by which the results are analysed and the right hand section shows the interpretation that may be inferred from the results.

Buy Class Analysis

Buy Class	Results						Criteria — Number of carriers									Interpretation		Buy Class
Number of shipments	= 1	> 1	> 5	> 10	> 20	> 50	Sea			Road			Rail					
							= 0	= 1	> 1	= 0	= 1	> 1	= 0	= 1	> 1			
Level of confidence/number of shipments by mode	No indication	Very weak indication	Weak indication	Moderate indication	Strong indication	Very strong indication										Indicated by Question 3		Confirmed by Question 4.1
Buy Class (Not indicated)	15							*		*			*			No indication	Single carrier	15
							*				*		*			No indication		
							*			*				*		No indication		
Buy Class (Positively indicated)		7						*	*	*			*			Buy-Rebuy - Sea	Single carrier	10
		2	1				*				*	*	*			Buy-Rebuy - Road		
							*			*				*	*	Buy-Rebuy - Rail		
		5							*	*			*			Modified rebuy - Sea	Many baskets	13
		7	1				*					*	*			Modified rebuy - Road		
							*			*				*	*	Modified rebuy - Rail		
		1	2					*	*		*	*	*			New buy - Sea and Road	Many baskets	6
							*				*	*		*	*	New buy - Road and Rail		
		1						*	*	*				*	*	New buy - Sea and Rail		
		1	1					*	*		*	*		*	*	New buy - Sea, Road and Rail		

Source: Author

Table 6.17 – Buy-class Analysis

Unfortunately, it was not possible to allocate the many baskets responses accurately between modified rebuy and new buy based on Question 2 alone. In order to separate these it was necessary to refer to Question 4.1 (see Questionnaire in Appendix 7). Question 4.1 also permitted clarification of some of the other classes where there was an anomaly between the number of carriers

specified and the number of total shipments (e.g. Two carriers for one shipment). The results of the combined analysis (Questions 2 and 4.1) are as follows:

- 15 x No significant indication (single shipments);

- 7 x Buy-Rebuy – Sea (Very weakly indicated);

- 2 x Buy-Rebuy – Road (Very weakly indicated);

- 1 x Buy-Rebuy – Road (Weakly indicated);

- 5 x Modified rebuy – Sea (Very weakly indicated);

- 7 x Modified rebuy – Road (Very weakly indicated);

- 1 x Modified rebuy – Road (Weakly indicated);

- 1 x New buy – Sea and road (Very weakly indicated);

- 2 x New buy – Sea and road (Weakly indicated);

- 1 x New buy – Sea and rail (Very weakly indicated);

- 1 x New buy – Sea, road and rail (Very weakly indicated);

- 1 x New buy – Sea, road and rail (Weakly indicated).

Proposition 2 - Buy Class (H_{a-2})

Measures of Association (3 x 3) - Observed				
Buy Class	Conformer	Improver	Explorer	Total
Buy/Rebuy	4	4	2	10
Mod/Rebuy	1	2	10	13
New buy	-	2	4	6
Total	5	8	16	29
tau-c	0.3853	Concordant pairs		142
Gamma	0.6136	Discordant pairs		34
Chi square	9.5588			
DF	4			
α = 0.05	9.4880			
Probability: p ≤ 0.05				
The distribution is significant				

Source: Author

Table 6.18 – Proposition 2 – Buy-class

The data was also analysed to determine the level of association between the typology of the respondents and buy class (Proposition 2). The analysis was set up so that gamma and tau-c indicate a positive association with the proposition. The results are shown in Table 6.18. It is not intended in this, or the analysis of Propositions 3 and 4, to show the tables relating to the null or fully supported hypothesis as these resemble, mutatis mutandis, the corresponding sections in Table 6.16 (Proposition 1).

Fifteen of the observations could not be included as they referred to single shipments and, as such, on their own did not indicate a buy class. This left only 29 or the original 44 valid responses on which to base this analysis. Thus, because the frequencies recorded in each category are very low, the indications for the buyclass preference are correspondingly weak. Even so, although there are very few new buys associated with Explorers (4/29 = 13%), the high number of modified rebuys provides a trend that supports the proposition. Consequently, the chi square of 9.588 exceeds the critical value for $\alpha = 0.05$ and the proposition (alternative hypothesis) is supported. The graphical analysis of Proposition 2 is shown as Figure 6.4.

Graphical analysis of Proposition 2
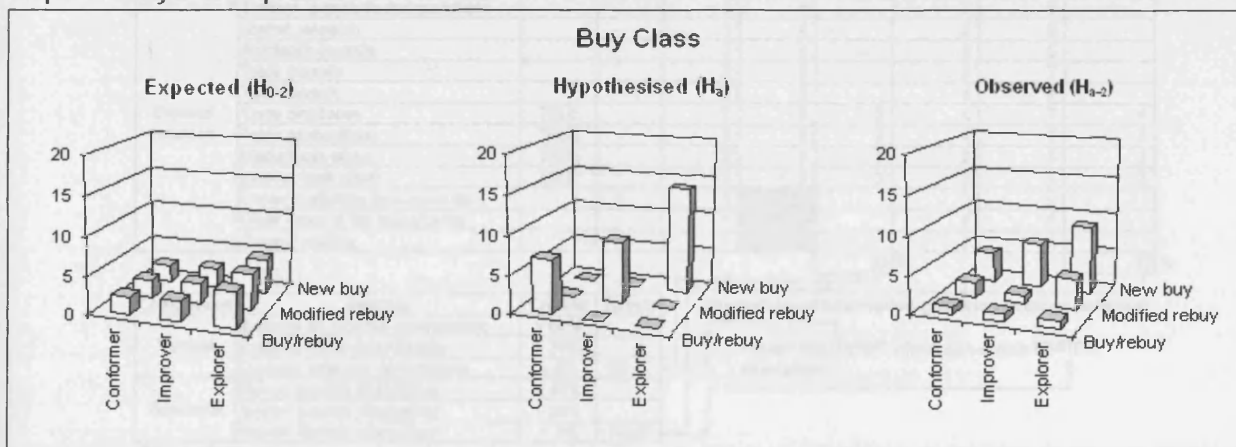
Source: Author

Figure 6.4 – Graphical analysis of Proposition 2

6.5.3   Proposition 3 - Information gathering strategies

> *Conformers tend towards limited search strategies (LSS) concentrating on the current mode and service, Improvers also tend to use limited search strategies (LSS) but across all feasible alternatives, and Explorers are more likely to use comprehensive search techniques (CSS) across all feasible alternatives.*

There are three parts to question three, dealing with predecisional information gathering strategies. Questions 3.1 and 3.2 seek to determine the

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strategy through inference, by assessing the type of data analysed and the degree of detail explored. Question 3.3 is a self-assessment question, whereby the respondents, armed with the respective definitions, choose the description that they consider best fits their search strategy. The background to this approach was given in more detail in Chapter 4 (Section 4.4.3, page 182). For clarity, the notations used for the search strategies are LSS (Limited Search Strategy), MSS (Moderate Search Strategy – Extended limited strategy across alternatives) and CSS (Comprehensive Search Strategy).

Example of evaluating the inferred predecisional information gathering strategy

Dimension		Checked Informal	Formal	Tariff for vertical Informal	Formal	Score Vertical	Tariff for Horizontal Informal	Formal	Score Horizontal
Internal sources	On time pick up/delivery performance	TRUE	TRUE	2	5	7			
	Analysis of customer complaints	TRUE		2	5	2			
	Review of claims and loss experience			2	5	-			
	Shipment tracing review	TRUE		2	5	2			
	Transportation costs studies or audits			2	5	-			
	Last experience of mode	TRUE		1		1			
	Own experience or advice from others	TRUE		1		1			
External sources	Tenders, proposals and quotations			1	4	-	2	5	-
	Market research			1	4	-	2	5	-
	Academic journals			2	5	-	2	5	-
	Trade journals			2	5	-	4	7	-
	Tariff bureaux			2	5	-	4	7	-
	Trade directories	TRUE		2	5	2	4	7	4
	Trade associations	TRUE		2	5	2	4	7	4
	Media/trade press	TRUE		2	5	2	2	5	2
	Internet (web sites)	TRUE		3	5	3	2	5	2
	Carrier marketing (brochures etc.)			1		-	2	5	-
	Other users of the mode/carrier			1		-	2	5	-
	General reading			1		-	2	5	-
						22 %			12 %

Component	Strategy	Criteria	Result
Vertical	Evaluate all possible determinants	> 60%	
	Evaluate some determinants	> 30%	
	Evaluate *relevant* determinants	> 5%	TRUE
Horizontal	Review feasible alternatives	> 40%	
	Review suitable alternatives	> 20%	
	Review *limited* alternatives	> 5%	TRUE

Predecisional information gathering strategy (inferred):

'Review RELEVANT information across LIMITED alternatives'.

Source: Author
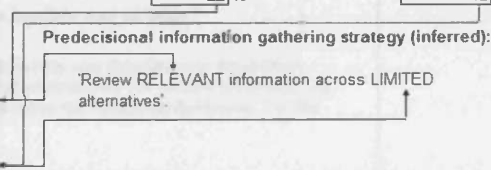
Table 6.19 – Inferred predecisional information gathering strategy

Question 3.1 explores the type of information available internally and which, by definition, deals almost exclusively with the current operation or operations (KPIs etc.). Question 3.2 looks towards external sources and, thus, it is inferred, is more likely to explore one or more alternatives. Both sets of potential sources are divided into informal and formal evaluation (where this is appropriate), the definition of which is given at the top of each question in the questionnaire. Multiple answers are required. The analysis of the answers is based on an assessment of the horizontal component of the search, relating to the number of options evaluated, and the vertical component the number of determinants (of choice) considered. This is done by the researcher assigning

scores to the horizontal and vertical components, according to whether informal or formal search strategies are employed (see Table 6.19). In general, formal evaluation is given a higher tariff than informal, but where it is improbable that an informal approach to tenders, for example, will contribute to a depth of knowledge (vertical component) this is only accorded a score of "1". It can also be seen that there is no tariff for the horizontal components relating to internal sources, because these can only apply to services already employed (recently or in the past).

The scores in this example are totaled and arbitrary "hurdles" (shown at the bottom, left of the table) are used that define the strategy. This strategy then corresponds with the same descriptors used for the self-assessed strategy in Question 3.3. Although this appears arbitrary, the consistency of approach corresponds with that used for the AHP model (see 3.6.4, page 140).

Screenshot - "Context Help" from question 3 of the Questionnaire

Source: Author

Figure 6.5 – Screenshot from "Context Help" – Question 3.1

In fact, Table 6.19 shows only an example of how the data from one respondent is analysed. The columns marked "Checked" showing "TRUE" in

some of the boxes relate to the check boxes decoded from the questionnaire. In the actual analysis, the tariff on this table is used as a "lookup" and the data analysed horizontally in a database format. To aggregate the responses and then analyse them here would not be meaningful and to summarise them would not exemplify the process.

Although the results are specific to one respondent, the scores assigned to particular sources are consistent. The methodology has been made completely transparent to allow a more detailed interpretation or, if required, application of different weightings and hurdles. Even though the hurdles are set quite low, especially in terms of the horizontal component, the results provided by this analysis are not as optimistic as those from the self-assessment (see Table 6.20).

Question 3.3 presents the respondent with nine options from which to select a predecisional information gathering strategy that they consider best describes the method employed in their organisation. To assist the respondents make this assessment basic descriptions are provided as part of the question. In addition, the respondents can drill down to a more detailed explanation (hyperlink button), on one of the "Context Help" screens (see Figure 6.5).

Predecisional Information Gathering Strategies

Strategy	Inferred (Q3.1 & 3.2)				Self-Assessed (Q3.3)			
	Conformer	Improver	Explorer	Total	Conformer	Improver	Explorer	Total
Review all information across feasible alternatives		3 = 27%	1 = 5%	4 = 9%	2 = 18%	2 = 18%	5 = 23%	9 = 20%
Review all information across suitable alternatives					3 = 27%	3 = 27%	7 = 32%	13 = 30%
Review all information across limited alternatives							1 = 5%	1 = 2%
Review some information across feasible alternatives		3 = 27%	2 = 9%	5 = 11%		1 = 9%	1 = 5%	2 = 5%
Review some information across suitable alternatives	2 = 18%	1 = 9%	6 = 27%	9 = 20%				
Review some information across limited alternatives	1 = 9%		2 = 9%	3 = 7%	2 = 18%		2 = 9%	4 = 9%
Review relevant information across feasible alternatives						2 = 18%	1 = 5%	3 = 7%
Review relevant information across suitable alternatives	1 = 9%	1 = 9%	1 = 5%	3 = 7%	2 = 18%	1 = 9%	1 = 5%	4 = 9%
Review relevant information across limited alternatives	7 = 64%	3 = 27%	10 = 45%	20 = 45%	2 = 18%	2 = 18%	4 = 18%	8 = 18%
Total	11	11	22	44	11	11	22	44

Table 6.20 – Predecisional information gathering strategy

Table 6.20 shows the results of both the inferred and the self-assessed responses to Question 3. Interestingly, in the inferred assessment, a large proportion of respondents (45%), based on the scoring system described above, only review relevant information across limited Alternatives. This compares with the self-assessed descriptions where the majority (52%) review all the information across different alternatives. This is most true of the way Explorers

describe their information gathering strategies (although the situation is almost reversed on an inferred basis).

In order to test Proposition 3, both the inferred data and the self-assessed data were statistically analysed to determine if an association exists between the typology of the respondent and the predecisional information gathering strategy. In this analysis, the alternative hypothesis is that Explorers tend to employ comprehensive strategies (CSS), Improvers to use moderate strategies (MSS) and Conformers to use only limited strategies (LSS). The results for the inferred experiment are shown as Table 6.21.

Proposition 3 - Predecisional Information gathering - Inferred (H_{a-3i})

Measures of Association (3 x 3) - Observed				
Info (Infer)	Conformer	Improver	Explorer	Total
LSS	7	3	10	20
MSS	4	2	9	15
CSS	-	6	3	9
Total	11	11	22	44
tau-c	0.0496	Concordant pairs		218
Gamma	0.0792	Discordant pairs		186
Chi square	11.7333			
DF	4			
α = 0.05	9.4880			
Probability: p ≤ 0.5				
The distribution is significant				

Source: Author

Table 6.21 – Proposition 3 – Information Strategy - Inferred

It can be seen that although all classes of respondent tend towards limited search strategies (20/44 = 45%), this is more significant as a percentage for Conformers. Improvers are strongly inclined towards comprehensive strategies, whereas Explorers appear more inclined towards limited strategies. However, even though only 3 Explorers use comprehensive strategies the general trend, taking account of Improvers, is sufficient to support the proposition. Concordant pairs outnumber discordant pairs, indicating a positive direction of the association, and chi square is calculated as 11.7333 (which exceeds the critical value for α = 0.05 corresponding to four degrees of freedom). Thus the null hypothesis is rejected and Proposition 3 is supported in terms of inferred data.

These results are shown graphically as Figure 6.6.

Predecisional Information Gathering Strategy - Inferred

Expected (H_{0-3i}) Hypothesised (H_3) Observed (H_{a-3i})

Source: Author

Figure 6.6 – Graphical analysis of Proposition 3 (Inferred)

The results from the self-assessed experiment are not as conclusive (see Table 6.22). At face value it does appear as though Explorers do employ more comprehensive search strategies than Improvers or Conformers. Compared with the inferred experiment, 13 Explorers using comprehensive strategies rather than 3 appears far more in line with the alternative hypothesis in Proposition 3. However, closer inspection reveals that Conformers also rate themselves higher whilst Improvers remain almost the same. In fact, Conformers, Improvers and Explorers, on average, all rate themselves pretty much the same which accords more closely with the null hypothesis (see Figure 6.7).

Proposition 3 - Predecisional Information gathering - Self-assessed (H_{a-3a})

Measures of Association (3 x 3) - Observed				
Info (Self A)	Conformer	Improver	Explorer	Total
LSS	2	2	4	8
MSS	4	3	5	12
CSS	5	6	13	24
Total	11	11	22	44
tau-c	0.0697	Concordant pairs		205
Gamma	0.1233	Discordant pairs		160
Chi square	0.7500			
DF	4			
α = 0.05	9.4880			
Probability: p <= 1				
The distribution is not significant				

Source: Author

Table 6.22 – Proposition 3 – Information Strategy – Self-Assessed

Although the analysis shows that concordant pairs exceed concordant pairs, giving a positive Gamma, the value for chi square (0.7500) does not even

match the critical value for 50% probability (3.3570). Based on the self-assessed experiment for information gathering Proposition 3 should be rejected.

From the graphical analysis it is clear that there is very little association between the independent and dependent variables. It is possible for results of this nature to occur even when the actual proposition is, in fact, well founded. Such anomaly may be due to the design of the instrument or misspecification of the model - Type II error (Robson 2002). For this reason, when a reliable method of observation is difficult to specify, two measures may be used and compared (Howitt, 2000). In this case, however, it is more likely that all respondents are equally optimistic in their subjective assessment of their own search strategies.

Graphical analysis of Proposition 3
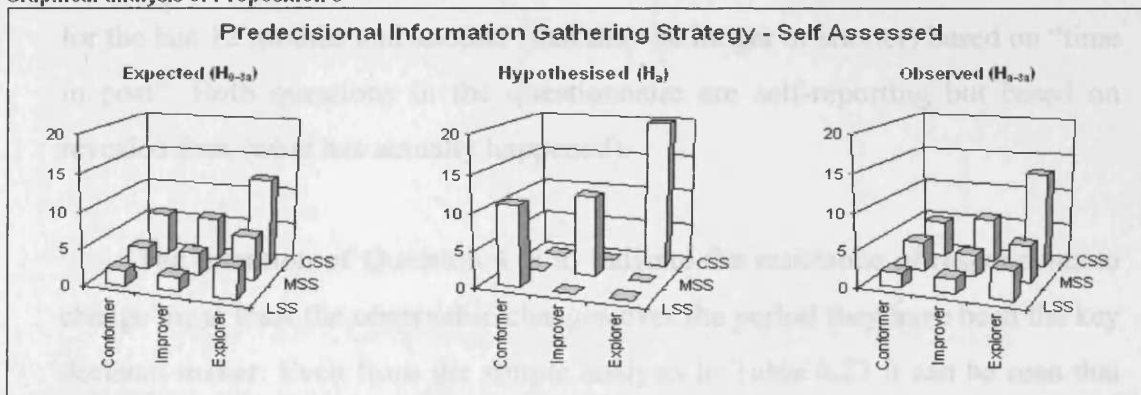
Figure 6.7 – Graphical analysis of Proposition 3 (Self Assessed)

6.5.4   Proposition 4 - Change management (inertia)

Explorers, whatever mode they are currently using, are likely to weigh the feasible options and select the mode most suitable according to the information available (new buy or modified rebuy). b) Improvers will tend to remain with the current mode (not exclusively) but look for service improvements (modified rebuy). c) Conformers will tend to remain with the mode, service and carrier currently used except if they have inherited an option they perceive to be too risky in which case they may change to a less risky option (rebuy or, modified rebuy).

Inertia (resistance to change)

Changes in the last 12 months					Changes since assuming responsibility				
Criteria	Co.	Im.	Ex.	Tot.	Criteria	Co.	Im.	Ex.	Tot.
No, same carrier	5	2	2	9	Same carrier - inherited	1	4	4	9
No, same carriers (more or less)	3	5	2	10	Same carriers - inherited	1	2	4	7
Yes, same carrier but different terms			5	5	Same mode - inherited (different carrier)	1	2	5	8
Yes, same carriers but different terms			5	5	Same mode - inherited (different carriers)	8		3	11
Yes, same mode but different carrier					Different mode and carrier		1	1	2
Yes, same mode but different carriers	2	2	2	6	Different mode and carriers		2	5	7
Yes, different mode	1	2	6	9					
Total	11	11	22	44	Total	11	11	22	44

Source: Author

Table 6.23 – Resistance to change

The fourth proposition considers whether the different typologies are more or less resistant to change – whether there is inertia in terms of evaluating and changing to alternative transportation strategies. Two timeframes are used, one for the last 12 months and another (that may be longer or shorter) based on "time in post". Both questions in the questionnaire are self-reporting but based on revealed data (what has actually happened).

The intention of Question 4 is to indicate the resistance of respondents to change or, at least the observable changes over the period they have been the key decision-maker. Even from the simple analysis in Table 6.23 it can be seen that Explorers as a percentage have less resistance to change than Conformers.

Proposition 4 - Inertia - 12 months ($H_{a4\,12}$)

Measures of Association (3 x 3) - Observed				
Inertia - 12	Conformer	Improver	Explorer	Total
High	8	7	4	19
Medium	-	-	10	10
Low	3	4	8	15
Total	11	11	22	44
tau-c	0.2836	Concordant pairs		302
Gamma	0.4347	Discordant pairs		119
Chi square	16.6737			
DF	4			
α = 0.05	9.4880			

Probability: p ≤ 0.05
The distribution is significant

Source: Author

Table 6.24 – Proposition – Inertia – 12 months

In order to be consistent with the other propositions, the same method of statistical analysis is used. The descriptions in Table 6.23 are converted to

"High" resistance to change, "Medium" and "Low". The results for the 12-month experiment are shown in Table 6.24. Proposition 4 associates high resistance to change with the Conformer group, and "Medium" to a lower resistance to change linked to Improvers. Explorers are deemed, in this study, to have a low resistance to change. The reasonably substantial value for chi squared in Table 6.24 confirms that this proposal is well founded and Proposition 4 should be accepted.

The result can be seen graphically in Figure 6.8.

Graphical analysis of Proposition 4 - 12 months
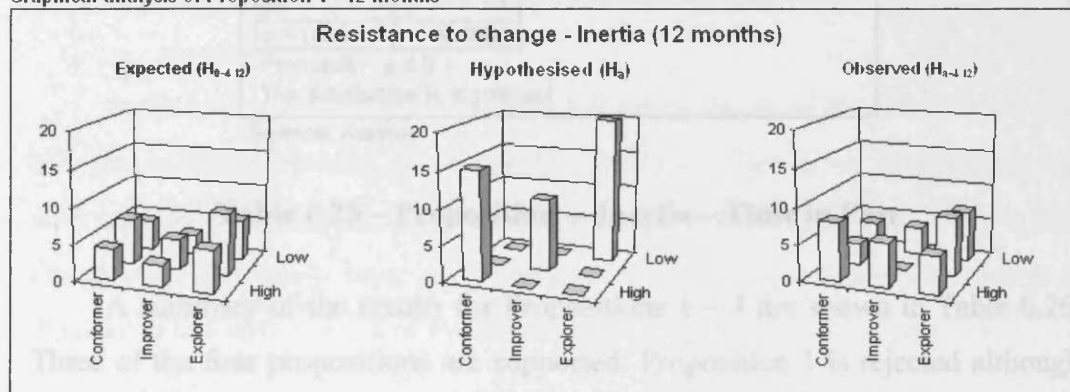
Source: Author

Figure 6.8 – Graphical analysis of Proposition 4 (12 months)

The same form of statistical analysis is carried out for the resistance to change since the decision-maker has been responsible for transportation choice (termed for this experiment "time in post"). When the experiment was being designed, it was thought that this would provide a more accurate assessment of the resistance to change. In fact, as can be seen from Table 6.14 (page 263), a large proportion of the respondents (28/44 = 64%) had been in post for over five years, and four had been in the same job for over 20 years. Given such a long period, changes will almost certainly have been imposed through changes of product or technology, or some other external factor.

The results shown in Table 6.25 appear to confirm this. Rather than being a better indication, as might have been expected over a shorter period, the results are not as significant as for 12 months. Chi square is 8.2857, against a critical value of 9.4880 for $\alpha \leq 0.05$ (4 degrees of freedom). However, the critical value

for $\alpha \leq 0.01$ is 7.7790 giving a probability of 90%. Although the proposition is rejected according to the criteria adopted for this experiment, it is still a statistically significant result.

Measures of Association (3 x 3) - Observed				
Inertia - 12	Conformer	Improver	Explorer	Total
High	2	6	8	16
Medium	9	3	9	21
Low	-	2	5	7
Total	11	11	22	44
tau-c	0.0248	Concordant pairs		200
Gamma	0.0417	Discordant pairs		184
Chi square	8.2857			
DF	4			
$\alpha = 0.05$	9.4880			
Probability: $p \leq 0.1$				
The distribution is significant				

Source: Author

Table 6.25 – Proposition – Inertia – Time in Post

A summary of the results for Propositions 1 – 4 are shown in Table 6.26. Three of the four propositions are supported. Proposition 1 is rejected although there is some indication that an association exists, broadly in line with the hypothesis.

Comparison of results - Propositions 1 - 4

Proposition (abbreviated)		Critical value			Analysis		Alternative hypothesis
		$p \leq 0.05$	$p \leq 0.1$	$p \leq 0.5$	X^2	Result	
P_1	Triggers	9.488	7.779	3.357	3.5055	50% probability	Rejected
P_2	Buy class	9.488	7.779	3.357	9.5588	95% probability	Supported
P_{3i}	Info (inferred)	9.488	7.779	3.357	11.7333	95% probability	Supported
P_{3a}	Info (self-assessed)	9.488	7.779	3.357	0.7500	Not significant	Rejected
$P_{4\,12}$	Inertia (12 months)	9.488	7.779	3.357	16.6737	95% probability	Supported
$P_{4\,tip}$	Inertia (TiP)	9.488	7.779	3.357	8.2857	90% probability	Rejected

Source: Author

Table 6.26 – Comparison of results – Proposition 1 - 4

6.6 Proposition 5 - Determinants of dissatisfaction and choice

Determinants of choice are actually determinants of dissatisfaction arising from the most recently used transportation choice.

Proposition 5 advocates that the classic concept in many transportation modal choice studies, that choice is based on a set of standard and predictable determinants, is in fact misconceived and choice is actually determined by determinants of dissatisfaction influence by a previous transport choice. For the proposition to be accepted there are two criteria that should be satisfied;

- Primarily, there should be a close association between determinants of dissatisfaction (arising from Question 5.1) and the determinants of choice (arising from Question 5.2) when measured individually;

- Secondly, there should be a much weaker preference in the aggregated population for particular determinants of choice (5.2).

In Chapter 4 it was proposed that the determinants of dissatisfaction (with the last carrier or mode) were highly significant factors in determining the determinants of choice for making future transportation decisions. Even in this Chapter it has already been seen that one of the major triggers for change is dissatisfaction with aspects of the current service (see Table 6.15, page 265).

Determinants of Dissatisfaction

Determinants	Worst	Next Worst	Least Worst	Rank	%
Overall cost	13	10	7	1	26.1%
On time pick up/delivery	12	5	2	2	19.0%
Shipment information	2	11	7	3	13.8%
Flexibility (ability to change pick up times/days etc.)	5	4	5	4	11.1%
Loss/damage record	4	1	7	5	8.3%
Claims response	3	3	6	6	8.3%
Transit time reliability	2	3	5	7	6.7%
Overall transit time	1	4	0	8	4.3%
Other (please specify)	2	0	0	9	2.4%
Total	44	41	39		
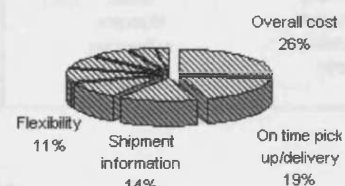
Source: Author

Table 6.27 – Determinants of dissatisfaction

The difficulty, as far as designing the questionnaire was concerned was to find a method that, in the first instance, elicited information about both determinants of choice and dissatisfaction, without respondents consciously (or unconsciously) making the connection (and thus biasing the responses). At the same time, similar (comparable) descriptions were necessary so that the two could be regressed. A further complication is the nature of dissatisfaction. Although there is only limited evidence, it is argued here that dissatisfaction is a

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largely subjective judgment (Chu, Gertsner & Hess, 1998) that focuses on a limited number of factors. Choice, especially where made in a corporate environment, is more likely to be based on objective evaluation (although, as has already been found, this is not necessarily always the case) of a much wider range of alternatives. For this reason, in Question 5.1 a fairly explicit matrix was used to expose determinants of dissatisfaction, ranking only three from worst through to least worst. The results of this ranking are shown in an aggregated format for all respondents in Table 6.27.

The main determinants of dissatisfaction identified in the study were:

- Overall cost (26%);
- On time pick-up and delivery (19%);
- Shipment information (14%);
- Flexibility (11%).

Determinants of Choice

Determinants	1st	2nd	3rd	Rank	%
More flexibility	12	14	7	1	27.4%
Better on time pick up/delivery	10	8	4	2	18.5%
Better shipment information	8	7	11	3	18.1%
Lower overall cost	5	7	5	4	13.0%
More reliable transit time	5	4	7	5	11.9%
Better loss/damage record	2	3	7	6	7.0%
Faster claims response	1	1	1	7	2.2%
Shorter transit time	1	0	2	8	1.9%
Total	44	44	44		
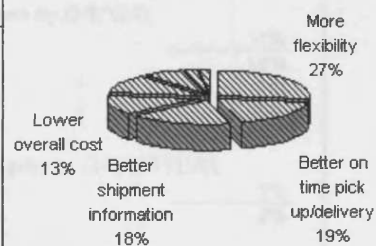
Source: Author

Table 6.28 – Determinants of choice

For ranking the determinants of choice, the definitions were changed slightly (e.g. "On time pick-up/delivery" under Determinants of dissatisfaction became "Better on time pick/up/delivery" under determinants of choice. More importantly, the determinants of choice were presented in pairs, using an adaptive stated preference format, in a completely different sequence from that used in the determinants of dissatisfaction. Whilst this difference in presentation seemed minor, the results appeared to show that the methodology was effective. The results of the analysis of determinants of choice are shown in Table 6.28.

The main determinants of choice identified in the study were:

- More flexibility (27%);

- Better on-time pick-up and delivery (19%);

- Better shipment information (18%);

- Lower overall cost (13%).

Clearly, although the determinants of dissatisfaction are not ranked in the same order as those for choice, there is obviously common ground. Another interesting result, not actually apparent from Tables 6.27 and 6.28, is that as a percentage, dissatisfaction with on time pick-up and delivery, as well as the desire for greater reliability in terms of the transit time, is more prevalent amongst exclusive users of the maritime mode than other classes.

Probability - Combinations

The probability of matching ONE of THREE determinants. given eight choices is given by (3/8):	
Calculated probability	38%
Actual (one match)	39%
Actual (first of two matches)	50%
Actual (first of three matches)	2%
Actual Result	91%
The probability of matching TWO of THREE determinants. given eight choices is given by (3/8)*(2/7):	
Calculated probability	11%
Actual (two matches)	50%
Actual (second of three matches)	2%
Actual Result	52%
The probability of matching THREE of THREE determinants. given eight choices is given by (3/8)*(2/7)*(1/6):	
Calculated probability	2%
Actual Result Actual (Three matches)	2%

Source: Author

Figure 6.9 – Proposition 5 - Combinations

It was important in terms of investigating the proposition that the questionnaire was designed so that different methods were used to solicit the two variables such that the answers to the first part (5.1) would not directly influence (or be copied to) the second ranking in the adaptive stated preference technique used for 5.2. The data from 5.1 provided up to 3 ranked choices, and from 5.2, eight ranked choices. Only the first three of each were analysed.

The data was compared in two ways. Firstly, it was evaluated to find any commonality between the determinants of choice and the first three determinants of dissatisfaction. These combinations were counted regardless of position.

Having done this, the probability was assessed for one match, two matches and three matches respectively. Given eight possible options for three choices the odds were assessed as $\alpha = 3/8 = 38\%$ for one match, $(3/8) \times (2/7) = 11\%$ for two matches and $(3/8) \times (2/7) \times (1/6) = 2\%$ for three matches. For converting this to frequencies the numbers are cumulative such that three matches will contribute to two and one, whilst two will contribute to one (i.e. at least one match will incorporate the results of two and three). The results are shown in Figure 6.9.

This is significant as the commonality between the matches found between determinants of dissatisfaction are substantially more than would be found in the general population. Over 90% have one in common and more than 50% have two. However, in order to establish whether this is statistically significant the percentages are converted to frequencies and tested using chi-squared goodness of fit (see Table 6.29).

In common (Combinations)

Presence	Predicted	Expected (f_e)	Observed (f_o)	χ^2
Three	1.79%	1	1	-
At least two	10.71%	5	23	64.8000
At least one	37.50%	17	41	33.8824

$$\Sigma\chi^2 \quad 98.6824$$

$$DF = (3 - 1) \times (2 - 1) = 2 \qquad\qquad 5.9910$$

Probability: $p <= 0.05$
The distribution is significant

Source: Author

Table 6.29 – Proposition 5 – Combinations - Chi-squared test

From Table 6.29 it can be seen that the $\chi2$ result is significantly higher than the $\alpha \leq 0.05$ level for 2 degrees of freedom (in fact it exceeds the $\alpha \leq 0.0001$ confidence level).

Common incidence in the first three is one aspect to consider, but in view of the fact that both sets of data are ranked they can be analysed to see if the correspondence is exact. This is a much more severe test as the odds against it happening by chance are much greater (as is illustrated by the factorial elements in the function below) (Knight, 2000).

$$n \Pr = \frac{n!}{(n - r)!}$$

This formula is evaluated using the "@FACT" function in Excel to give probabilities for exact matches (permutations) for one, two and three positions. The results are:

$$_8P_3 = 8!/(8-3)! = 8!/5! = 40{,}320/120 = 336$$

$$_8P_2 = 8!/(8-2)! = 8!/6! = 40{,}320/720 = 56$$

$$_8P_1 = 8!/(8-1)! = 8!/7! = 40{,}320/5{,}040 = 8$$

These translate into percentages of 0.30% for three exact matches, 1.79% for two exact matches and 12.50% for one exact match. The probabilities of the matches occurring by chance in the survey population are converted to frequencies and evaluated using chi-squared (see Table 6.30).

Exact match (Permutation)

Coincidence	Predicted	Expected (f_e)	Observed (f_o)	χ^2
3 matches	0.30%	0	0	-
2 matches	1.79%	1	4	9.0000
1 match	12.50%	6	16	16.6667

$$\Sigma\chi^2 \quad 25.6667$$

$$DF = (3 - 1) \times (2 - 1) = 2 \qquad 5.9910$$

Probability: $p <= 0.05$

The distribution is significant

Source: Author

Table 6.30 – Proposition 5 – Permutations - Chi-squared test

Again, it can be seen that the occurrence in the sample is far higher than would be expected in the null hypothesis. The χ^2 value is significant at the $\alpha \leq$ 0.0001 level. According to both measures (combination and permutation) the distribution is significant and the proposition should be accepted. However, it is logical that the underlying variable (the determinant of choice), identified in other studies, is an important factor common to both observations in this study.

It can be seen from Table 6.31 that for both determinants of dissatisfaction and choice, the observed frequencies generate large χ^2 values indicating that the

distributions are highly significant, i.e. significant at the $\alpha \leq 0.001$ level (36.123 at DF = 14). Closer examination shows that there are dominant determinants in both data sets. The frequency of 12 for the first choice in "On time pickup and delivery" as a determinant of dissatisfaction compares with a frequency of 10 in the corresponding column as a determinant of choice. Similar comparisons may be made for cost and shipment information. Even so, although these are comparisons that can be made at the aggregate level, they are not necessarily distributed in the same way at the disaggregate level.

The two measures are not completely independent at an aggregate level, which is not surprising, but there are sufficient differences to suggest that the results at the disaggregate level do stand and are adequate to support the proposition. Thus, determinants of dissatisfaction do influence determinants of choice and may become adopted as determinants of choice in their own right in the long run.

Independence of aggregate determinants of dissatisfaction and choice

Rank	Lower overall cost	On time pick up/ delivery	Loss/ damage record	Reliable transit time	Faster claims response	Ship- ment info	Shorter transit time	More flexibility	χ^2
Determinants of dissatisfaction - Observed Frequency									
1	13	12	2	2	1	5	5	3	
2	10	5	3	12	4	4	1	3	
3	7	3	5	7	0	5	7	6	
Determinants of dissatisfaction - Expected Frequency									
1	5.21	5.21	5.21	5.21	5.21	5.21	5.21	5.21	
2	5.21	5.21	5.21	5.21	5.21	5.21	5.21	5.21	
3	5.21	5.21	5.21	5.21	5.21	5.21	5.21	5.21	
Determinants of dissatisfaction - χ^2 Function									
1	11.66	8.86	1.98	1.98	3.40	0.01	0.01	0.94	28.82
2	4.41	0.01	0.94	8.86	0.28	0.28	3.40	0.94	19.11
3	0.62	0.94	0.01	0.62	5.21	0.01	0.62	0.12	8.13
								$\Sigma\chi^2$	56.06
Determinants of choice - Observed Frequency									
1	5	10	2	5	1	8	1	13	
2	7	8	3	5	1	7	0	14	
3	6	4	7	7	1	11	2	7	
Determinants of choice - Expected Frequency									
1	5.63	5.63	5.63	5.63	5.63	5.63	5.63	5.63	
2	5.63	5.63	5.63	5.63	5.63	5.63	5.63	5.63	
3	5.63	5.63	5.63	5.63	5.63	5.63	5.63	5.63	
Determinants of choice - χ^2 Function									
1	0.07	3.40	2.34	0.07	3.80	1.00	3.80	9.67	24.16
2	0.34	1.00	1.23	0.07	3.80	0.34	5.63	12.47	24.87
3	0.03	0.47	0.34	0.34	3.80	5.14	2.34	0.34	12.78
								$\Sigma\chi^2$	61.80

Source: Author

Table 6.31 – Independence of aggregate determinants

For shipments between the UK and Russia, a) Explorers are most likely to prefer a sea based option, b) Improvers are most likely to use a "Many Baskets" approach, and c) Conformers are most likely to limit themselves to one option, most probably road based.

SERVICE CHOICE ANALYSIS

Rank Respondent	1st Choice	2nd Choice	3rd Choice	4th Choice	5th Choice	6th Choice	7th Choice	8th Choice
1	Invalid response							
2	C	E	A	H	D	F	B	G
3	A	E	C	G	B	H	D	F
4	C	E	A	H	F	B	D	G
5	D	E	A	H	C	F	G	B
6	D	F	A	G	E	C	B	H
7	C	E	A	G	D	F	B	H
8	F	D	H	A	E	C	G	B
9	C	F	B	H	E	D	G	A
10	D	F	H	A	E	C	G	B
11	D	E	H	A	C	F	G	B
12	B	F	D	H	C	E	G	A
13	H	D	F	A	C	E	B	G
14	D	F	H	A	C	E	G	B
15	C	E	A	G	D	F	B	H
16	C	F	A	H	D	E	G	B
17	F	D	H	A	E	C	G	B
18	C	E	A	G	D	F	B	H
19	F	D	H	A	E	C	G	B
20	D	E	A	H	C	F	B	G
21	F	A	C	H	E	B	D	G
22	D	E	G	A	F	C	H	B
23	F	D	H	A	C	E	G	B
24	D	E	A	H	C	F	G	B
25	C	E	H	A	D	F	G	B
26	C	F	H	A	D	E	B	G
27	C	E	H	A	D	F	B	G
28	D	F	B	H	G	C	E	A
29	F	D	H	A	C	E	G	B
30	C	E	B	H	D	F	A	G
31	D	E	G	A	C	F	B	H
32	D	E	G	A	C	F	H	B
33	D	E	A	H	C	F	B	G
34	D	E	A	H	C	F	G	B
35	C	E	H	B	D	F	A	G
36	D	E	A	H	C	F	G	B
37	F	C	H	A	D	E	G	B
38	D	E	A	H	F	C	G	B
39	F	D	A	G	C	E	H	B
40	F	A	H	C	D	E	G	B
41	C	E	A	G	D	F	B	H
42	D	E	H	A	F	C	G	B
43	F	D	H	A	C	E	G	B
44	F	D	H	A	C	E	G	B
45	C	E	A	H	F	B	D	G
Overall	D	E	C	A	F	H	G	B

Source: Author

Table 6.32 – Results of the Service Choice analysis

Propositions 1 to 5 deal with the process by which the transportation decision is made. Proposition 6 concerns the modal choice and the likelihood that Conformers will choose road options, Improvers a Many Baskets approach

and Explorers a multimodal approach based on sea transport. An adaptive stated preference technique was used presenting the respondents with two sets of twelve by two options. The instrument was designed so that the first set of twelve questions tested the choice made based exclusively on "Service" attributes (cost, transit time, reliability etc.) and then, in the second set, the same choices were presented (in a completely different order) but providing additional "Route" information (mode, route etc.). The results from both sets were output as ranked data 1 – 8 (see Tables 6.32, 6.34 and Appendix 14).

This section deals with both service choice and route choice as they are closely related to each other. In the instrument design (see Chapter 5) it was decided to use an adaptive stated preference technique for both these questions (6.1 and 6.2). There are two reasons; firstly, stated preference allows exploration of rail options, which are not widely used (as became even more apparent from the results of the survey). Secondly, stated preference techniques also allow quite complex data to be presented for comparison, in a manner that is fairly easily assimilated by the respondents. Having investigated the methodology applied in the LASP (Leeds Adaptive Stated Preference) technique, which uses three choices in addition to the base choice, it was decided this was too complex for this experiment, even for experienced decision-makers to answer consistently and reliably. For this reason, Questions 6.1 and 6.2 required only the evaluation of two possible choices at any one time.

Service and Route Coding

Service Choice		Route Choice	
Code	ID No.	Code	ID No.
A	142856	A	189142
B	596238	B	596238
C	353360	C	353360
D	650665	D	856456
E	586555	E	586555
F	189142	F	650665
G	689753	G	689753
H	856456	H	142856

Source: Author

Table 6.33 – Service and Route coding

Question 6.1 presented 12 sets of choices of two options, comprising a total of eight discrete options. The service choice options in question 6.1 are concerned only with cost, transit time and reliability. They are randomly presented and the subsequent questions are adapted according to the answers given (choices made) in the preceding questions. The consequent "knockout and plate" competition between the 12 choices results in an absolute ranking of the eight possible options. The outcome of this ranking is delivered in the form of an eight-letter code (letters "A" to "H"), with each letter representing a particular service choice. The results from all the respondents are shown in Table 6.32.

ROUTE CHOICE ANALYSIS

Rank Respondent	1st Choice	2nd Choice	3rd Choice	4th Choice	5th Choice	6th Choice	7th Choice	8th Choice
1	Invalid response							
2	F	C	A	H	E	D	G	B
3	A	E	C	G	B	H	D	F
4	A	E	C	G	B	F	D	H
5	F	A	D	G	E	C	H	B
6	C	F	A	H	E	D	G	B
7	D	F	A	G	B	H	E	C
8	A	F	D	G	C	E	H	B
9	C	F	H	B	E	A	D	G
10	A	F	D	G	E	C	H	B
11	A	F	D	G	B	E	C	H
12	C	E	H	B	A	F	D	G
13	A	F	D	G	C	E	H	B
14	F	A	D	G	E	C	H	B
15	C	F	H	B	E	A	G	D
16	E	A	D	G	C	F	H	B
17	A	F	D	G	C	E	H	B
18	C	F	H	A	E	B	G	D
19	A	F	C	G	D	E	H	B
20	F	C	H	A	E	B	D	G
21	F	C	A	H	E	D	G	B
22	F	C	H	A	E	D	G	B
23	A	F	D	G	C	E	H	B
24	A	F	D	H	G	B	C	E
25	F	A	C	H	D	E	G	B
26	C	F	A	H	D	E	G	B
27	C	E	B	H	A	F	D	G
28	C	E	H	A	F	B	G	D
29	A	F	C	G	D	E	H	B
30	C	E	H	A	F	D	B	G
31	F	A	C	H	D	G	E	B
32	F	A	D	G	C	E	B	H
33	C	E	H	A	F	D	B	G
34	F	C	H	A	E	D	G	B
35	C	E	A	H	F	B	D	G
36	F	C	H	A	E	B	G	D
37	F	A	C	G	E	D	H	B
38	F	A	H	D	E	C	G	B
39	A	E	D	G	F	C	H	B
40	A	F	D	G	E	C	H	B
41	C	F	H	A	E	B	G	D
42	F	A	D	G	E	C	H	B
43	F	A	D	H	C	E	G	B
44	A	E	D	G	F	C	H	B
45	A	F	D	G	C	E	H	B
Overall	A	F	C	E	D	H	G	B

Source: Author

Table 6.34 – Results of the Route choice analysis

The overall result is obtained from the summation of each letter by its reverse ranking, thus showing the preference for the entire sample. If this is then related back to the corresponding services by decoding the results (see Figure 6.33 and Appendix 15)[20]: it can be seen that the overall preference is based in the first instance essentially on cost, with service attributes only shown to be significant where costs are very close (i.e. Frequency reversing the cost preference between choices two and three). The letters in Table 6.32 refer to the following service options:

- D = 650665 (Cost = £43.80, T/time = 9.5d, Rel +/-1d = 83%, Freq = 1d);
- E = 586555 (Cost = £44.87, T/time = 9.0d, Rel +/-1d = 70%, Freq = 2d);
- C = 353360 (Cost = £42.73, T/time = 9.0d, Rel +/-1d = 70%, Freq = 7d);
- A = 142856 (Cost = £49.14, T/time = 10.5d, Rel +/-1d = 55%, Freq = 2d);
- F = 189142 (Cost = £59.35, T/time = 10.0d, Rel +/-1d = 95%, Freq = 1d);
- H = 856456 (Cost = £62.32, T/time = 10.0d, Rel +/-1d = 95%, Freq = 1d);
- G = 689753 (Cost = £57.87, T/time = 11.0d, Rel +/-1d = 68%, Freq = 1d);
- B = 596238 (Cost = £53.42, T/time = 12.0d, Rel +/-1d = 40%, Freq = 7d).

Question 6.2 takes a similar approach to Question 6.1, except that details of the route, including mode and intermediary services (such as ports) are offered as part of a modal comparison. The service choice details are identical, although they may be presented in a different sequence. No information is provided other than what is available on the screen so that any perceptions beyond what is given in terms of the service specification has to come from the respondent's own knowledge (and, arguably, any "availability", "representative" and "confirming" heuristic). Because of the length and complexity of the questionnaire (taking into account the typology questions) no provision was made to explore the motives and prejudices in further detail. From the results, this is certainly an area of potential further study.

The results, obtained in the same way as those for Question 6.2, are given in Table 6.34.

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[20] The 6 digit ID code was devised to avoid respondents being able to remember earlier choices they had made by a single digit code. Later it was realised that the code did not have to be shown at all to the respondents but, by this time, a lot of the Web site had been developed and so the unnecessarily long ID Code was retained.

The letters used represent different service (and route) options from those shown in Question 6.1 (so that respondents, if they realize the similarity in the choices presented, cannot simply repeat the same eight letter code). However, the numeric codes used, do correspond, so that the results from the two questions can be compared with each other.

- A = 189142 - Route = Road – one nominated road carrier via Poland,

  Cost = £59.35, T/time = 10.0d, Rel +/-1d = 95%, Freq = 1d.

- F = 650665 - Route = MB Sea and road – Mixture of road and sea carriers,

  Cost = £43.80, T/time = 9.5d, Rel +/-1d = 83%, Freq = 1d.

- C = 353360 - Route = Sea - One nominated carrier - UK port to St Petersburg,

  Cost = £42.73, T/time = 9.0d, Rel +/-1d = 70%, Freq = 7d.

- E = 586555 - Route = MB Sea – Several suitable sea carriers,

  Cost = £44.87, T/time = 9.0d, Rel +/-1d = 70%, Freq = 2d.

- D = 856456 - Route = MB Road carriers – Several suitable road carriers,

  Cost = £62.32, T/time = 10.0d, Rel +/-1d = 95%, Freq = 1d.

- H = 142856 - Route = MB Sea/Rail – Mixture of sea carriers and rail services,

  Cost = £49.14, T/time = 10.5d, Rel +/-1d = 55%, Freq = 2d.

- G = 689753 – Route = MB Road and rail – Mixture of road and rail services,

  Cost = £57.87, T/time = 10.5d, Rel +/-1d = 55%, Freq = 2d.

- B = 596238 – Route = Rail service,

  Cost = £53.42, T/time = 12.0d, Rel +/-1d = 40%, Freq = 7d.

It can be seen from the results that the majority of respondents prefer a "Road" option, for which there is quite a significant premium. However, the second choice, is many baskets at a much lower cost. Rail options are not favoured at all and the exclusively rail service is ranked last overall.

In order to test the proposition, three tests were applied to the data:

- Comparison of the two rankings to test whether the choices made on the basis of route information were different from those made on the service attributes alone (Spearman's rho);

- Evaluation of the relative importance of the route and service variables using rank order vectors;

- Frequency analysis of first choice made according to typology using chi-squared.

Unlike the determinants of dissatisfaction and choice where the absolute position of the first three choices are important, in this analysis the ranking of both sets of eight options are available for comparison. A non-parametric test was used, Spearman's r. In order to test for significance, the correlation statistic, is compared with a table of critical values for the degrees of freedom (n-2) and the level of probability required ($\alpha \leq 0.05$).

Correlation between Service and Route choice

DM Type Class	Service (ranking)	Route (ranking)	Pearson - r	Spearman's (rho) - ρ	Critical Value - α =< 0.05	Significance	Significance by typology	Same first choice by typology
				Invalid				
Explorer	12345678	25461387	0.5000	0.5000	0.7380	Not significant		
Improver	12345678	62345781	0.0952	0.0952	0.7380	Not significant		
Explorer	12345678	32871564	0.1429	0.1429	0.7380	Not significant		
Explorer	12345678	15736248	0.3810	0.3810	0.7380	Not significant		Explorer
Conformer	12345678	23475186	0.5000	0.5000	0.7380	Not significant		
Improver	12345678	87642351	- 0.8333	- 0.8333	0.7380	Not significant		
Explorer	12345678	12376548	0.7619	0.7619	0.7380	Significant	Explorer	Explorer
Explorer	12345678	16475283	0.1905	0.1905	0.7380	Not significant		Explorer
Improver	12345678	21375648	0.7619	0.7619	0.7380	Significant	Improver	
Explorer	12345678	26387145	0.0476	0.0476	0.7380	Not significant		
Explorer	12345678	45671283	- 0.1190	- 0.1190	0.7380	Not significant		
Improver	12345678	32175684	0.5952	0.5952	0.7380	Not significant		
Improver	12345678	12376548	0.7619	0.7619	0.7380	Significant	Improver	Improver
Conformer	12345678	15372648	0.5714	0.5714	0.7380	Not significant		Conformer
Conformer	12345678	52736148	0.1905	0.1905	0.7380	Not significant		
Conformer	12345678	12376548	0.7619	0.7619	0.7380	Significant	Conformer	Conformer
Explorer	12345678	15372468	0.6190	0.6190	0.7380	Not significant		Explorer
Explorer	12345678	12576348	0.6190	0.6190	0.7380	Not significant		Explorer
Conformer	12345678	15372468	0.6190	0.6190	0.7380	Not significant		Conformer
Explorer	12345678	34265817	0.3571	0.3571	0.7380	Not significant		
Explorer	12345678	15734268	0.4762	0.4762	0.7380	Not significant		Explorer
Conformer	12345678	12375648	0.7857	0.7857	0.7380	Significant	Conformer	Conformer
Explorer	12345678	28437156	0.0952	0.0952	0.7380	Not significant		
Conformer	12345678	36541278	0.3333	0.3333	0.7380	Not significant		
Improver	12345678	13542687	0.8095	0.8095	0.7380	Significant	Improver	Improver
Improver	12345678	12746538	0.5952	0.5952	0.7380	Not significant		Improver
Explorer	12345678	54687123	- 0.4762	- 0.4762	0.7380	Not significant		
Conformer	12345678	12573648	0.6905	0.6905	0.7380	Not significant		Conformer
Explorer	12345678	12765438	0.5238	0.5238	0.7380	Not significant		Explorer
Explorer	12345678	17643285	0.2381	0.2381	0.7380	Not significant		Explorer
Explorer	12345678	16485237	0.2143	0.2143	0.7380	Not significant		Explorer
Explorer	12345678	52361478	0.5238	0.5238	0.7380	Not significant		
Explorer	12345678	15362478	0.6905	0.6905	0.7380	Not significant		Explorer
Explorer	12345678	12765348	0.5476	0.5476	0.7380	Not significant		Explorer
Explorer	12345678	15382476	0.5000	0.5000	0.7380	Not significant		Explorer
Explorer	12345678	23671548	0.4524	0.4524	0.7380	Not significant		
Improver	12345678	15342678	0.7857	0.7857	0.7380	Significant	Improver	Improver
Explorer	12345678	15746238	0.3095	0.3095	0.7380	Not significant		Explorer
Conformer	12345678	17362548	0.4286	0.4286	0.7380	Not significant		Conformer
Improver	12345678	15372468	0.6190	0.6190	0.7380	Not significant		Improver
Improver	12345678	15372648	0.5714	0.5714	0.7380	Not significant		Improver
Conformer	12345678	21345678	0.9762	0.9762	0.7380	Significant	Conformer	
Improver	12345678	15376248	0.4762	0.4762	0.7380	Not significant		Improver
Conformer	12345678	56731824	- 0.3095	- 0.3095	0.7380	Not significant		

Source: Author

Table 6.35 – Correlation between Service and Route choice

To test the correlation between the Service choices and Route choices the results of the questionnaire were analysed such that the Service choices made by

each individual respondent were ranked from one to eight (regardless of the details of the service). For example, the service choice for the first respondent (n_1) might be "AFDHCEBG" and this would be assigned a ranking of "12345678". The second respondent (n_2) might then select "CEAHDFBG" and this would also be assigned the ranking "12345678". The Route choice would then ranked using the coding for the Service choice so that if n_1 ranked the Route options as DEFBACHG for the first choice, the ranking for Route choice would become 36271548. Similarly, if n_2 delivered EDHFCGB for route choices, this would correspond to a ranking for n_2's route choice of 25461387. These rankings presented in this manner are called ranking vectors.

Although the principle as described here is correct (including the ranking), the example omits a further layer of coding used to disguise to the respondent the results of the Route choice from those of the Service choice. In the adaptive stated preference question (Q6) in the questionnaire, whilst the first sequence of letters for n_1 and n_2 are correct, the second sequence would have been different to prevent the respondents simply copying the results across. Thus, these sequences of letter columns have been excluded from the table.

It is important to note that because the rankings are assigned to the choices made by individuals they cannot be compared with each other, i.e. n_1's ranked one ("A") does not correspond with n_2's rank one ("C"). Having assigned these codes, the ranking delivered by the respondents for Service are then compared with those for Route using Spearman's rho. It is interesting to note, from Table 6.35, that Spearman's ρ, here, is the same as Pearson's r.

Critical values for Spearman's ρ and Pearson r

One-tailed level of significance			0.050	0.025	0.010	0.005
Two-tailed level of significance			0.100	0.050	0.020	0.010
Spearman's ρ	DF = n	N = 8	0.643	0.738	0.833	0.881
Pearson r	DF = n - 2	N = 6	0.622	0.707	0.789	0.834

Source: Adapted from Sheskin (2004)

Table 6.36 – Critical values for Spearman's ρ and Pearson's r

The significance of the result is tested against the critical values corresponding to a probability $\alpha \leq 0.05$ (bearing in mind that DF for $\rho = n - 2$). An extract from the critical values table for rho is shown as Table 6.36.

It can be seen from Table 6.36 that the critical value for ρ corresponding to a two-tailed level of significance is 0.707. This is applied to the results in Table 6.35. Based on these results, Table 6.37 shows that in only 8 out of 44 responses is there a significant level of correlation between the Service choices made by individuals, based on service attributes (cost, transit time, reliability etc.) and Route information (mode, route etc.). Thus, as route information was applied retrospectively to the same service attributes from the first part of the ASP sequence, using this measure suggests that route information is a significant feature influencing modal choice.

Correlation between Service and Route results

Significance	Conformer	Improver	Explorer	Overall
Significant	3	4	1	8
Total population	11	11	22	44
% of total population	27%	36%	5%	18%

Source: Author

Table 6.37 – Correlation between Service and Route

However, this is not the full story since, although the correlation between the full ranking is not statistically significant in most cases, a large proportion of respondents have made the same ultimate choice for their first preference (see Table 6.35 for detail and Tables 6.37 and 6.38 for the results). This raises an interesting question whether the order in which the options are presented affects the ultimate rank. The adaptive stated preference technique is designed so that it does not, as the options are generated in such a way as to provide a fully determined (1 to 8) ranking.

Same first choice for Service and Route

Matching	Conformer	Improver	Explorer	Overall
Same first choice	6	7	13	26
Total population	11	11	22	44
% of total population	55%	64%	59%	59%

Source: Author

Table 6.38 – Same first choice for Service and Route

In order to find out how, and by what attributes, the respective respondents are motivated to make their final choices, further analysis was undertaken. The relative importance of service and route variables were examined in more detail and, in consequence, the second part of the analysis for Proposition 6 concerns this aspect. The approach used for this analysis was an exploratory technique using rank order vectors.

Rank order vectors are usually associated with ranking for group consensus or group representation (Chang et al., 2000). This analysis is concerned with comparing the influence that the various attributes of the transport service may have had on the service and route decision. In order to evaluate the relative importance of an attribute within the rank, moments are calculated for the position of each element in the rank. This is done by allocating each rank in the vector a "distance" that corresponds to the total number of ranks in the vector plus 1 (here nominally $8 + 1 = 9$) less the position of the rank in the vector ($9 - 1...8$). The magnitude element of the moment is provided by the variation of the particular attribute about its mean such that some will have a positive magnitude and others a negative magnitude. The specification of this moment is given below, using the Road transport attribute - X^{Ro} which ranges between $+1$ where a road transport mode features and -1 where it does not:

$$M^{Ro} = \sum_{d=8..1}^{Ro1..8} (k^{Ro} d(x^{Ro1...Ro8} - \bar{x}^{Ro})) \qquad [1]$$

A constant k is introduced so that in a best case scenario where x, ranked largest to smallest, is interacted with d ranked largest to smallest, the summation will equal $+1$ ($M^{Ro}_{max} = +1$). Similarly, where x, smallest to largest, is interacted with d ranked largest to smallest the summation will equal -1. The purpose of this device is to provide a basis for comparison between a decision-maker's preference for variations in one attribute against those of another (see equations [2] and [3]).

$$M^{Ro}_{max} = \sum_{d=8..1}^{Ro1..8} (k^{Ro}(x^{Ro1...8} - \bar{x}^{Ro}))_{max} = +1 \qquad [2]$$

$$M^{Ro}{}_{min} = \sum_{d=8}^{Ro1...8}{}_1 \; (k^{Ro}(x^{Ro1...8} - \bar{x}^{Ro}))_{min} = -1 \qquad [3]$$

This approach is logical. For example, if the decision-maker relied totally on the road attribute to rank the options the aggregate result would be plus one. Equally, if the decision-maker was ambivalent about using road and preferred other modes, the aggregate result would be minus one. Variables that are not absolutes adopt a calculated value in the same +1/-1 range. Having established k (using the "goal-seek" function in Excel), which in the case of the road attribute happens to be 0.63, the aggregate moment for road is calculated as follows (Equation [4]):

$$M^{Ro} = (k^{Ro} 8(x^{Ro1} - \bar{x}^{Ro})) + k^{Ro}7(x^{Ro2} - \bar{x}^{Ro}) + k^{Ro} 6(x^{Ro3} - \bar{x}^{Ro}) + k^{Ro} 5(x^{Ro4} - \bar{x}^{Ro})$$
$$+ k^{Ro} 4(x^{Ro5} - \bar{x}^{Ro}) + k^{Ro} 3(x^{Ro6} - \bar{x}^{Ro}) + k^{Ro} 2(x^{Ro7} - \bar{x}^{Ro}) + k^{Ro} 1(x^{Ro8} - \bar{x}^{Ro})) \qquad [4]$$

The moments for the other attributes are calculated in the same way, each with a different value of k to bring them within the maximum and minimum range (+1/-1). Thus, M^{Ra} represents the moment for "rail", M^{Se} = "sea", M^{Sp} = "St Petersburg", M^{Mb} = "Many Baskets", M^{Ct} = "cost per ton", M^{Tt} = "transit time", M^{Re1} = "reliability (+1/-1 day)", M^{Re2} = "reliability (+2/-2 days), M^{Re3} = "reliability (+4/-4 days), M^{Fd} = "fixed departure day", M^{Fa} = "fixed arrival day", M^{Fr} = "frequency" and M^{Li} = "the number of lifts in transit".

In order to compare the responses from the different typologies, the mean value for each attribute is taken for both the Service rank and the Route rank, bearing in mind that only the service attributes are available to the respondents in the former. Thus, the absolute values for road, sea, Many Baskets and St Petersburg in the service options are merely a theoretical manifestation of the other attributes.

All the signs in the table have been set up so that a "+" sign is a positive indicator (i.e. a preference for lower cost is shown as "+" and an increased frequency is shown as "+"). The results of the analysis are shown in Table 6.39.

Stated Preference - Results (Service)

Seq.	Attribute	Service				Rank
		Conformer	Improver	Explorer	Overall	
Route and mode information						
1	Road	+ 0.1	+ 0.0	- 0.0	+ 0.0	3
2	Sea	+ 0.4	+ 0.5	+ 0.4	+ 0.5	1
3	Rail	- 0.5	- 0.5	- 0.5	- 0.5	4
4	Many baskets	+ 0.1	+ 0.2	+ 0.1	+ 0.1	2
5	St Petersburg	+ 0.3	+ 0.2	+ 0.2	+ 0.2	
Service attributes						
6	Cost per tonne	+ 0.2	+ 0.3	+ 0.3	+ 0.3	3
7	Transit time	+ 0.5	+ 0.5	+ 0.5	+ 0.5	1
8	Reliability +/- 1 day	+ 0.4	+ 0.3	+ 0.3	+ 0.3	2
9	Reliability +/- 2 days	- 0.5	- 0.4	- 0.3	- 0.4	9
10	Reliability +/- 4 days	+ 0.1	+ 0.2	+ 0.2	+ 0.2	6
11	Fixed departure - time	+ 0.3	+ 0.1	+ 0.0	+ 0.1	7
12	Fixed arrival - time	+ 0.3	+ 0.1	+ 0.0	+ 0.1	7
13	Frequency	+ 0.3	+ 0.3	+ 0.2	+ 0.2	5
14	Lifts	+ 0.3	+ 0.2	+ 0.2	+ 0.2	4

Source: Author

Table 6.39 – Stated Preference results (Service)

It can be seen that, based on this simple analysis, all respondents appear to have made choices to improve their overall utility and the number of minus signs (where trade offs have occurred) is quite small. In general terms, and in fact for each class of respondent, transit time appears the most important attribute followed by reliability (+1/-1 day). Cost is ranked as third most important, although it can be seen that Conformers may have traded lower cost against reliability. Conformers (tending towards a risk averse personality) seem to have a high preference for fixed departure and arrival times, although this does not appear so important for Explorers and Improvers.

One of the key issues of interest in this study is how the decisions made on the basis of Service attributes are influenced by information about route and mode. From Table 6.40 it can be seen that the overall ranking of modes does not change, although the strength of preferences within the overall ranking does vary. For example, the overall preference for sea does not appear as strong in the route matrix, largely due to Improvers and Explorers shifting their preference

from sea to road and sea to Many Baskets respectively. Rail is not favoured in either the Service or Route choice, and the disinclination to used rail is stronger when the full route and mode information is made available.

Stated Preference - Results (Service and Route)

Seq.	Attribute	Service				Service Rank	Route				Route Rank
		Conformer	Improver	Explorer	Overall		Conformer	Improver	Explorer	Overall	
	Route and mode information										
1	Road	+ 0.1	+ 0.0	- 0.0	+ 0.0	3	+ 0.2	+ 0.1	+ 0.0	+ 0.1	3
2	Sea	+ 0.4	+ 0.5	+ 0.4	+ 0.5	1	+ 0.4	+ 0.3	+ 0.3	+ 0.3	1
3	Rail	- 0.5	- 0.5	- 0.5	- 0.5	4	- 0.6	- 0.6	- 0.5	- 0.6	4
4	Many baskets	+ 0.1	+ 0.2	+ 0.1	+ 0.1	2	+ 0.1	+ 0.1	+ 0.2	+ 0.1	2
5	St Petersburg	+ 0.3	+ 0.2	+ 0.2	+ 0.2		+ 0.2	+ 0.2	+ 0.2	+ 0.2	
	Service attributes										
6	Cost per tonne	+ 0.2	+ 0.3	+ 0.3	+ 0.3	3	+ 0.2	+ 0.1	+ 0.1	+ 0.1	7
7	Transit time	+ 0.5	+ 0.5	+ 0.5	+ 0.5	1	+ 0.6	+ 0.5	+ 0.5	+ 0.5	1
8	Reliability +/- 1 day	+ 0.4	+ 0.3	+ 0.3	+ 0.3	2	+ 0.5	+ 0.5	+ 0.4	+ 0.4	2
9	Reliability +/- 2 days	- 0.5	- 0.4	- 0.3	- 0.4	9	- 0.6	- 0.5	- 0.4	- 0.5	9
10	Reliability +/- 4 days	+ 0.1	+ 0.2	+ 0.2	+ 0.2	6	+ 0.1	+ 0.1	+ 0.1	+ 0.1	8
11	Fixed departure - time	+ 0.3	+ 0.1	+ 0.0	+ 0.1	7	+ 0.4	+ 0.4	+ 0.3	+ 0.3	4
12	Fixed arrival - time	+ 0.3	+ 0.1	+ 0.0	+ 0.1	7	+ 0.4	+ 0.4	+ 0.3	+ 0.3	4
13	Frequency	+ 0.3	+ 0.3	+ 0.2	+ 0.2	5	+ 0.3	+ 0.3	+ 0.2	+ 0.2	6
14	Lifts	+ 0.3	+ 0.2	+ 0.2	+ 0.2	4	+ 0.5	+ 0.4	+ 0.3	+ 0.4	3

Source: Author

Table 6.40 – Stated Preference results (Service and Route)

Turning to the attributes, the most interesting change is that cost looks as though it becomes the least important consideration, dropping from rank 3 to 7, once mode and route information is made available. Transit time and reliability retain their place at one and two respectively and although "lifts" continues to feature surprisingly high, fixed departure and arrival times still precede frequency.

The statistical analysis of the stated preference experiment does not give any firm indication of modal choice differences between the three typologies. Overall, based on Table 6.40, there appears to be a preference for sea which is ranked first, followed by many baskets, ranked second.

Because there is a practical limit to the quantity of choices that respondents are prepared to make in a stated preference experiment, the number of ways that attributes can be differentiated is also limited. Thus, however carefully the experiment is designed, it is inevitable that some monotonic relationships exist between particular route and mode choices and the various attributes

(collinearity). This, in some ways, is quite sensible and reflects a real life situation, but it does make it difficult to isolate particular causal variables.

From the correlation matrix shown in Table 6.41 it is evident that collinearity does exist between some of the variables. Most examples that occur at the $R^2 > 0.5$ levels are amongst the service attributes of frequency and reliability, which have been deliberately associated to some extent with the route characteristics. Thus, in assessing the importance of each of these in terms of the decision-maker's choice set, in the statistical analysis they have been regressed independently of each other against "Y", the ranking of the respondent's choices.

Correlation Matrix

Service	Road	Sea	Rail	St P	MB	Cost	Transit	Rel 1	Rel 2	Rel 3	F-ETD	F-ETA	Freq	Lifts
Road	+ 1.00	+ 0.35	+ 0.17	+ 0.63	+ 0.02	+ 0.57	+ 0.07	+ 0.72	+ 0.62	+ 0.82	+ 0.50	+ 0.50	+ 0.50	+ 0.71
Sea	+ 0.35	+ 1.00	+ 0.05	+ 0.05	+ 0.43	+ 0.84	+ 0.50	+ 0.25	+ 0.14	+ 0.74	+ 0.59	+ 0.59	+ 0.59	+ 0.30
Rail	+ 0.17	+ 0.05	+ 1.00	+ 0.03	+ 0.00	+ 0.13	+ 0.23	+ 0.61	+ 0.68	+ 0.16	+ 0.45	+ 0.45	+ 0.45	+ 0.67
St P	+ 0.63	+ 0.05	+ 0.03	+ 1.00	+ 0.31	+ 0.15	+ 0.04	+ 0.31	+ 0.26	+ 0.37	+ 0.10	+ 0.10	+ 0.10	+ 0.34
MB	+ 0.02	+ 0.43	+ 0.00	+ 0.31	+ 1.00	+ 0.21	+ 0.25	+ 0.00	+ 0.02	+ 0.06	+ 0.14	+ 0.14	+ 0.14	+ 0.00
Cost	+ 0.57	+ 0.84	+ 0.13	+ 0.15	+ 0.21	+ 1.00	+ 0.28	+ 0.52	+ 0.39	+ 0.90	+ 0.84	+ 0.84	+ 0.84	+ 0.52
Transit	+ 0.07	+ 0.50	+ 0.23	+ 0.04	+ 0.25	+ 0.28	+ 1.00	+ 0.02	+ 0.07	+ 0.23	+ 0.03	+ 0.03	+ 0.03	+ 0.00
Rel 1	+ 0.72	+ 0.25	+ 0.61	+ 0.31	+ 0.00	+ 0.52	+ 0.02	+ 1.00	+ 0.98	+ 0.65	+ 0.76	+ 0.76	+ 0.76	+ 0.94
Rel 2	+ 0.62	+ 0.14	+ 0.68	+ 0.26	+ 0.02	+ 0.39	+ 0.07	+ 0.98	+ 1.00	+ 0.51	+ 0.67	+ 0.67	+ 0.67	+ 0.90
Rel 3	+ 0.82	+ 0.74	+ 0.16	+ 0.37	+ 0.06	+ 0.90	+ 0.23	+ 0.65	+ 0.51	+ 1.00	+ 0.76	+ 0.76	+ 0.76	+ 0.67
F-ETD	+ 0.50	+ 0.59	+ 0.45	+ 0.10	+ 0.14	+ 0.84	+ 0.03	+ 0.76	+ 0.67	+ 0.76	+ 1.00	+ 1.00	+ 1.00	+ 0.75
F-ETA	+ 0.50	+ 0.59	+ 0.45	+ 0.10	+ 0.14	+ 0.84	+ 0.03	+ 0.76	+ 0.67	+ 0.76	+ 1.00	+ 1.00	+ 1.00	+ 0.75
Freq	+ 0.50	+ 0.59	+ 0.45	+ 0.10	+ 0.14	+ 0.84	+ 0.03	+ 0.76	+ 0.67	+ 0.76	+ 1.00	+ 1.00	+ 1.00	+ 0.75
Lifts	+ 0.71	+ 0.30	+ 0.67	+ 0.34	+ 0.00	+ 0.52	+ 0.00	+ 0.94	+ 0.90	+ 0.67	+ 0.75	+ 0.75	+ 0.75	+ 1.00

Results at the $R^2 > 0.5$ level are shown in "Black/bold" type (except "1.00" which are shown only as "Bold")
Source: Author

Table 6.41 – Correlation Matrix

By combining the answers from Question 2 (Buy Class) with Question 4 (Inertia) it was possible to discern revealed preferences regarding shipments made over the past year. In order to do this, it was necessary to assume that where different modes were used that the total number of shipments were spread evenly between the modes. It may be significant that all the single shipments were shipped by road. Thus, the analysis was carried out based on all shipments and then recalculated with the single road shipments excluded (see Table 6.42).

It can be seen from this analysis that when the 15 single road shipments are included there is an overall preference for road transport. Surprisingly, in this analysis, Conformers reveal a higher usage of sea transport than either Explorers or Improvers. When the single road shipments are excluded, the split between sea and road reverses, although still with Conformers higher users of sea

transport. Rail usage is quite limited and Conformers have made no shipments by rail.

All shipments						Not including singular shipments (shipped by road)				
Mode	Sea	Road	Rail	Total		Mode	Sea	Road	Rail	Total
Overall						Overall				
Conformer	17.50	12.50	-	30.00		Conformer	17.50	6.50	-	24.00
Improver	6.83	14.83	4.33	26.00		Improver	6.83	12.83	4.33	24.00
Explorer	20.00	29.00	3.00	52.00		Explorer	20.00	22.00	3.00	45.00
	44.33	56.33	7.33	108.00			44.33	41.33	7.33	93.00
Percentage by typology						Percentage by typology				
Conformer	39%	22%	0%	28%		Conformer	39%	16%	0%	26%
Improver	15%	26%	59%	24%		Improver	15%	31%	59%	26%
Explorer	45%	51%	41%	48%		Explorer	45%	53%	41%	48%
	100%	100%	100%	100%			100%	100%	100%	100%
Percentage by mode						Percentage by mode				
Conformer	58%	42%	0%	100%		Conformer	73%	27%	0%	100%
Improver	26%	57%	17%	100%		Improver	28%	53%	18%	100%
Explorer	38%	56%	6%	100%		Explorer	44%	49%	7%	100%
	41%	52%	7%	100%			48%	44%	8%	100%

Source: Author

Table 6.42 – Revealed preference - modal split (estimated)

Based on the statistical analysis, whilst certain inferences can be drawn about an overall disinclination to use rail, there is very little substantial statistically significant evidence of a preference between the sea and road options. Certainly, there is insufficient statistical distinction between the results, to realistically differentiate the preferences of one typology class from another. If anything, the preferences of Explorers and Conformers are the reverse of that proposed. Thus, based on this analysis, Proposition 6 is not supported.

6.8   Other variables

6.8.1   Findings

According to the analysis reported in this chapter, of the six propositions outlined in Chapter Five,. Proposition Two (Buy Class), Proposition Three (Predecisional Information Strategy - inferred), Proposition Four (Inertia or Resistance to Change – 12 months) and Proposition Five (Determinants of Dissatisfaction) are fully supported (>95% probability). Proposition One (Triggers) is not supported, although there is some evidence of an association in line with the proposition (>50% probability). Proposition 5 (Resistance to

Change – Time in Post) is only supported at the 90% probability level. Proposition Six (Modal Choice) is fully rejected, although there is some evidence of modal preferences for the different typologies but this is weak and not in line with the proposition.

There were some unexpected results arising from the response to the questionnaire (see Table 6.43). Most of these relate to background demographics (cargo characteristics, age and experience of the respondent) and are relatively unimportant. The proportion of Conformers, Improvers and Explorers seems broadly in line with those that might be anticipated from the UK adult population norms and middle managers. The split between Improvers and Explorers is more in line with the UK population norm that middle managers. However, the proportion of Rainmakers (RI or N/T types) and judgmental (J types) is much higher amongst the respondents to this survey than either the UK population or middle managers.

Distribution of Typologies

Type	OPP Survey	%	Con.	Imp.	Exp.	NT	J	Cranfield Study	%	Con.	Imp.	Exp.	NT	J	This study	%	Con.	Imp.	Exp.	NT	J
	UK Norm (adult population)							Middle Managers							Transportation Decision-makers						
ISTJ	224	14%			14%		14%	202	24%			24%		24%	3	7%			7%		7%
ISTP	105	6%			6%			37	4%			4%									
ESTP	95	6%			6%			33	4%			4%									
ESTJ	170	10%			10%		10%	176	21%			21%		21%	1	2%			2%		2%
ISFJ	208	13%	13%				13%	55	6%	6%				6%	8	18%	18%				18%
ISFP	100	6%	6%					10	1%	1%					1	2%	2%				
ESFP	142	9%	9%					10	1%	1%					1	2%	2%				
ESFJ	206	13%	13%				13%	50	6%	6%				6%	1	2%	2%				2%
INFJ	28	2%		2%			2%	20	2%		2%			2%	4	9%		9%			9%
INFP	52	3%		3%				26	3%		3%				2	5%		5%			
ENFP	103	6%		6%				25	3%		3%				2	5%		5%			
ENFJ	45	3%		3%			3%	14	2%		2%			2%	3	7%		7%			7%
INTJ	23	1%			1%	1%	1%	55	6%			6%	6%	6%	6	14%			14%	14%	14%
INTP	40	2%			2%	2%		25	3%			3%	3%		1	2%			2%	2%	
ENTP	45	3%			3%	3%		36	4%			4%	4%		1	2%			2%	2%	
ENTJ	48	3%			3%	3%	3%	75	9%			9%	9%	9%	10	23%			23%	23%	23%
	1634	100%	40%	14%	46%	10%	58%	849	100%	15%	10%	75%	22%	76%	44	100%	25%	25%	50%	41%	82%
	Source: OPP, 2006							*Source: Lewis and Margareson. 1989*							*Source: Author*						

Source: Author

Table 6.43 – Distribution of typologies[21] [22]

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[21] The sample reported in Table 6.43 (OPP, 2006) consisted of 1,634 people living in the United Kingdom. 748 46%) were male and 865 (54%) female. 94% of the sample were white and 6% came from other ethnic groups. Ages ranged from 16 to 65 years with 50% aged between 30 and 50. The sample included people of all educational levels. 69% were currently employed, with 40% at supervisory/first level management or above. A wide range of industry sectors was represented.

[22] The data referring to middle managers is taken from a survey of 849 middle managers by Cranfield School of Management (Lewis and Margareson, 1989).

There are three possible explanations for this anomaly. First, it may be due to respondent bias, meaning that NT and J types are more inclined to respond to questionnaires of this nature; second, recruitment and selection policies for transportation decision-makers may be (explicitly or implicitly) predisposed to such typologies; or thirdly, there may be a degree of self selection or advancement for NT and J types in such decision-making environments.

Considering the first possibility, that the typology influences non-response bias, there is evidence to suggest that some personality types do affect survey completion rates (Abbot, Yost & Harding, 2003). In this survey it has been difficult to evaluate precise response rates due to lack of information about the total population. However, it is possible to test for non-response bias by using late respondents as surrogates for non-respondents (Nwachukwv et al., 1997).

Numbei of iespondeuts and aveiage iesponse times

	Conformei	Impiovei	Exploiei	Total
Respondents (excluding anonymous invalid)				
Co Sec	1	1	1	3
Recruit	4	4	7	15
Inst Exp	3	1	8	12
Inst Log	3	4	5	12
Total	11	10	21	42
Average response times (days)				
Co Sec	45.00	43.00	43.00	43.67
Recruit	18.50	10.00	12.43	13.40
Inst Exp	5.67	9.00	9.99	8.82
Inst Log	8.33	6.25	3.60	5.67
Average [1]	14.64	11.70	10.85	12.05
Average [2]	11.60	8.22	9.24	9.61

Note: Average [1] = All respondents excluding anonymous/invalid
Average [2] = As Average [1] excluding "Co Sec"

Source: Author

Table 6.44 – Number of respondents and average response times[23]

Table 6.44 shows the number of respondents and the average time the different typology groups took to respond to the survey. The sample size is 42 because the anonymous responses via the Web-based interview, could not be

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[23] Respondents identified through the UK Trade and Investment Section, plus those from conference delegate lists have been grouped under one heading, namely "Co Sec". None of the respondents through this channel responded to the first mailing, despite follow-ups. Ultimately, the responses were achieved by referral through the Company Secretaries of the firms identified in these channels.

reliably identified back to the source. It can be seen that the level of response is influenced more by the source of the population, than by the typology group itself, with those respondents contacted through Company Secretaries appearing a lot worse than the rest. In this case, however, it is not a fair comparison because it is not known how long it took for the request to participate in the survey to be passed from the addressee (named Company Secretaries) to the actual respondent. However, judging by the nil returns (that were still arriving some three months after the survey was despatched) this lead-time was considerable. There was no discernable difference (in terms of type) between those that responded promptly and those that did not.

On the issue of whether organization development strategies, recruitment and selection policies, or even self-selection, favours particular psychological types for specific roles, the evidence is mixed. Whatever the reason, having discounted respondent bias, it appears from the results of this survey that there is a definite predisposition for NT and J types in the sample being surveyed that may well be representative of the entire population. Hence, the likelihood of this and its possible impact on the experiment is assessed below.

6.8.2   Influence of J Type variable

In order to explain the apparent aberration in the survey results, figures were obtained for attendees at the Cambridge Management Centres MBTI programmes (6,528 respondents) of which 67% were shown to be J types (Rogers, 1997). Further discussions took place with the researchers at OPP who provided data regarding the MBTI preferences of UK middle managers (Lewis and Margareson, 1989), based on a survey carried out at Cranfield University (see Table 6.45). This survey showed 76% to be J types. Whilst, from these studies, J types appear to be higher amongst middle managers they do not attain the result of 82% found in this study.

Whatever the underlying reason for the higher proportion of J types in this experiment than the surveys carried out by Cranfield and Cambridge Management, there is a strong inference that managers, in general, tend to be J types.

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This high proportion of Js is undesirable from a statistical point of view as any trend identified could be attributed to the prevalence of Js in the underlying population. The dominance of J types, if they have either a positive or negative influence in terms of the other constructs proposed, may tend to overwhelm or mask the NT/ST, NF and SF preferences. This, potentially, has critical implications in terms of interpreting the results of the study and so has been investigated further.

In order to prove an absolute relationship between the three typologies and modal choice both the "J/P" and "I/E" scales would have to be neutral in terms of their influence on that choice. Clearly, this is not the case and the "J/P" preference, at least, is an extraneous variable.

Distribution of Typologies

Type	UK Norm			Middle Managers			Decision-makers		
	OPP Survey	NT	J	Cranfield Study	NT	J	This study	NT	J
ISTJ	224		14%	202		24%	3		7%
ISTP	105			37					
ESTP	95			33					
ESTJ	170		10%	176		21%	1		2%
ISFJ	208		13%	55		6%	8		18%
ISFP	100			10			1		
ESFP	142			10			1		
ESFJ	206		13%	50		6%	1		2%
INFJ	28		2%	20		2%	4		9%
INFP	52			26			2		
ENFP	103			25			2		
ENFJ	45		3%	14		2%	3		7%
INTJ	23	1%	1%	55	6%	6%	6	14%	14%
INTP	40	2%		25	3%		1	2%	
ENTP	45	3%		36	4%		1	2%	
ENTJ	48	3%	3%	75	9%	9%	10	23%	23%
	1634	10%	58%	849	22%	76%	44	41%	82%

Source: Various

Table 6.45 – Typologies in the UK population, middle managers and survey[24]

Unfortunately it is not possible to remove the J/P scale because it is inherent in each of the typology classes. The only other option is to try and control, or allow for the variable so that it does not help or hinder one group

[24] Table 8.6 is made up from various sources. The UK adult population figures are as Table 8.1, provided by OPP. The survey results are those reported here based on the questionnaire returns. The data referring to

more than another (Foster and Parker, 1999). The first method, randomisation or allocating participants randomly to groups is not appropriate for this study. The other method, ensuring that extraneous variables are reasonably represented in each group and allowing for any variations that do occur, is applicable.

Table 6.45 shows a comparison of Jungian typologies (N/T and J), between the UK adult population, middle managers and the results of this survey. It should be noted that the proportion of N/T types increases from 10% in the general population to 22% for middle managers to 41% in this survey. More importantly, the split of "J" types between Conformers, Improvers and Explorers grows in a similar proportion and is reasonably represented between the groups.

Proportion of J types distributed between classes

	Total in survey		J Types	
	Respondents	%	Js	%
Conformers	11	25%	9	25%
Improvers	11	25%	7	19%
Explorers	22	50%	20	56%
Total	44	100%	36	100%

Source: Author

Table 6.46 – Proportion of J types distributed between classes

It can be seen from Table 6.46 that the J types are, in fact, distributed in almost the same proportion as the typology classes so that any help or hindrance should be similar for each group. This, under normal circumstances, would be sufficient to negate the effect of any contribution the J preference makes to the decision process. However, in this case not only is the J type extremely dominant in the overall population – 82% (see Table 6.45), there are strong indications that the J preference may be primary in determining modal choice (see Table 6.47).

Relationship between J/P typology and Service and Route choices

Judging/Perceiving scale - J = 1	Coefficients	Standard Error	t Stat	P-value
Intercept	0.736	0.092	8.018	0.000
Service Mode Dummy - MB = 1	0.267	0.137	1.947	0.058
Route Mode Dummy - MB = 1	- 0.304	0.138	- 2.201	0.033

Source: Author

Table 6.47 – Relationship between J/P typology and Service and Route choices

middle managers is taken from a survey of 849 middle managers by Cranfield School of Management (Lewis and Margareson, 1989).

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The Judging/Perceiving scale was regressed against modal choice for both Service and Route, with Judging and Many Baskets accorded the dummy variables of "1". The results of the regression analysis (see Table 6.47) gave coefficients (part-worths) of +0.267 for the Service choice and –0.304 for Route choice, with corresponding p-values of 0.058 and 0.033 respectively. These p-values show the result to be well above the 90% significance level ($\alpha \leq 0.1$). Thus, the J/P scale and modal choice (many baskets) is endogenous.. Consequently, it was decided to analyse the constructs against each of the bi-polar types, in order to gauge the strength of the J's influence and to identify other potential extraneous variables.

Evaluation of constructs against bi-polar scales

Construct	Type	Chi	DF	Con't	Dis't	Gamma	Degree of certainty			
							I/E	S/N	F/T	J/P
Triggers	I/E	0.7598	2	108	168	- 0.217				
	S/N	9.0987	2	76	163	- 0.364		97.5%		
	F/T	7.2507	2	84	186	- 0.378			95.0%	
	J/P	11.8617	2	119	98	+ 0.097				99.0%
Buy Class	I/E	2.4691	2	39	60	- 0.212				
	S/N	7.0998	2	33	47	- 0.175		95.0%		
	F/T	4.9742	2	47	57	- 0.096			90.0%	
	J/P	5.4601	2	41	57	- 0.163				90.0%
Information strategy	I/E	1.1782	2	114	196	- 0.265				
	S/N	10.7616	2	65	178	- 0.465		99.0%		
	F/T	5.3221	2	156	140	+ 0.054			90.0%	
	J/P	11.1766	2	136	106	+ 0.124				99.0%
Inertia - 12 months	I/E	1.6318	2	161	155	+ 0.019				
	S/N	8.6063	2	164	84	+ 0.323		97.5%		
	F/T	9.6726	2	190	114	+ 0.250			99.0%	
	J/P	12.5807	2	123	124	- 0.004				99.0%
Inertia - Time in Post	I/E	1.4955	2	194	106	+ 0.293				
	S/N	10.4849	2	136	96	+ 0.172		99.0%		
	F/T	2.4813	2	148	126	+ 0.080				
	J/P	11.8383	2	144	100	+ 0.180				99.0%
Modal choice - Service	I/E	3.4747	3	32	64	- 0.333				
	S/N	9.6925	3	48	32	+ 0.200		97.5%		
	F/T	3.4545	3	24	57	- 0.407				
	J/P	15.6037	3	24	66	- 0.467				99.0%
Modal choice - Route	I/E	2.1095	3	107	220	- 0.346				
	S/N	7.9047	3	108	148	- 0.156		95.0%		
	F/T	2.4089	3	158	138	+ 0.068				
	J/P	14.0676	3	165	94	+ 0.274				99.0%

Source: Author

Table 6.48 – Evaluation of constructs against bi-polar scales

To perform this analysis all the data relating to the constructs were converted to dummy variables corresponding to each typology such that, for example, an I type who indicated a particular buy-class, scored "1". Using this method 28 frequency tables were generated. These tables were then analysed using the chi-squared test (Hinton, 2005) to see if a significant relationship existed, and gamma (based on concordant and discordant pairs) to indicate direction (Rafter, 2002). It should be noted that a degree of certainty does not indicate the strength of the relationship and Krastal's gamma is only a reliable measure of direction for two by two tables. Thus, Table 6.48 is indicative only and any conclusions drawn below are based on further examination and analysis of the underlying data.

The analysis provides some insights into possible interactions between the S/N, T/F and J/P preferences (the I/E scale does not appear to have any significant influence on the constructs). It should be remembered that Explorers comprises both ST and NT types so that "S" influencing Explorers will also influence Conformers (SF) in the same direction. Similarly, "N" influencing Explorers will also influence Improvers in the same direction. The same applies to J types, except that J is present in all groups, but is represented twice in the Explorers group (STJ and NTJ). Thus the relationships can be quite complex.

For example, it can be seen that the proposition relating to Triggers, which is inconclusive in the original analysis, shows S and T to be opposed and N and T to be complimentary. J also acts in the same direction as S and T. Thus, whilst the ST/NT combination does not produce a significant result, the dominance of J may do so. This was tested on the data for "Triggers". Changing the specification amended the classes slightly (Conformers = 11, Improvers = 13 and Explorers = 20) and produced a higher value of chi squared (from 3.5055 to 7.5097). As the critical value for $\alpha \leq 0.1$ (DF = 4) is 7.779 the addition of the "J" component did not change the level of probability. However, minor changes were noted in the chi square value for all the other constructs but not of sufficient magnitude to affect the outcome. Thus, although J is influential it would probably only be material for results on the cusp of a critical value.

It can be seen that the whole of the typology analysis is a lot more complex than purely allocating the different typologies to particular decision-maker classes. Even with this last breakdown of results, the Introvert/Extrovert bi-polar scale has been ignored, because the results do not produce any statistical level of significance. This does not infer, however, that this preference does not influence the decision-making process in any way. It means simply that, in this experiment, it has not been possible to discern and isolate any significant influence.

6.9   Conclusion

This chapter has set out the various analyses that have been carried out on the data collected. The reliability and validity of the instrument has been tested and the response rate evaluated for possible bias. The basic data regarding the psychological profile and the demographics of the sample have been analysed. Each of the propositions has been tested in a variety of ways, and descriptive statistics produced. The findings have been detailed and consideration given to the possibility Type I and Type II errors as appropriate. The presence of extraneous variables has been identified and further analysis carried out to determine if and how this may influence the findings.

The results of this analysis are given in the next chapter together with a discussion of the effectiveness of the taxonomy used, the impact of the demographics, the influence of the extraneous variables and the implications of the findings.

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Chapter 7

7   CHAPTER 7 – DISCUSSION OF RESULTS

7.1   Introduction

Structure of Chapters 7 - Discussion of results
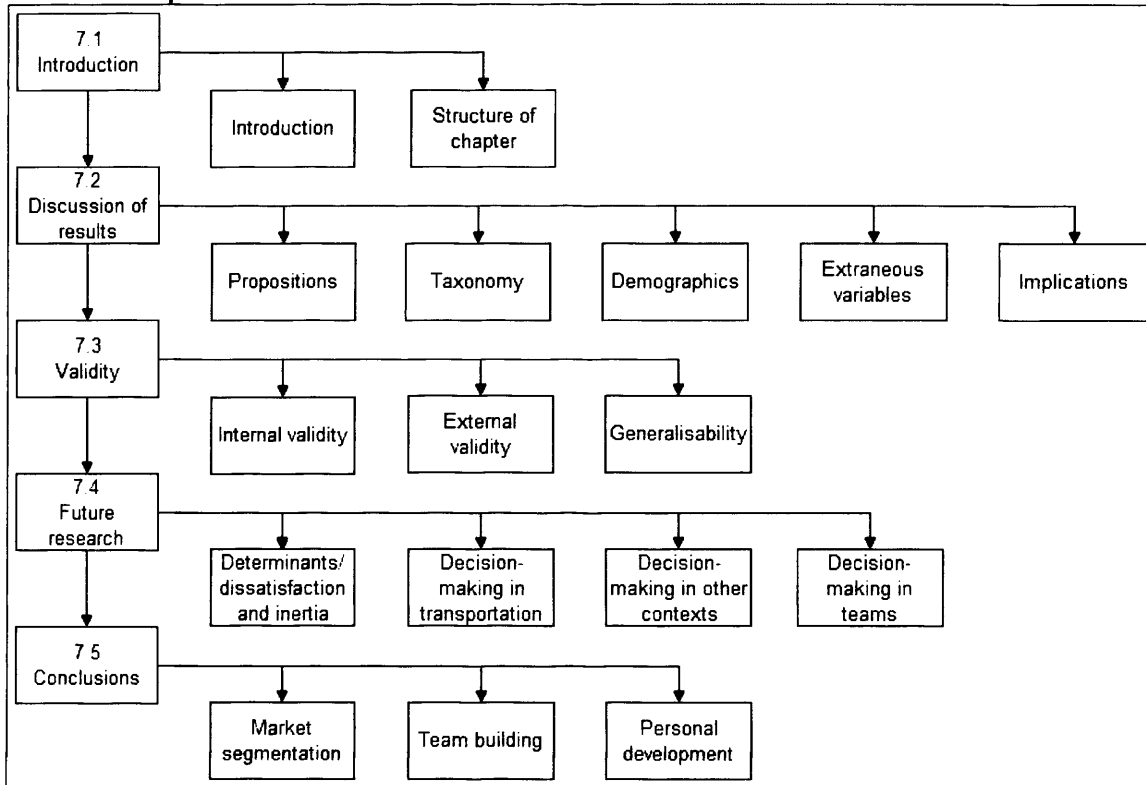
Source: Author

Figure 7.1 – Structure of Chapter 7 – Discussion of results

Before discussing the findings of the study, it is worth restating the objectives (from Chapter 1) together with a summary of the hypothesis developed and the propositions formulated in order to explore the subject. The primary objective of the study is:

> "...to examine modal choice and, specifically, the reasons why a significant proportion of exporters appear to behave irrationally, moving freight from the United Kingdom to western Russia choosing the typically more expensive road transport option in preference to maritime transport. The study seeks to explore this apparent aberration and, from the results, draw conclusions about the freight product offering and how it is packaged."

From the previous studies identified in the literature review it appears that different people make different choices according to the decision-making

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strategies they employ. Some base decisions on hard data and detailed analysis, whilst others tend towards less formal methods, relying on experience and decision-making heuristics to streamline the decision-making process. For the purpose of this study, based on prior research, the former has been termed "maximizing" and the latter "satisficing". Earlier research also indicates that different psychological types tend towards one or other strategy, or a combination of both. Using the Myers Briggs Type Indicator (MBTI) for the analysis, a new taxonomy was proposed such that "Explorers" are inclined to maximizing strategies, "Conformers" to satisficing strategies and "Improvers" to a combination of the two.

Based on this hypothesis, the following propositions were formulated to assist with exploring the decision-making process:

- *First* - <u>All</u> decision-makers will respond to reactive triggers to review transport arrangements but only Explorers and (possibly) Improvers will be proactive seeking improvements or new solutions.

- *Second* - Explorers tend to be in the new buy-class, Improvers in the modified rebuy class and Conformers in the rebuy class.

- *Third* - Conformers tend towards limited search strategies (LSS) concentrating on the current mode and service, Improvers also tend to use limited search strategies (LSS) but across all feasible alternatives, and Explorers are more likely to use comprehensive search techniques (CSS) across all feasible alternatives.

- *Fourth* - Explorers, whatever mode they are currently using, are likely to weigh the feasible options and select the mode most suitable according to the information available (new buy or modified rebuy). Improvers will tend to remain with the current mode (not exclusively) but look for service improvements (modified rebuy). Conformers will tend to remain with the mode, service and carrier currently used, except if they have inherited an option they perceive to be too risky, in which case they may change to a less risky option (rebuy or, modified rebuy).

- *Fifth* - Determinants of choice are actually determinants of dissatisfaction arising from the most recently used transportation choice.

- *Sixth* - For shipments between the UK and Russia, Explorers are most likely to use a multimodal option based on sea transport, Improvers are most likely to use a "Many Baskets" approach which may include road and sea transport, and Conformers are most likely to limit themselves to one option, most probably road based.

The remainder of this chapter is set out as follows (see Figure 7.1):

- Discussion of results;
- Validity;
- Future research;
- Conclusions.

7.2 Discussion of results

Statistical analysis of the six propositions, based on a 95% confidence level, when tested against an expected distribution representing the null hypothesis (see Appendix 12), provided the results shown in Table 7.1.

Summary of findings according to the original proposals

Construct	Findings
Triggers	Not significant.
Buy Class	Explorers tend towards new buy, Improvers towards modified rebuy and Conformers to buy/rebuy.
Information Strategy (Inferred)	Explorers tend towards CSS, Improvers towards MSS and Conformers towards LSS.
Information Strategy (Self-assessed)	Not significant.
Inertia (12 months)	Explorers appear to have a low resistance to change and Conformers a high resistance to change.
Inertia (Time in post)	Not significant.
Determinants of choice	Determinants of choice are influenced by determinants of dissatisfaction.
Modal choice - Service	Not significant.
Modal choice - Route	Not significant.

Source: Author

Table 7.1 – Summary of findings according to the original proposals

From the statistical analysis based on the original proposals, together with the general findings, the results of the experiment are as follows:

- A equal proportion of Explorers and Conformers appear to be the main decision-makers (see Table 6.8, page 258);

- Although different decision-makers appear to react to different triggers to initiate a transport review there was no strong statistical significance between the typology and proactive, passive or reactive triggers (See Section 6.5.1, page 266);

- The buy-class analysis suggests that the majority of Conformers tend towards buy/rebuy, Improvers towards modified rebuy and Explorers towards new buy (see Section 6.5.2, page 270);

- Based on inferred data, Conformers incline towards limited information gathering strategies, Improvers towards moderate strategies and Explorers towards comprehensive strategies. However, whilst this was the trend, the majority of respondents used limited or moderate strategies. Statistical analysis of the self assessed data for information gathering strategies was inconclusive (see Section 6.5.3, page 275);

- Measured over twelve months, Conformers tend to have a high resistance to change, Improvers less resistant and Explorers low resistance. The results of the experiment for time in post were inconclusive (see Section 6.5.4, page 278);

- Determinants of dissatisfaction influence determinants of choice (see Section 6.6, page 285);

- There appears to be no statistical relationship between the typologies and the eventual modal decision made (see Section 6.7, page 300).

7.2.1 Propositions

Proposition 1 – Association between typology and triggers

The results of the investigation into the type of trigger that initiates a transport review was inconclusive. There may be some confusion whether a "Trigger" is singular or plural, i.e. could there be more than one trigger that initiates a transportation review? The uncertainty over the definition may have prejudiced the outcome of the experiment.

The view taken was, in line with other disciplines (e.g. computer programming), that a trigger is a singular event that initiates a process. Such definition not only accords with the layman's perception of the "straw that breaks the camel's back", in a practical sense, it facilitates analysis of whether the trigger in this experiment is proactive or reactive.

If, as has been suggested, triggers are regarded as plural, this has the same meaning as "determinant of dissatisfaction" use elsewhere in the study. In such circumstance two triggers could be selected, e.g. "Dissatisfaction with aspects of the service" (proactive) and "Changes in technology" (reactive). If this were the case, it would not be possible to conclude whether the decision-maker were acting proactively or simply reacting to an external event. Thus, for the purpose of this study, "Trigger" was taken to be singular and "Determinants of dissatisfaction" as plural.

Even though the statistical analysis did not produce a significant result, the respondents' answers did reveal some other interesting trends. Based on the analysis, more than half of the decision-makers are proactive in terms of finding better freight solutions for their organizations (26/44 = 59%) (see Section 6.5.1, page 265). The problem with the statistical analysis was that this trend was more or less in equal measure for Explorers, Improvers, and Conformers. Referenced against the specific question in the questionnaire, it was found that the respondents either seek a better price or level of performance or, conversely, are dissatisfied with some aspect of the current service. The volatility generated by such proactive strategy leads naturally in the process to the buy-class, i.e. is the respondent, regardless of typology, more likely to stick with one mode and carrier (buy/rebuy) or seek a better alternative?

Proposition 2 – Association between typology and buy class

In the simplest form, the ultimate satisficing strategy, proposed here to be adopted by Conformers, is buy/rebuy, i.e. accepting the first option that satisfies the basic criteria, in this case a satisfactory existing option (buy/rebuy). The literature suggests that Explorers are more likely to accept the risk (in the

ultimate case, risk assessed on the basis of probability), and invest time and effort identifying and evaluating a new buy. Improvers may compromise and adopt a modified rebuy approach.

The results of this part of the experiment were complicated by the fact that some of the respondents (15) had only been involved in single shipments between the UK and Russia in the last year. This made it impossible to determine a buy class strategy as it needs at least two shipments (preferably more) to reveal such behaviour. Where there are a number of shipments and more than one carrier/mode it is also impossible to determine whether the choices are concurrent (many baskets) or progressive/serial (new buy). Thus, the responses to Question 4.1 were used to clarify the answers to Question 2.

With only 29 usable responses, the frequencies in each category were very low. The exception to this was a high preference for modified rebuy for Explorers (10) and this, together with four new buys, generated a sufficiently strong trend to support the proposition.

Ten of the twenty-nine usable responses (34%) were exclusively buy/rebuy. If we follow Cook (1967) it can be assumed that in these cases the freight supplier's performance exceeds expectation. Thirteen of the twenty-nine were in the modified rebuy class (45%) compared with Saleh and La Londe (1972) who reported 94% in their experiment. The inference to draw from this, is either that the freight market has changed, which is quite conceivable, given the developments in logistics since 1972 (Evans & Danks, 1998 and Towill, 1996), or the trade to Russia imposes quite specific requirements on decision-makers. In any event, the route between the UK and Russia is probably fairly contestable - within certain limits of risk aversion, i.e. the freight buyer may be willing to try a new or different service, but without engaging in too much risk (many baskets).

Proposition 3 – Association between typology and information strategy

Two methods were used to observe the information gathering strategies of the respondents. The first inferred the breadth of the search (horizontal

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component) and level of detail (vertical component) from a number of specified information sources. External sources were assigned a high horizontal tariff and formal methods involving hard data were accorded high vertical tariffs. Hurdles were set to define the search strategies based on a percentage of the overall scores available. This may appear subjective but, it is argued, provides a consistent and auditable trail between the answers given by the respondents and assignment to one of the three strategies, namely Comprehensive (CSS), Moderate (MSS) and Limited Search Strategy (LSS).

Predecisional Information Gathering Strategy

	Inferred				Self-assessed			
	Conformers	Improvers	Explorers	Total	Conformers	Improvers	Explorers	Total
LSS	7	3	10	20	2	2	4	8
MSS	4	2	9	15	4	3	5	12
CSS	0	6	3	9	5	6	13	24
	11	11	22	44	11	11	22	44
LSS	64%	27%	45%	45%	18%	18%	18%	18%
MSS	36%	18%	41%	34%	36%	27%	23%	27%
CSS	0%	55%	14%	20%	45%	55%	59%	55%
	100%	100%	100%	100%	100%	100%	100%	100%

Source: Author

Table 7.2 – Predecisional information gathering strategy

It can be seen from Table 7.2 that, on an inferred basis, only 20% of respondents use comprehensive search strategies. However, the statistics yield some surprising results. Although almost half (45%) of the Explorers use limited strategies and six Improvers use comprehensive strategies, compared with only three Explorers, the overall trend is in line with Proposition 3. Consequently, statistical analysis (see Section 6.5.3, page 275) shows the proposition to be supported.

This may appear, on face value not to be totally in line with the original proposition. It should be noted, however, that the hurdles classifying the strategies as limited, moderate or comprehensive are arbitrary. Thus, what the Author deems the appropriate tariffs and hurdles to define the respective strategies (see Table 6.19, page 272) may be considered too rigorous by other observers. Lowering the hurdles would have the effect of moving some of the LSS respondents to MSS , and some of the MSS respondents to CSS. This would make the analysis of the frequencies look more elegant but would not, in fact,

change the result statistically. Hence, the table is left as originally specified and the trend, which is the critical issue, reported as originally observed.

Information gathering - scoring of self-assessed selection

Question	Vertical component	Horizontal component	Assessed	Result
1 Review all information across feasible alternatives	3	3	6	CSS
2 Review all information across suitable alternatives	3	2	5	CSS
3 Review all information across limited alternatives	3	1	4	MSS
4 Review some information across feasible alternatives	2	3	5	CSS
5 Review some information across suitable alternatives	2	2	4	MSS
6 Review some information across limited alternatives	2	1	3	LSS
7 Review relevant information across feasible alternatives	1	3	4	MSS
8 Review relevant information across suitable alternatives	1	2	3	LSS
9 Review relevant information across limited alternatives	1	1	2	LSS

Source: Author

Table 7.3 – Information gathering – scoring of self-assessed selection

The other method of assessing the information strategies used was to provide definitions of nine strategies comprising three vertical components ("All", "Some" and "Limited") and three horizontal components ("Feasible", "Suitable" and "Relevant"). The scoring system is provided in Table 7.3 with the corresponding results for CSS, MSS or LSS. Using this system, all three classes of typology provided broadly similar responses, with limited search strategies being exactly the same (18%, 18% and 18%), and MSS and CSS more-or-less comparable (see Table 7.2). This meant that the different typologies could not be differentiated statistically and, on the basis of self-assessed data alone, the Proposition 4 would have had to be rejected.

Possibly, the most important findings of the study are to do with the actual detail of the information gathering strategies employed by the respondents. In the original constructs (see Chapter 5), it is suggested that the triggers and buy-class particular to the typology classes predispose decision-makers to certain information gathering strategies. In fact, it was not possible to establish a statistically significant association between triggers and typology groups. On the other hand, a relationship between buy class and typology has been established and this does appear to translate, on an inferred basis, to the predecisional information gathering strategies. In addition, analysis of the raw data obtained from the inferred experiment does reveal some interesting insights about the types of information sources used by freight transport decision-makers.

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Ranking of predecisional information gathering sources

	Conformers		Improvers		Explorers		Total	
	Informal	Formal	Informal	Formal	Informal	Formal	Informal	Formal
Internal								
On time pick up/delivery performance	2	13	20	3	20	*2*	14	4
Analysis of customer complaints	9	5	12	8	18	5	14	7
Review of claims and loss experience	13	9	20	5	20	*2*	21	4
Shipment tracing review	5	24	20	8	18	12	14	18
Transportation costs studies or audits	9	13	12	12	20	8	18	10
Last experience of mode	2		5		10		9	
Own experience or advice from others	5		*1*		9		4	
Average - Internal	8	13	14	8	18	8	19	15
External								
Tenders, proposals and quotations	13	5	12	*2*	12	*1*	13	*1*
Market research	9	27	8	26	5	26	8	27
Academic journals	22	27	26	32	14	30	22	32
Trade journals	*1*	27	12	26	*2*	28	*2*	29
Tariff bureaux	24	27	26	20	23	28	25	27
Trade directories	20	27	20	26	23	33	23	31
Trade associations	13	24	12	12	14	26	14	25
Media/trade press	13	27	8	32	10	30	11	32
Internet (web sites)	*2*	27	*3*	26	14	30	*2*	30
Carrier marketing (brochures etc.)	13		5		14		12	
Other users of the mode/carrier	20		12		14		18	
General reading	22		20		23		24	
Average - External	14	24	13	22	12	26	14	26
Average - Overall	11	20	13	16	15	18	14	19

Source: Author

Table 7.4 – Ranking of predecisional information gathering sources

Table 7.4 is based on the number of respondents who tick the boxes on the questionnaire for the different sources of predecisional information, informal and formal. The importance of the sources of information in each category, internal and external, are then ranked with "1" representing the most important (or, at least, widely used). The results are shown for each typology class and overall, with the first three rankings in each group shown in *"bold-italic"* to aid interpretation (although, because there are ties between some of the first and second choices, the third choice does not appear at all except for Improvers).

There are several interesting observations that can be made from this table. For internal information gathering, formal methods are preferred by both Improvers and Explorers. Both rank formal evaluation of on time pick-up and delivery in the first three, and Explorers rank formal monitoring of claims at two. For external information, Improvers and Explorers rely on formal tenders, proposals and quotations (ranked second and first respectively), whilst Conformers rank informal reviews of trade journals as their primary source of external information. Conformers and Improvers also rank information obtained from the Internet quite highly.

In terms of the overall results, external sources of information, trade journals/press and information from the Internet (specified here as freight supplier Web sites) are two of the most important sources of information used by the respondents to this survey. Interestingly these sources are not even considered in McAuley's study (1993) on the "The perceived usefulness of export information sources" although Sayers (2000) refers to the use of the Internet for information as a "revolution in international trade".

Conformers and Improvers rank "Last experience of mode" and "Own experience and advice from others" amongst their primary sources of internal information. This, together with the results of the inferred experiment, suggests a less than methodical approach to predecisional information gathering. Whether the tariff or hurdles used in this experiment are set appropriately or not, the insinuation of lack of thoroughness and objectivity accords with the findings of Stock and La Londe (1977), Bruning and Lynagh (1984) and (particularly) Malchow and Kanafani (2004) referred to in Chapter Four.

Proposition 4 – Association between typology and inertia

Following on from this, the relationship between the information search strategies and inertia was investigated, i.e. that limited search strategies would be associated with higher degrees of inertia. The findings were broadly in line with what would intuitively be expected, that a person prepared to invest the time and effort to research possible options thoroughly, is clearly going to be more amenable to change - if such change is forecast to yield beneficial outcomes. The converse argument is also true, that a decision-maker who is not prepared to invest time and effort in predecisonal research is likely to be more resistant to change.

Thus, the principle of "determinants of inertia" is beginning to be established as a counterbalancing force to the determinants of dissatisfaction. This notion does not appear to be explored extensively (if at all) in the freight transport arena, but conceptually it does feature in other markets, such as

financial services (White and Yanamandram, 2004). Understanding and identifying such determinants of inertia (of which reluctance to invest time in researching alternatives appears to be one) in the freight market would improve overall understanding of transportation choice and is a possible area of future study.

It is not surprising, therefore, that the results of the investigation into an association between typology and inertia, based on the last twelve months, showed an association between typology and resistance to change, with high resistance being associated with Conformers and low resistance with Explorers. Unfortunately, the results over time in post were not as conclusive but, as shown by the analysis in Chapter 6 (Section 6.5.4, page 271, and Section 6.4.6, page 262), the results were probably influenced by the length of time some of the respondents had actually been in post. Obviously, measuring resistance to change over twelve months provides a more consistent and reliable result than over a range of between one and thirty years.

The questions in Section 4 of the questionnaire (see Appendix 7), as well as exploring inertia, made a contribution to the analysis of buy class, helping to differentiate between many baskets and new buy preferences. Although this may have raised issues of collinearity between buy class and resistance to change, these were considered similar constructs anyway and, hence, the commonality was inevitable.

Proposition 5 – Association between determinants of dissatisfaction and choice

One aspect of the decision-making process that was examined in this study in fairly great detail, was the relationship between determinants of dissatisfaction and those of choice. The statistical analysis clearly demonstrates that, based on this survey, determinants of dissatisfaction are accurate predictors of determinants of choice. This may be considered a facile distinction to make but it is important from the perspective of the influence that an adverse (dissatisfying) experience has on the decision-making process. In Chapter Three, the various

decision heuristics are discussed in terms of their positive or negative impact on the objectivity and effectiveness of the decision-making process. The "availability" heuristic, that is associated with the vividness in memory of a past experience (Tversky and Kahneman, 1974), appears quite potent. It is argued here that an adverse event is far more likely to be remembered vividly and consequently, can have a disproportionate influence on future decisions. Thus, the affect of determinants of dissatisfaction may lead to irrational decision-making rather than a more objective appraisal (e.g. generalised cost or sustained reliability) of determinants of choice (Nisbett and Ross, 1980).

The point was made in Chapter 6 that over time, determinants of dissatisfaction become adopted as determinants of choice and so a relationship between them is inevitable. Table 6.31 (page 286) illustrates this well and shows that at the aggregate level there is strong relationship between some of the determinants of dissatisfaction and those of choice. The very close relationship between the frequencies for on time pick-up and delivery are a good example of such influence. It can readily be seen that the inconvenience (and consequent dissatisfaction) caused by vehicles consistently turning up at the wrong times, can very easily translate into a disproportionately important determinant of choice, even though the generalised cost of such inconvenience is probably relatively small.

The theoretical background to this was provided In Chapters Three and Four. The rationale put forward is that, particularly with the satisficing approach which relies on past experience and heuristics, dissatisfying events are likely to be highly influential in specifying future determinants of choice. The vividness heuristic described in Chapter 3 (page 74), and its influence on both the availability and representativeness heuristics, contribute to such potential bias. Conversely, where a maximizing approach dominates, it is likely that the salience of the available determinants is measured more objectively and the alternatives ranked accordingly.

The questions in Section 5 of the questionnaire were framed to elicit up to three determinants of dissatisfaction and eight determinants of choice. It was

reasoned that because dissatisfaction tends to be subjective, it is guided by vivid memories of past events. It is improbable to conceive that any transportation decision-maker would tolerate more than three dissatisfying experiences and so, to attempt to elicit more than three in the questionnaire was thought unrealistic. On the other hand, modal decisions may well involve evaluating and ranking numerous determinants of choice. For these reasons, in this experiment at least, up to three determinants of dissatisfaction are compared with the top three of eight possible determinants of choice (identified from previous research).

For Proposition 5 to be accepted it is necessary to establish two tests, namely a strong association between determinants of dissatisfaction and choice on an individual basis, and a much weaker relationship on an aggregate basis. The first of these assumptions was tested on the basis of probability, using both combinations and permutations to compare the ranked determinants of dissatisfaction and choice respectively. The results were found to be highly significant ($\alpha \leq 0.001$), thus supporting the proposition. Testing the same data on an aggregate basis also produced a significant result indicating that over time, determinants of dissatisfaction are probably adopted as determinants of choice.

Proposition 6 – Association between typology and modal choice

The ultimate question in this study is whether, having gone through the decision process, according to the maximizing or satisficing strategies deemed by earlier research to be preferred by Explorers, Improvers and Conformers (and largely confirmed by this experiment), modal choice can be predicted. In other words, do different typologies incline towards particular modal choices?

All of the preceding analysis and argument should lead in an orderly fashion to a method of predicting modal choice. In fact, the stated preference experiment revealed no substantive statistical evidence that distinguishes one class of decision-maker from another in terms of choice of mode. The only reliable outcomes are the disinclination for all classes to use rail transport and an inclination towards sea based options (exclusive and many baskets). The inclusion of St Petersburg in an itinerary makes no discernable difference.

Route information	Headline attributes	SERVICE CHOICE (Ranking)					Route equivalent	Preferences (part worths)
		Conformer	Improver	Explorer	Overall	First		
None	Cost £44/Rel 83%	2	1	1	1	1	MB Road/sea	+ 0.1
None	Cost £45/Rel 70%	6	4	2	2	7	MB Sea	+ 0.1
None	Cost £43/Rel 70%	4	3	3	3	2	Sea	+ 0.5
None	Cost £49/Rel 55%	2	2	5	4	4	MB Sea/rail	+ 0.1
None	Cost £59/Rel 95%	1	6	4	5	3	Road	+ 0.0
None	Cost £62/Rel 95%	5	5	6	6	4	MB Road	+ 0.1
None	Cost £58/Rel 68%	7	7	7	7	7	MB Rail/road	+ 0.1
None	Cost £53/Rel 40%	8	8	8	8	4	Rail	- 0.6

Route information	Headline attributes	ROUTE CHOICE (Ranking)					Route equivalent	Changes (part worths)
		Conformer	Improver	Explorer	Overall	First		
Road	Cost £59/Rel 95%	2	1	2	1	1	Road	+ 0.1
MB Road/sea	Cost £44/Rel 83%	1	2	1	2	1	MB Road/sea	+ 0.0
Sea	Cost £43/Rel 70%	3	4	3	3	3	Sea	- 0.2
MB Sea	Cost £45/Rel 70%	5	5	4	4	4	MB Sea	+ 0.0
MB Road	Cost £62/Rel 95%	4	3	6	5	4	MB Road	+ 0.0
MB Sea/rail	Cost £49/Rel 55%	6	7	5	6	6	MB Sea/rail	+ 0.0
MB Rail/road	Cost £58/Rel 68%	6	6	7	7	6	MB Rail/road	+ 0.0
Rail	Cost £53/Rel 40%	8	8	8	8	6	Rail	+ 0.0

Source: Author

Table 7.5 – Summary of modal choice findings

The data obtained from the stated preference experiment on modal choice was analysed in a number of ways. The most useful analysis, in terms of effectively testing the proposition, was the rank order vector method as this showed changes in preferences according to whether the choice was based purely on attributes, or a combination or attributes and route/mode information. The results are presented in several different ways in Chapter 6. In Table 7.5 the most explicit of these results are summarized.

It can be seen that based on Service attributes alone (ranked by overall assessment) the choices made are mainly based on cost, although the frequency of service (not shown) inverses some of the monotonic relationships. The results shown for Conformers do not appear to be consistent with the analytic approach used by Improvers and Explorers. Based on part-worths alone, sea appears the more favoured option but this is because the attributes are common with some of the many basket options. In terms of actual choice made, it is not a suitable measure for ranking.

When route information is added, the road-based options are preferred. Although road is shown at the top of the ranking, this is only the first option for Improvers. Conformers and Explorers, on average, prefer a many baskets

approach that includes both road and sea. It is unlikely this choice preference is based purely on a trade off between reliability and cost as the options associated with these attributes were reversed on the Service analysis. Rail was ranked last in the Route choice results. However, despite the poor reliability attributed to this mode in the Service choice sequence, it still ranked fourth ahead of the slightly more expensive road and rail option.

Although some interesting observations can be made from these results in terms of overall preference, the frequencies are too low to draw any substantial conclusions regarding typologies. This view is supported by the statistical analysis, which showed no significant distinction between the typology groups. Thus, not only must Proposition 1 be rejected, there does not appear to be an alternative specification that can be substituted.

7.2.2 Extraneous variables

The analysis in Chapter 6 (Table 6.48, page 306) indicates that the decision process, and ultimate modal choice, may be influenced by factors other than those specified in the original constructs (Propositions 1 to 4). There is a strong association between the Sensing/iNtuitive scale and Propositions 1 to 4. The Thinking/Feeling scale is not statistically significant but can be seen to be contributing in some cases to the strength of association and detracting in others.

The results for the J/P scale are more striking. Analysis of this scale in relation to Propositions 1 to 4, as well as Proposition 6, show statistically significant results in all cases, including modal choice. Again, however, the influence is not necessarily in line with the Proposition, having the effect of strengthening the relationship in some cases and weakening it in others.

On face value the influence of the individual scales suggests that the propositions should be revisited to accommodate the individual affects of the S/N, N/T as well as the J/P components. In this case, because the influence of the different scales is not always in the same direction, even if the I/E (Introvert/Extrovert) scale is ignored, this would mean adopting eight

taxonomical specifications. The consequent reduction in frequency would make it impossible to draw any inference based on the existing data and no relationships could be established when the data was analysed at this level.

As J has been identified as a potential influence on the way that Explorers, Improvers and Conformers behave, a small analysis was carried out on the data to see if adding "J" to one of the specifications would materially affect the results. The Explorer (ST/NT) specification was selected and the analysis recalculated. The impact has been evaluated in terms of whether it strengthens or dilutes the findings according to the original constructs. The summary shown in Table 7.6 is based on the original findings (Table 7.1, page 316) and the analysis shown in Table 6.48 (page 306).

As expected, some of the changes that took place contributed to the null hypothesis and some to the alternative hypothesis. Although small changes were noted they did not alter the level of significance. A material change might occur if the original results of one of the constructs were near the cusp between two critical values. As none were in this zone, the results of the experiment remain unchanged. For this reason the taxonomy originally specified in this experiment appears to be valid.

Significance of J acting on Explorers, Improvers and Conformers

Construct	Inference in terms of Explorer (ST/NT), Improvers and Conformers	Inference in terms of J component
Triggers	Findings based on Explorers (ST/NT), Improvers and Conformers are not significant.	
Buy Class	Explorers (ST/NT) tend towards new buy, Improvers towards modified rebuy and Conformers towards buy/rebuy.	S and N are deemed to be neutral. T and J are opposed. J may dilute if NT is dominant or overwhelm if ST is dominant.
Information Strategy (Inferred)	Explorers (ST/NT) tend towards CSS, Improvers towards MSS and Conformers towards LSS.	S and N are deemed to be neutral. T and J are opposed. J may dilute if NT is dominant or overwhelm if ST is dominant.
Inertia (12 months)	Explorers (ST/NT) appear to have a low resistance to change and Conformers a high resistance to change.	S and N are deemed to be neutral. T and J are complimentary.
Modal choice - Service	Findings based on Explorers (ST/NT), Improvers and Conformers are not significant.	
Modal choice - Route	Findings based on Explorers (ST/NT), Improvers and Conformers are not significant.	

Source: Author

Table 7.6 – Significance of J acting on Explorers, Improvers and Conformers

7.2.3 Taxonomy

The taxonomy used in this experiment has a solid background based on previous research. The decision to avoid adopting an existing taxonomy is justified on the basis that the findings in this experiment, although similar, may not coincide precisely with earlier specifications. This would complicate both the analysis and subsequent discussion because any anomalies would have to be explained with reference to the constructs here, as well as the findings of earlier work (which, itself, may not be totally valid). Whilst this might add to the rigour of the process, it would make the study unnecessarily complicated, constrain the research and make it backward facing rather than forward looking.

The policy adopted here was to specify a metaphoric taxonomy that describes the key characteristics of the decision-maker in a way that closely follows the principles of similar work. It is not intended that the taxonomy should be pejorative. Whilst the maximizing approach associated here with Explorers may appear to be more thorough than the Conformer's satisficing strategy, it is rarely practical in the real world. Thus, one may be tempered by the other and the middle ground, where analytical techniques are most effectively combined with decision-making heuristics and experience, is assigned to "Improvers".

Although, more reliable associations were established between some of the propositions and three of the four bi-polar scales when they were analysed individually, this did not hold true when they were combined back into the Myers Briggs Typology Index (MBTI). Whether this would be the case with a larger sample, providing greater frequencies, is not known. However, even if this were established, the results for the taxonomy actually employed might also be enhanced.

In a practical sense, the taxonomy used here based on three classifications, is easier to apply in industry than an eight or sixteen part classification corresponding to the MBTI. Consequently, although the findings of this

experiment are quite limited, the taxonomy as originally specified is used in the remainder of the discussions.

7.2.4 Demographics

Although demographic information was collected no significant association could be found between the various data, at individual or company level, and the decision-making behaviours. Whilst earlier research indicates that some relationships may exist, the relatively small sample size, combined with the number of categories (Industry sector = 6, Size of enterprise = 6, Trading pattern = 6, Freight characteristics = 6, Age = 5, Time in post = 6) resulted in too many degrees of freedom to yield statistically significant results.

7.2.5 Implications

The primary purpose of this study was to discover why some UK exporters apparently act irrationally and use road transport to Russia rather than sea. An experiment was designed to identify preferences for a particular modal choice, in the context of the decision process, and to evaluate the implications this has for the freight market. Specifically, the objective of this study is to determine how freight suppliers (carriers and other players in the supply chain) should design and package their product to appeal to particular types of decision-maker. Identifying the various stages of the decision-making process, and the way each is approached by different types of freight buyer, provides an understanding of where a freight provider might intervene (to retain or secure business) most effectively.

Triggers for a transportation review are generally not manifested externally until they have provoked an action, i.e. to evaluate alternative suppliers. Whether the action is as a result of proactive intervention by the decision-maker in this study, by somebody else in the organization, or externalities such as changes in technology or product, is largely inconsequential. However, according to the findings of this study, the odds of a transportation review being initiated are greater if the decision-maker is proactive, behaviour associated here with the

Explorer and, to some extent, Improver types. The implications of such triggering events lead on naturally to buy class.

This study has demonstrated an association between typology and buy class. If the freight buyer (decision-maker) is a Conformer this has positive implications for an "in-carrier" as all that is necessary is to continue to provide a satisfactory service in order to retain the business. If the freight buyer is an Explorer the supplier's task of retaining existing business becomes harder as it is likely that performance will be constantly monitored and compared with competing services and modes. In this situation the supplier must be able to positively differentiate the product and provide cogent proof of exemplary performance.

Conversely, if the supplier is not an existing carrier, the challenge of getting onto an approved carrier list and winning the business is much harder if the freight purchaser is a Conformer. Whereas a buyer that tends towards maximizing strategies (Explorers) may be amenable to receiving information about, and even trying, new services, the Conformer may prove more reticent. In the latter case, highlighting the potential risks associated with the current mode, appealing to the heuristics employed in a satisficing approach, especially if these coincide with previously publicized poor experiences, may be a more effective strategy than providing tangible proof of a better or more reliable service.

The approach required by the buy class preference locks into the information gathering strategies employed by the different types of decision-maker. In the self-assessed experiment Explorers tend towards comprehensive strategies with Conformers, at the other end of the scale, relying on a more limited form of enquiry. The results of this study indicate that the primary sources of information for Explorers and, to a certain extent, Improvers are tenders and proposals; whereas Conformers indicate trade journals as their primary source. Conformers also list "last experience of mode" and the "Internet" as their secondary sources of predecisional information. Against this, Explorers and Improvers identify formal KPIs, such as "On time pick-up/delivery performance", as their secondary source. This implies that different

channels and levels of rigour appeal to different types of freight purchaser and, thus, have to be systematically employed by freight suppliers in order to communicate with and persuade the respective types of customer.

The modal choice part of the experiment, as framed by the original proposition, did not produce conclusive results. Although the different typology groups displayed certain preferences, these were in terms of consistency, with Explorers appearing to rely on analysis of attributes rather than mode or route information. The stated preference experiment showed a weak inclination for the majority of respondents in all typology classes to use road transport. All typology classes showed a disinclination to use rail transport. A high proportion of respondents in all classes made the same first choice based on Service attributes and Route information.

Although not part of the original experiment, a revealed preference analysis was carried out using the information supplied in response to the questions in Sections 2 and 4 (see Table 6.42, page 300). This showed an overall preference for road largely as a result of Explorers (56%) and Improvers' (57%) use of this mode. Conformers were the only typology class to clearly demonstrate a revealed preference for sea transport (58%). It was noted that 15 of the 108 observations related to single (one-off) road shipments. When these were removed from the analysis the preferences displayed by the individual typologies did not alter although, overall, the balance between road and sea shipments moved slightly in favour of sea shipments.

The implications of this should be of some concern to suppliers involved in sea transport (carriers and ports) as the typology group accorded with the more analytical, maximizing approach (Explorers) appear to prefer road transport. Conformers, who tend to be inert, and who are in the buy rebuy class, are responsible for a large proportion of the sea shipments, but even they, on single shipments, are exclusively inclined towards road. Given the reasonable assumption that new business starts with single shipments, Conformers that inaugurate their export initiative with road shipments, because of their buy class preference, are more likely to remain with this mode. If the analytical tendencies

of Explorers also persuade them in the same direction (whatever the underlying determinants) they will also be disinclined to change. Hence, the combination of both satisficing and maximizing approaches work in the same direction, migrating transport buyers from maritime to road shipments, indicating that this preference (despite the ecological considerations noted in the literature review) may evolve to become even more dominant in future.

It was proposed in this study that determinants of choice actually arise from determinants of dissatisfaction. An investigation of this aspect produced some evidence to support this such that it held true for more individuals than would have occurred in a normal distribution. On an aggregate basis, determinants of choice were found to differ from those of dissatisfaction, even at typology group level. Because first hand experience is a prerequisite of dissatisfaction, determinants of dissatisfaction must be governed by context. If this is true and if, as this study shows, determinants of choice are associated with determinants of dissatisfaction, then determinants of choice must be contextual. The implication for the freight service provider is that any product offering and packaging taking account of such determinants must also be trade specific.

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Determinants of choice and dissatisfaction (by typology)

Choice

Conformer		Improver	
1	More flexibility	1	More flexibility
2	Better on time pick up/delivery	2	Better on time pick up/delivery
3	Better shipment information	3	Better shipment information

Explorer		Overall	
1	More flexibility	1	More flexibility
2	Better shipment information	2	Better on time pick up/delivery
3	Better on time pick up/delivery	3	Better shipment information

Dissatisfaction

Conformer		Improver	
1	On time pick-up/delivery	1	Overall cost
2	Overall cost	2	Shipment information
3	Transit time reliability	3	Flexibility

Explorer		Overall	
1	Overall cost	1	Overall cost
2	On time pick-up/delivery	2	On time pick-up/delivery
3	Transit time reliability	3	Shipment information

Source: Author

Table 7.7 – Determinants of choice and dissatisfaction by typology

Determinants of choice based on the first three selections, were almost identical for all typologies. However, determinants of dissatisfaction were more particular to the typology groups. Cost, considered as the most important determinant of dissatisfaction for Explorers and Improvers (and ranked second by Conformers) ranked fourth as an overall determinant of choice (See Table 6.28, page 283). Even though several of the determinants of dissatisfaction emerge as determinants of choice, cost appears to increase in importance as a measure of dissatisfaction for all typologies. This may be insignificant, but it could also indicate that whilst shippers are comfortable with the contracted costs agreed in advance, they are dissatisfied with the ultimate (unspecified) costs when paid in arrears. When investigated further it was noted that in every instance except two shipments (sea), dissatisfaction with cost was associated with road transport (see Table 7.8).

Dissatisfied with cost

Mode	Determinant of dissatisfaction "Cost"					
	Worst	Next worst	Least worst	Not dissatisfied	Total	%
Exclusively road	4	4	6	0	14	32%
Road plus other mode(s)	7	5	1	0	13	30%
Exclusively sea	2	0	0	0	2	5%
Exclusively rail	0	0	0	0	0	0%
Not dissatisfied with cost	0	0	0	15	15	34%
Total	13	9	7	15	44	100%

Source: Author

Table 7.8 – Dissatisfied with cost

The other determinants are service oriented, which is broadly in line with previous research, although the underlying attributes may differ according to the trade specific context.

7.3   Product design and packaging

The ultimate purpose of this study is to understand the decision-making process in freight transport, in order to be able to better design the product offering (the transport service) and its packaging (the way that it is marketed). The findings of the study may not be generalisable due to the low frequencies in the results. The context used for the experiment and this discussion, is the freight market between the UK and Western Russia. The general principles may be of

interest in other areas of research. The following discussion addresses some of the key issues:

- The perspective in terms of the identity of the service provider;
- The market segments to be addressed;
- The marketing and sales strategies that need to be developed to address the market segments;
- The packaging of the product in terms of the service offering and the way that it is marketed.

The audience for this study is likely to be service providers, although this does not preclude buyers from using it to better understand the freight buying process - and how this can be used to improve their own decision-making. As has already been discussed in Chapter Two, there are several types of service provider in the surface transportation market, namely carriers (road, rail and sea), nodal points (ports, inland depots etc.) and intermediaries (logistics service providers, forwarding agents, brokers etc.). The discussion here concentrates on the freight service provider's perspective, and is broken down in two ways. Firstly, consideration is given to whether the supplier is an "in" supplier (one that wishes to retain existing customers) or an "out" supplier (one that wants to attract new customers). Secondly, the findings are assessed according to mode, i.e. whether the supplier is involved in sea transportation (carrier, port etc.), road transportation or rail transportation.

In order to do this, the results are considered in terms of how they can be used to segment the respective markets. The objective of segmentation in general is to define relatively homogeneous groups "in order that individuals with similar desires for product benefits or characteristics are assumed to respond similarly to a product strategy" (Currim, 1981). Industrial markets are often broken down by segmentation variables. The categories proposed by Matear and Gray (1995) are:

- Company demographics;
- Operating variables;
- Purchasing approach;
- Situational factors; and
- Personal characteristics of the decision-maker.

In this study, the method of segmentation adopted is the "personal characteristics of the decision-maker". Personal characteristics are viewed as an important method of segmentation by a number of researchers. For example, Vieira (1992) uses latent structure models to integrate attitudinal indicators with observable shippers' characteristics in the definition of segments, and Grant (1993) applies Jungian typologies in a segmentation analysis of critical incidents (determinants of dissatisfaction). Consumer market segmentation is accomplished by accurately targeting specific audiences by using profiling systems such as "PRIZM" and "Super Profile" (Martin and Peck, 2003).

The principles used in consumer markets, to apply different strategies, and even different tariffs, to new customers and existing customers (White & Yanamandram, 2004), can be effectively applied to the freight market. Commonly, existing customers ("happily inert") in consumer markets find themselves paying higher prices whilst new customers are attracted by various lower-price incentives and offers. In the freight market, existing customers at the Conformer end of the scale can be retained providing that the service matches or exceeds the basic requirements. As with the consumer market, prices can be increased progressively because the Conformer is unlikely to have invested time and effort obtaining comparisons. Triggers for change can occur but, according to earlier research, these are likely to be reactive, either responding to external complaints, changes in products or new technology. Even when such trigger occurs, the Conformer's resistance to change (confirmed here) should provide an adequate opportunity to respond to any new requirements.

Explorers and Improvers require a different approach. A review of transportation arrangements may occur at any time, based on monitoring existing performance or even perceiving advantages offered by an alternative supplier. Explorers and Improvers' resistance to change is lower than Conformers and so alternatives may be reviewed on a more equitable basis, with no advantage (opportunity to rectify any shortfall) provided in advance. This means that customers where the key decision-maker is an Explorer or Improver are higher maintenance than Conformers, requiring suppliers to be constantly alert to

indications of dissatisfaction or the possibility of a review of transportation arrangements.

In terms of converting new customers, the situation is completely reversed. Conformers, with a high resistance to change, tending towards buy/rebuy, may not even wish to be disturbed by details of an alternative and, possibly, a better service than their current supplier. Providing the existing service matches or exceeds their basic requirements they may even be indifferent to lower prices, following the logic of Fornell (1992) and arguing that, in any case, these would probably offset by switching costs anyway. The results of this study also suggest that Conformers are disinclined to invest time in formal predecisional information gathering strategies. However, it is useful to note that the "trade press" is identified here as one of their primary sources of predecisional information.

Explorers and, to some extent, Improvers are less resistant to change and may welcome the opportunity to make a comparison with a new service. The indications from the associations found here, are that Explorers will evaluate the information against other possibilities and, if there are potential advantages, may accept the risks associated with a new buy. The demarcation between the categories used here is not absolute but, for example, Improvers may also respond to information about another service but then use the data to negotiate better terms with the current supplier (modified rebuy). The big difference is that both Explorers and Improvers identified "formal proposals, tenders and quotations" as their primary source of predecisional information. Hence, whilst the provision of such formal proposals can be speculative, bearing in mind the maximiser's predisposition to analysis of hard data, it must be accurate and complete. Comprehensive search strategies, which Explorers are identified by this experiment as using, are defined in terms of breadth as well as depth and so persuasive statistical comparisons (modes and services) may well be usefully included by the "out" supplier.

Addressing these questions, as they relate to the specific business of the service provider, should allow a better product design and packaging. For

example, bearing in mind that the Explorers have a low resistance to change, what are the relationships among the variables of the service providers' product offering (determinants of choice and possibly dissatisfaction) that will influence customer retention (Folkman, Curasi, & Kennedy, 2002)? Equally, when attracting new business what potential determinants of dissatisfaction, if subtly highlighted in the trade press, would appeal to the representative and vividness heuristics, and lever the risk aversion of the Conformer? Could such a strategy be used to provoke uncertainty about the current mode/supplier and instigate an uncharacteristic inclination towards a new buy?

It can be seen from the results of this study that not only the product offering but also the way that it is packaged can be effectively designed to appeal to the different types of decision-maker. However, this must also be matched to appropriate marketing channels so that the type of information and the way that the types of decision-maker obtain (and respond to) their predecisional information, coincide. To reiterate the findings (see Table 7.4 page 322), in terms of external information Explorers rely on formal proposals, tenders and quotations, market research, trade journals and the Internet. Improvers also prefer formal proposals, tenders and quotations, as well as the Internet. As far as the findings of this study are concerned, the Conformer's first preference is trade journals, followed by internally generated indicators regarding the current supplier (on time pick-up and delivery).

Occurrence of determinants of dissatisfaction by mode

Determinant of dissatisfaction	Road		Sea		Rail	
Cost	28	64%	14	32%	0	0%
On time pick-up/delivery	17	39%	12	27%	1	2%
Loss/damage record	10	23%	5	11%	4	9%
Transit time reliability	18	41%	13	30%	3	7%
Claims response	4	9%	3	7%	1	2%
Shipment information	12	27%	5	11%	1	2%
Overall transit time	12	27%	10	23%	3	7%
Flexibility	9	20%	11	25%	2	5%
Total respondents	44	100%	44	100%	44	100%
Total shipments (estimated)	56.33		44.33		7.33	

Source: Author

Table 7.9 – Occurrence of determinants of dissatisfaction by mode

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Three modes of freight transport between the UK and Russia are examined by this study. The results of the stated preference experiment showed a slight preference for road transport, followed by many baskets, road and sea (see Table 7.5, page 327). The revealed preference analysis showed significantly more shipments by road than sea transport (see Table 6.42, page 299), but the difference was almost entirely due to single one-off shipments by road freight. With these (15) removed, the use of sea and road was found to be more-or-less equal. Of the 108 observations, only 7 shipments were by rail (conservative estimate).

In the discussion regarding the implications of the findings it was noted that a high proportion of customers dissatisfied with cost use road (Table 7.8, page 335). This exercise was extended (see Table 7.9) to take in all the occurrences of determinants of dissatisfaction. The table does not differentiate between "Worst", "Next worse" and "Least worst", and is not absolutely definitive as some respondents use more than one mode. It is also acknowledged that more respondents use road than rail. However, the table does show, that even taking account of the different number of shipments involved, the areas that may need to be addressed in each mode to improve performance (or redesign the packaging).

In addition to improving performance in areas of actual weakness, freight suppliers need to identify the strengths and weaknesses as perceived by the customer and design and package their product so that weaknesses are minimized and strengths, especially where they can be used to differentiate the product, are both exploited and conveyed to customers – actual and potential. From the indications in Table 7.8, a supplier of road-based services might wish to investigate whether the price dissatisfaction directed towards it is real or perceived. If it is real, especially if the customer is an Explorer, then it may be necessary to redesign the product offering (i.e. adjust the price, if possible). If it is simply a problem of perception, or if the customer is a Conformer, it might be better to look at the product packaging (promotional literature, advertising, quotation process etc.).

Although this study was not able to discern a direct association between typology and modal choice, understanding this form of segmentation, and combining the preferences with other factors in the marketing mix, is a powerful tool that may be used effectively to influence modal choice, carrier selection and even product packaging.

7.4 Reliability and validity

The previous sections in this chapter have dealt with the findings and their implication with regard to modal choice. This section discusses the results of the experiment in terms of reliability and validity. The pre-survey instrument evaluation procedures detailed in Appendix 11 and reported at the beginning of Chapter 6, confirm the reliability and internal validity of the instrument.

In terms of pre study validation, a rigorous process was employed to establish face value, content and construct validity. The reliability of the instrument was confirmed through a test and retesting procedure (see Section 6.2.1, page 247). Although the results were not perfect, partly due to control of the interval between tests, the overall results were within acceptable limits. The minor changes on two of the bipolar scales were not thought to have materially affected the outcome of the experiment.

The principles for conducting the survey, stipulated by Pearce and Özdemiroglu (2002), and stated in Section 5.3 (page 207), have been followed rigorously. In analysing the data, strict statistical principles have been used and results discarded if the 95% confidence level (also specified in Section 5.3) has not been reached.

7.4.1 Response rate

The response rate for this study was very poor with pseudo-random methods yielding the worst results. The problem initially appeared to be recruiting respondents who would embark on the questionnaire as the Web site statistics showed abandonment after this point to be very low. Thus, the actual

design of the questionnaire was considered satisfactory (not contributory to abandonment) and there was feedback (using the feedback form confirming this – see Figure 6.2, page, 249)

Poor response rates appear to be becoming more of a problem as academic researchers compete with professional market research companies for respondent time. This is exacerbated by call-centre based market research, often low cost and located overseas. Receptionists and other first line filters (guardians) have become adept at declining calls and "blue chip" companies, in particular, have developed several strategies (including organisation-wide "no-name policies") that protect key executives from being disturbed. It is not impossible to get past these gatekeepers but it is extremely time consuming and hence randomness has to give way to strategic targeting of likely organisations.

For this reason, there must be some doubt in a study of this nature that the methods of sampling used actually yield valid information for statistical analysis. There are three areas of concern:

- The sample frame is not sufficiently random such that the responses can be considered representative and that any results or conclusions can be safely generalised across the entire population;

- There is a real possibility of a non-response bias from some sectors of the sample frame (pan European, medium and small UK-based organisations) such that any inferences drawn from the study are not representative of those sectors;

- The willingness, or not, of potential respondents to take part in the survey is a particular problem in behavioural type studies where the variable that may contribute to the non-response bias (typology) is also an observable variable in the proposed constructs.

Non-response bias has been evaluated (Section 6.3, page 252) using late responses as surrogate for non-responses (Nwachukwv et al., 1997). It was concluded that notwithstanding the limited number of respondents involved, the late responses identified by this method were broadly in line with the general population (see Table 6.11, page 260).

Despite these qualifications, it was concluded that the sample frame was representative of the wider population. The split between the types of organisation, the trading areas, and the age and experience of respondents was sufficiently diverse that neither individually nor as groupings could they be isolated as separate extraneous variables (Clark & Brookover, 1992). The proportion of different types of organisation represented in the sample corresponds with the profile of companies operating to Russia, identified through the UK Trade and Investment Section.

7.4.2 Internal validity

The test/retest process highlighted some areas of caution where respondents with weaker preferences could flip onto the other side of the scale (thus appearing to change their typology). However, except in two instances, this did not alter the classification used in this study. Where there was a significant shift along the bi-polar scale (one respondent), the scoring for that respondent on the non-Jungian parts of the questionnaire was also poor.

The quality and expert groups, based on the explanatory booklet provided with the questionnaire, confirmed the face and content validity. Conceptual problems arose with the construct domain inventory, but these were resolved by further technical explanation of the requirements.

7.4.3 External validity

The first part of criterion validity relies on comparing the results of this study with other contemporary studies investigating broadly the same concepts, whilst the second is the predictive, i.e. the ability of the instrument to predict future outcomes. The latter, of course, cannot be verified at this time.

The concepts that are explored, and for which evidence of concurrent validity is provided, are:

- Segmentation by personality type;
- The use of the MBTI to explore management behaviour;

- Modal choice;
- Determinants of choice.

This study, as far as can be determined, is the first study of its kind that has attempted to segment the freight transportation market by decision-maker psychological type. There are precedents in other industries where this has been done successfully, namely, selling computers (McBride & Cline, 1989), the tourism industry (Gountas, & Gountas, 2001) and the financial services industry (Pompian, 2006). Folkman, Curasi, and Kennedy (2002) have also explored the preferences of customers in services marking with regard to customer loyalty and retention.

There are several studies that relate the psychological type to management behaviours. These include "Risk and organizational behaviours" (Smallman, 1996). "Intuition as a Brain Skill in Management" (Agor, 1985), "The influence of decision style on decision-making behaviour", (Henderson & Nutt, 1980), "On human cognition and the design of information systems" (Spence & Tsai, 1997), "The influence of decision style on decision-making behaviour" (Henderson & Nutt, 1980), "Adaptors and Innovators" (Kirton, 1976), "Cognitive style and personality" (Kirton & De Ciantis, 1986). Several of these link reactive and proactive behaviour in decision-making to psychological type, using similar taxonomies to the Explorer, Improver, Conformer used in this study.

Even so, for the typology experiment, there has been very little work done in this area of research to which this study can be compared. However, the typology splits identified in this study are not wildly dissimilar from those found in either the UK adult population norm OPP (2006) or middle managers (Lewis and Margareson, 1989) (see Table 6.43, page 301). Even this trend towards a higher proportion of NT and J types can be explained by the trends in both the Cranfield (Lewis, Margareson, 1989) and Cambridge (Rogers, 1997) surveys. For studies using typology to predict decision-making and, thus, segment the market it is necessary to refer to McBride and Cline (1989), Grant (1993), Gountas and Gountas (2001), Folkman, Curasi and Kennedy (2002) and

Pompian (2006). Therefore, it is considered that the criteria for concurrent validity of the typology constructs are satisfied.

Identifying studies on modal choice (and other forms of transportation choice) is much easier. Eighty-eight studies identified in this study alone (Table 3.9, page 111) deal with thirty-four of the most popular determinants of choice, whilst other researchers have explored such diverse aspects as "neatness of vehicle operators" (McGinnis, 1989), "product value-to-weight ratio" (Gilmour, 1976) and "promotional material" (Whyte, 1993) as potential determinants of choice. Despite the various reviews of earlier work (Murphy & Hall, 1995), taxonomies (McGinnis, 1990) or mathematical analysis, (McFadden, 1981) to try to find a consensual solution or, at least, common language, there appears to be little agreement as to what encourages a decision-maker actually to choose one mode in preference to another.

In terms of concurrent validity, the results of the determinants of choice experiment are within the gambit of the other studies of this nature, summarised in Table 3.9 (page 111). The most contemporary of these is the modal choice experiment of Garcia-Menendez, Martinez-Zarzoso and Pinero De Miguel (2004) carried out with 157 exporting firms located around Valencia. There are distinct similarities between this experiment and the study here. All three main modal options are available on the Spanish Peninsula but, possibly because of a similar rail gauge problem, the study concentrates on a comparison between road and sea.

The study here starts from the viewpoint that exporters from the UK to Russia do not always appear to make logical transportation choices. Garcia-Menendez, Martinez-Zarzoso and Pinero De Miguel also take the view that transportation decision-makers "do not always follow perfectly rational and predictable rules". The findings in terms of determinants of choice in the Garcia-Menendez, Martinez-Zarzoso and Pinero De Miguel experiment, namely – "Cost, transit time and frequency of shipment" are reflected in the findings here. Cost is found to be the most important attribute in both the Service choice (Table 6.40, page 298) and determinants of dissatisfaction (Table 6.27, page 281).

Transit time was the third choice in terms of service attributes whilst frequency, considered as part of flexibility in the stated preference part of this experiment, ranked first (Table 6.28, page 282). Thus, there is a high degree of congruence between the findings of the two experiments.

The same comparisons can be drawn with Damas (2000), Lambert, Lewis, and Stock (1993), Jeffs and Hills (1990), Chow and Poist (1984), Bardi (1973) and Saleh and La Londe (1972).

Between the studies detailed above there is sufficient evidence to support concurrent validity in terms of each of the issues examined in this experiment.

7.4.4 Generalisability

Finally, there is the issue of external validity; whether the results of this experiment are generalisable across a wider population, or in different contexts. In terms of the wider population in the UK to Russia market, although the number of respondents was quite low, as already foreshadowed in Section 5.3 (page 206), because the overall size of the population in the Russian market is also quite small, it was likely that the sample size for the study would be similarly small. This turned out to be the case. However, the sample size actually represents quite a high proportion of the population and so, other considerations aside, generalization of the results should not be discounted.

Danielis, Marcucci and Rotaris (2005) consider the sample size in relation to the frequencies generated for analysis. In their stated preference study involving commodity groups, they took the view that because each sector became quite small, the results were not statistically sound. A similar problem may have been encountered in this study where, when the data was split out into the three typology classes the frequencies in each class were very low and, in some cases, zero. Low frequencies and, in particular, zeros lead to instability in statistical tests, especially chi-squared (Frankfort-Nachmias & Leon-Guerrero, 2005). A review of this aspect showed that where low frequencies had occurred

the results did not achieve the appropriate level confidence and were discarded anyway. Thus, this in itself should not disqualify the results.

One of the unavoidable concerns in this study is the possible association between response rate and the psychological predisposition (or not) of certain types to completing surveys of this nature. This is even more of a problem if the typology of the respondents is one of the variables being examined. As the introduction of bias through this means cannot be excluded the results, based on such a small sample, should not be generalized.

Thus, even though the principles of both sampling and statistical analysis have been applied rigorously, extreme caution should be exercised in attempting to generalize the results of this experiment or export them into other contexts.

7.5 Future research

This piece of research has addressed a large number of issues within the decision-making process. Even so, the results have highlighted several topics that were either not contemplated in the original experiment design, or that could actually constitute an entire piece of research in their own right.

7.5.1 Determinants of dissatisfaction and inertia

Determinants of dissatisfaction have been explored thoroughly in this study in the context of the UK to Russia trade. The importance of dissatisfying experiences in guiding identification of salient determinants of choice, especially for decision-makers tending towards satisficing strategies, is a useful tool for product design and packaging. One aspect that was highlighted, but not pursued in this experiment, was the potentially counterbalancing force of determinants of inertia. Identifying such determinants, in the freight transport market, and resolving whether they are generic or contextual, would provide useful insights for guiding customer retention or conversion strategies.

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7.5.2 Decision-making in transportation

One of the fundamental issues that arises out of this study is that despite there being limited evidence from the stated preference experiment of a desire to use the less polluting options (sea and rail), the small assessment of revealed behaviour indicated that it was far more likely for the proportion of road transport usage to grow even further. This appeared to hold true for respondents inclined towards maximizing strategies as well as those more likely to adopt satisficing techniques, although for different reasons. Perhaps contributory, but still salient is that all the single shipments in the study were made by road. Understanding this fully is of crucial importance to the debate on the environmental impact of transport and, it is argued, probably has far more to do with psychology (and the issues being explored here) than road pricing. Extending the principles exposed in this study to areas of transportation research concerned with environmental impact could make a significant contribution to that type of research.

7.5.3 Decision-making in other contexts

An important area of freight transportation is concerned with the delivery of humanitarian aid, where conditions are often extremely hostile, and handling facilities can be fairly basic, and often under tremendous pressure. The contexts are often not dissimilar to the one investigated here, with several modal options available (including air). Frequently, destinations are inland, not only offering the obvious modal choices (road and rail) but also maritime possibilities arising out of hub and spoke activities (centred on adjacent ports). Some of the principles explored in this study might be usefully adapted to that type of research and, hopefully, help improve supply chain performance in such areas.

7.5.4 Decision-making in teams

There is a danger for a study of this nature to be perceived as pejorative; implying that one class of decision-maker is better than another. Although this is not the intention, by associating one classification with what appears to be a

more thorough and analytical approach, the conclusion is almost inevitable. If Explorers were specified as "decision-making based on tedious attention to unnecessary detail" and Conformers as "decision-making based on experience and efficient evaluation of salient facts", the perception of the taxonomy used here might be different. In fact, a blend of the two approaches is often the most effective (and probably the most prevalent). For this reason, many of the major decisions in companies are made by teams to which the various psychological types contribute effectively. Although more complicated to design, and expensive to undertake, understanding the process might be further improved by conducting the investigation at team or group level.

7.6   Conclusions

Of the six propositions used here to investigate the decision-making process for modal choice, three out of four were supported. Thus, the concepts identified in the literature review relating to buy class, information gathering and resistance to change have been justified. The fifth proposition dealing with determinants of choice, and their influence on determinants of dissatisfaction was also supported. The sixth proposition assumed that the process exposed by the first four constructs, when applied to the determinants of choice, would logically lead to the prediction of a particular modal choice preference. This turned out not to be the case.

Modal choice in this context cannot be predicted according to typology. Too many other factors are involved, not least of which the mode inherited and changes forced by developments in product type and new technology. From the comparison of Service and Route choice in the stated preference experiment, however, it does appear that Explorers are slightly influenced by a more objective evaluation of service attributes and Conformers by route and mode information. Unfortunately, the revealed preference exercise showed that there was little difference between the typology groups, although overall road transport was more popular.

When the implications of these findings were examined, sufficient evidence was found of distinctive behaviours between the typology groups to use them as a basis for segmenting the freight market. Specifically, different strategies are available according to the typology of the buyer combined with the selling perspective, namely retaining existing business or attracting new business. These strategies can be modified to apply to suppliers within each mode, and tailored to improve product design and packaging.

Various tests were used to measure the reliability and validity of the experiment. Reliability and internal validity were confirmed. In terms of external validity, the research was compared with other similar studies and sufficient congruence was found confirm concurrent validity. It is doubtful that the experiment can be generalized beyond the current context, partly due to the small sample size and some degree of respondent bias arising from self-selection.

Four areas suitable for future research have been identified:
– Determinants of dissatisfaction and inertia;
– Decision-making in transportation – environmental impact;
– Decision-making in other contexts – humanitarian aid;
– Decision-making in teams.

The full conclusions, and the contribution made in terms of original, primary research, are set out in the final chapter.

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Chapter 8

8   CHAPTER 8 – CONCLUSION

The research arises out of the trade between the UK and Western Russia. Common sense suggests that the shortest, most economic and effective method of freight transport is by sea to St Petersburg. Against this, the trade press reveals numerous opportunities for road freight. The key question is why exporters apparently act irrationally and ship goods by road when there are satisfactory maritime options available. The study investigates the process of choosing between road, sea and even rail transport and thus, although carrier, port and route issues may be investigated, the study is emphatically one of modal choice.

This chapter summarises the research and is set out as shown in Figure 8.1.

Structure of Chapters 8 - Conclusion

Source: Author
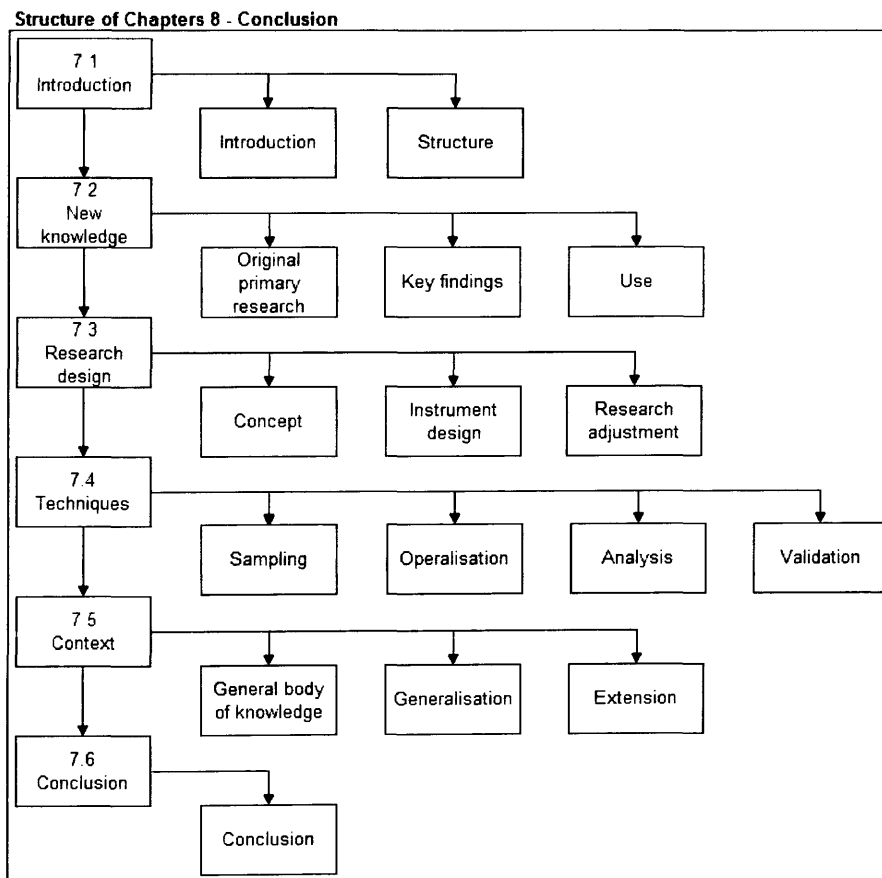
Figure 8.1 – Structure of Chapter 8 - Conclusion

Although there is a wealth of information available on modal choice, none appears to provide a satisfactory explanation of why, when all other things are

equal (location, cargo characteristics, etc.), some shippers choose to ship by one mode and some by another mode. Various earlier research identifies particular characteristics of the decision-maker (Bruning and Lynagh, 1984) as the distinguishing determinant.

In the process of identifying a suitable model to explore the subject it was noted that D'Este and Meyrick (1992) in their structural model for transportation choice showed two branches for the ranking of alternatives. One branch used maximizing techniques and the other satisficing. Whilst investigating what criteria stipulated the method analysis, it was discovered that Nutt (1979) and others had associated maximizing and satisficing with particular personality profiles.

Nobody, as far as could be ascertained has previously attempted to establish an endogenous relationship between the personality type of the decision-maker in freight transport, the maximizing or satisficing strategies used in the decision-making process, and the ultimate modal choice. This piece of original, primary research was constituted to establish such a link.

The key findings of the study support the existence of an association between the personality type and the decision process. Three representative typologies were specified. These typologies were shown to prefer different buy classes, invested more or less time and effort in predecisional search strategies and had a higher or lower resistance to change. Unfortunately, the decision process on its own did not translate into a predictable outcome in terms of modal choice.

During the study it was also discovered that determinants of dissatisfaction influence determinants of choice. This reinforces the view of other researchers (Stock and La Londe, 1977) that determinants of choice reflect previous dissatisfying experiences and are, therefore, subject to context. This is an important finding as certain psychological types are more likely to base new decisions on past experience (Henderson and Nutt, 1980) than others.

An unintended, but important finding arose out of a comparison between the stated preference experiment and revealed preference analysis of some of the

data. It was found that whilst respondents in the stated preference experiment showed part-worths based on attributes inclined towards sea (MB road/sea and sea), the ultimate choices made when Route information was made available was inclined further towards road based modes. This trend was even more conspicuous from the revealed preference data, which confirmed that actual behaviour strongly favoured road (even though the disparity was largely identified to fifteen separate single road shipments). The implication of this in terms of environmental impact were discussed.

The new knowledge generated by this study can be usefully applied to industrial freight buying situations. Specifically, knowledge of the way that the different psychological types approach the decision-making process can be used to segment the freight market. This means that particular types of decision-maker can be targeted with specific product design and packaging strategies that will appeal in either customer retention or customer attraction environments. Similarly, strategies were demonstrated appropriate to redesigning the service offering, or repackaging the strengths or weaknesses of particular modes.

The design of the research embraced the conceptualization of the constructs in a form that reflected the decision process and allowed observation of certain key behaviours. The relationship between the characteristics of the decision maker and the behaviours anticipated by the research were defined using six propositions. In order to determine the propositions it was necessary to identify the characteristics of the decision maker in consistently measurable terms. The psychometric test adopted measured individual preferences on four bi-polar scales and a new taxonomy was proposed to translate these into three types of decision-maker appropriate for this experiment.

The instrument for observation was designed to take account of exposing the behaviours anticipated by the proposals and the personality of the decision-maker. Inevitably the psychometric test formed a large part of the instrument so that the remainder, exploring the actual behaviour, had to be limited. To avoid respondent fatigue, the questions were designed to yield the maximum amount of information with the minimum level of enquiry. A self-administered CAWI

(computer assisted Web-based instrument) technique was designed (and written by the Author). This computer-based method combined the functionality required for an adaptive stated preference procedure with interactive components (Context Help) to assist the respondent.

During the research it became apparent that respondents preferred to use an instrument based on an interactive computer program that could be transmitted by email. The design of the instrument was adjusted to accommodate this preference. The Web-based instrument and the interactive computer program yielded the results in an identical format for automatic analysis.

Some problems were encountered with obtaining a sufficiently large random sample to validate the research. Six different channels were used with mixed results. Overall, fifty responses were received of which six were found to be invalid (5 prior to the initial analysis, and one subsequently). Although the response rate was poor, using late responses as surrogates for non-responses, and comparing the demographics with the larger population, it was concluded that the sample obtained was reasonably representative.

Various advanced analytical techniques were used to explore the data. Although proprietary packages were used for some of the initial analysis (SAS and SPSS) the descriptive statistics finally reported were calculated in MS Excel and checked against the earlier results. Using MS Excel permitted a higher degree of automation translating the information received via the Web and by email. In the early stages a proprietary package was also used for the psychometric analysis but later mapping of this technique facilitated automation of this aspect.

Validation was carried out by three groups: Quality, Expert and Pilot. The Quality and Expert groups confirmed face, construct and criterion validity. Reliability was determined by the pilot group and the test/retest results were deemed satisfactory. Concurrent validity was substantiated by reference to other contemporary studies with congruent work in the main areas of this study. The small sample size, the use of some qualitative techniques and the possibility of one of the variables (typology) also being associated with non-response rate, limits

the external validity of this experiment. Whilst some of the findings (buy class, information gathering and resistance to change) may be valid in other contexts, it is suggested that further confirmatory research would be necessary for this to be done safely. The only predictive outcome proposed, that of a relationship between the typology of the decision-maker and the ultimate modal choice, was not supported by this experiment.

The theoretical constructs behind this research are firmly grounded in the general body of knowledge, the evidence for which is in the literature review. The original research philosophy (triangulation and individualism), the decision structure (appropriate informant), decision model (psychometric test, taxonomy and model), information gathering (heuristics) and determinants of choice (including environmental considerations) are all supported by existing research. In addition, where comparisons are made, or other opinions are relied upon to develop an argument, references are provided at the end of each chapter. A bibliography is appended that embraces both the references and other background reading. A list of the 2,375 studies analysed in support of the psychometric test used is available for inspection but is not included here. Where specific psychometric studies have been relied upon in the argument, these have been referenced.

This study contributes to the general body of knowledge for transportation research, and in other areas. Although based on a relatively small sample size in a specialist market, it contributes original, primary research. Whilst not generalisable in terms of its ability to predict modal choice, some of the principles established are significant indicators for industry and, in particular, designing and packaging the transport product offering. Opportunities for extending the research in a number of areas, vertically and horizontally, have been identified.

This thesis reports a limited but, nevertheless, useful piece of research, properly grounded in theory and contributing original data and concepts. There are weaknesses, but where they exist they have been identified and impact on the findings assessed. The study offers some new knowledge as well as identifying opportunities for further development.

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Appendices

Appendix 1

Studies on which Table 3.9,
"Appearance of potential determinants of choice in earlier studies", is based

Danielis, Marcucci & Rotaris (2005); INRETS (2000); McFadden & Train (2000); Cullinane & Toy (2000); Danielis & Rotaris (1999); Jovicic (1998); Nam (1997); Murphy & Daley (1997); NERA (1997); Nam (1997); Jovicic (1997); Emerson & Grimm (1996); Tweddle (1996); Murphy & Daley (1994); Owaki (1994); Lillie & Sparks (1993); Matear & Gray (1993); Lambert, Lewis & Stock. (1993); Whyte (1993); Brooks (1993); Murphy, Daley & Dalenburg (1992); Abdelwahab & Sargious (1992); MVA (1992); Fowkes, Nash & Tweddle (1992); Damas (1991); D'Este & Meyrick (1992); Hall (1992); Murphy, Daley & Dalenburg (1991); Fowkes, Nash & Tweddle (1991); MVA (1991); Abshire & Premaux (1991); Gentry (1991); Morash and Calantone (1991); Jeffs & Hills (1990); MVA (1990); McGinnis (1990); Evans, Feldman & Foster (1990); Foster and Strasser (1990); Murphy, Dalenburg & Daley (1989); McGinnis (1989); Fowkes, Nash & Tweddle (1989); Bardi, Bagchi, & Raghunathan (1989); Meyrick & D'Este (1989); Coulter et al. (1989); Murphy, Dalenburg & Daley (1988); Bird (1988); Vanderleest (1991); Quinn (1987); Burdg & Daley (1985); Brand and Grabner (1985); Brunning & Lynagh (1984); Chow & Poist (1984); Traffic Management (1983), Slater (1982); Dunn (1982); Cunningham (1982); Keesling (1981); Currim (1981); Pearson (1980); McGinnis & Corsi (1979); Jerman, Anderson & Constantin (1977); Stock & La Londe (1978); Stock & La Londe (1977); Gilmour (1976); Anderson, Jerman, & Constantin (1978); Jones (1975); Evans an Southard (1974); Bardi (1973); Saleh and La Londe (1972) and Bardi (1971).

Note that McFadden and Train (2000) and Currim (1981) are passenger transport mode choice studies. Only attributes that translate to freight transportation choice have been included in the table.

Appendix 2

Determinants with less than two occurrences, not included in Table 3.9

1. Accessability (Rank 32): Nam (1997) and Murphy & Daley (1997); 2. Availability (Rank 32): Emerson & Grimm (1996) and Bardi (1973); 3. Back load potential (Rank 32): Owaki (1994) and Gilmour (1976); 4. Cargo care (Rank 32): Murphy & Daley (1994) and Dunn (1982); 5. Cargo value (Rank 32): Bolis & Maggi (2003) and McGinnis & Corsi (1979); 6. Consolidation (Rank 32): Stock & La Londe (1978) and Stock & La Londe (1977); 7. Financials (Rank 32): Murphy & Daley (1997) and Bardi, Bagchi, & Raghunathan (1989); 8. Service (Rank 32): Mangan, Lalwani & Gardner (2001) and Cullinane & Toy (2000); 9. Shipment size (Rank 32): Murphy & Daley (1997) and Abdelwahab & Sargious (1992); 10. Transport regulations (Rank 32): Vanderleest (1991) and Gilmour (1976); 11. Weight (Rank 32): Nam (1997) and Nam (1997); 13. Asset (Rank 43): Lai, Ngai & Cheng (2004); 14. Assistance obtaining rate changes (Rank 43): Anderson, Jerman, & Constantin (1978); 15. Avaliability (Rank 43): Currim (1981); 16. Aversion to transhipment (Rank 43): Meyrick & D'Este (1989); 17. Berths (Rank 43): Tiwari, Itoh & Doi (2003); 18. Carrier considerations (Rank 43): Mangan, Lalwani & Gardner (2001); 19. Commodity price (Rank 43): Owaki (1994); 20. Conference/Independent (Rank 43): Bird (1988); 21. Consignment size (Rank 43): Jeffs & Hills (1990); 22. Consignment weight (Rank 43): Gilmour (1976); 23. Contamination possibilities (Rank 43): Gilmour (1976); 24. Courtesy of vehicle operators (Rank 43): Evans, Feldman & Foster (1990); 25. Draught (Rank 43): Tiwari, Itoh & Doi (2003); 26. Ease of use (Rank 43): Lillie & Sparks (1993); 27. Fragility (Rank 43): McGinnis & Corsi (1979); 28. Handling and packaging costs (Rank 43): Gilmour (1976); 29. Industrial clustering (Rank 43): Maier, Bergman & Lehner (2002); 30. Infrastructure availability (Rank 43): Cullinane & Toy (2000); 31. Intercept (Rank 43): Bolis & Maggi (2003); 32. Inventory (Rank 43): Cullinane & Toy (2000); 33. JIT delivery (Rank 43): Bolis & Maggi (2003); 34. JIT receipt (Rank 43): Bolis & Maggi (2003); 35. Joint rates (Rank 43): Burdg & Daley (1985); 36. Latent variables (Rank 43): Walker (2001); 37. Logistics synergy (Rank 43): INRETS* (2000); 38. Loyalty (Rank 43): Nir & Lin (2003); 39. Market considerations (Rank 43): McGinnis * (1989); 40. Neatness of vehicle operators (Rank 43): Evans Feldman & Foster (1990); 41. No of lifts during transit (Rank 43):

Gilmour (1976); 42. Operations Efficiency (Rank 43): Lai (2004); 43. Packaging needed (Rank 43): Gilmour (1976); 44. Perishability (Rank 43): McGinnis & Corsi (1979); 45. Physical facilities (Rank 43): Whyte (1993); 46. Port (Rank 43): Matear & Gray (1993); 47. Predictability of market demand (Rank 43): Gilmour (1976); 48. Preference for consolidation (Rank 43): Meyrick & D'Este (1989); 49. Preference given to shipper (Rank 43): Pearson (1980); 50. Previous experience (Rank 43): Cullinane & Toy (2000); 51. Product (Rank 43): Murphy & Daley (1997); 52. Product density (Rank 43): Gilmour (1976); 53. Product seasonality (Rank 43): Gilmour (1976); 54. Product value-to-weight ratio (Rank 43): Gilmour (1976); 55. Promotional material (Rank 43): Whyte (1993); 56. Relationship (Rank 43): Matear & Gray (1993); 57. Risk reduction (Rank 43): Lillie & Sparks (1993); 58. Sales calls (Rank 43): Evans, Feldman & Foster (1990); 59. Sales per year (Rank 43): Cullinane & Toy (2000); 60. Satifies customer (Rank 43): Burdg & Daley (1985); 61. Security of supply (Rank 43): Cunningham (1982); 62. Service Effectiveness for Consignees (Rank 43): Lai, Ngai & Cheng (2004); 63. Service Effectiveness for Shippers (Rank 43): Lai, Ngai & Cheng (2004); 64. Shelf life (Rank 43): Gilmour (1976); 65. Shipment to new market or customer (Rank 43): Gilmour (1976); 66. Shipper market considerations (Rank 43): Mangan, Lalwani & Gardner (2001); 67. Shipping unit (SKU) (Rank 43): Meyrick & D'Este (1989); 68. Special body required (Rank 43): Gilmour (1976); 69. Special storage facilities needed (Rank 43): Gilmour (1976); 70. Supply Chain Performance (Rank 43): Lai, Ngai & Cheng (2004); 71. Throughput (Rank 43): Tiwari, Itoh & Doi (2003); 72. Traffic load (Rank 43): Arnold, Peeters & Thomas (2004); 73. Urgency (Rank 43): Gilmour (1976); 74. Usage (Rank 43): Tiwari, Itoh & Doi (2003); 75. Use of Le Shuttle (Rank 43): Danielis & Rotaris (1999); 76. User Satisfaction (Rank 43): Bardi (1973); 77. Willingness to negotiate rates (Rank 43): Foster and Strasser (1990) and 78. Willingness to negotiate service (Rank 43): Foster and Strasser (1990).

Appendix 3

Academic journals reviewed to evaluate psychometric instruments

1. Academy of Management Journal - Briarcliff Manor; 2. Accounting Education - London; 3. Agribusiness - Hoboken; 4. American Journal of Small Business; 5. American Marketing Association; 6. Behavioral Research in Accounting - Sarasota; 7. British Journal of Management - Chichester; 8. Career Development International - Bradford; 9. Communications of the Association for Information Systems - Atlanta; 10. Darden Business Publishing Case Collection - Charlottesville; 11. Group & Organization Management - Thousand Oaks; 12. Group & Organization Studies - Beverly Hills; 13. Harvard Business Review - Boston; 14. Hospital & Health Services Administration; 15. HR. Human Resource Planning - New York; 16. Human Relations - New York; 17. Human Resource Development Quarterly - San Francisco; 18. Human Resource Management Journal - London; 19. IEEE Transactions on Professional Communication - New York; 20. Industrial and Commercial Training - Guilsborough; 21. Interfaces - Linthicum; 22. International Journal of Contemporary Hospitality Management - Bradford; 23. International Journal of Management Practice - Olney; 24. International Journal of Organizational Analysis - Bowling Green; 25. International Journal of Project Management - Kidlington; 26. International Journal of Research in Marketing - Amsterdam; 27. International Journal of Selection and Assessment - Oxford; 28. International Journal of Value - Based Management - New York; 29. Issues in Accounting Education - Sarasota; 30. Journal of Accounting Education - Harrisonburg; 31. Journal of Applied Psychology - Washington; 32. Journal of Business and Psychology - New York; 33. Journal of Business Ethics - Dordrecht; 34. Journal of Business Research - New York; 35. Journal of Business Venturing - New York; 36. Journal of Consumer Behaviour - London; 37. Journal of Counseling and Development; 38. Journal of Economic Psychology - Amsterdam; 39. Journal of Education for Business - Washington; 40. Journal of Employment Counseling - Alexandria; 41. Journal of European Industrial Training - Bradford; 42. Journal of General Management - Henley-on-Thames; 43. Journal of Leadership &

Organizational Studies - Flint; 44. Journal of Management Education - Thousand Oaks; 45. Journal of Management - New York; 46. Journal of Managerial Psychology - Bradford; 47. Journal of Occupational and Organizational Psychology - Leicester; 48. Journal of Organizational Behavior - Chichester; 49. Journal of Organizational Change Management - Bradford; 50. Journal of Personality and Social Psychology - Washington; 51. Journal of Professional Services Marketing; 52. Journal of Security Administration - Savannah; 53. Journal of Travel & Tourism Marketing - Binghamton; 54. Journal of Vocational Behavior - Orlando; 55. Journal of Workplace Learning - Bradford; 56. Leadership & Organization Development Journal - Bradford; 57. Leadership Quarterly - Greenwich; 58. Lounsbury - Robert P - Steel - James M. Loveland - Lucy W. Gibson. Journal of Youth and Adolescence. New York; 59. Management Accounting. Jan 1996; 60. Management Decision - London; 61. Matta - Khalil F - Computers & Industrial Engineering. New York; 62. Nursing Management - Chicago; 63. Organization Development Journal - Chesterland; 64. Organization - London; 65. Organizational Analysis; 66. Organizational Behavior and Human Decision Processes - New York; 67. Organizational Behavior and Human Performance; 68. Personnel Psychology - Durham; 69. Personnel Review - Farnborough; 70. Psychology & Marketing - New York; 71. Public Administration Quarterly - Randallstown; 72. Public Personnel Management - Washington; 73. Quality Progress - Milwaukee; 74. Research Technology Management - Arlington; 75. Review of Public Personnel Administration - Columbia; 76. Risk Analysis - Oxford; 77. Simulation & Gaming - Thousand Oaks; 78. Singapore Management Review - Singapore; 79. Social Indicators Research - Dordrecht; 80. The Academy of Management Executive; 81. The British Accounting Review - Kidlington; 82. The International Journal of Human Resource Management - London; 83. The Journal of Applied Behavioral Science - Arlington; 84. The Journal of Behavioral Finance - Mahwah; 85. The Journal of Business Communication - Urbana; 86. The Journal of Conflict Resolution - Beverly Hills; 87. The Journal of Management Development - Bradford; 88. The Journal of Management Studies - Oxford; 89. The Journal of Product and Brand Management - Santa Barbara; 90. The Journal of the Operational Research Society - Oxford; 91. Total Quality Management; 92. Training &

Management Development Methods – Bradford, and 93. Women in Management Review – Bradford.

Exploratory exercise to discover the salience of potential determinants of choice

Sample Pilot Questionnaire

Transportation Study - Pilot Questionnaire

Impact of various determinants of choice

Name: _____ Organisation: _____ Date: _____ Ref: PQ001

Question	Determinant of choice	Outcome	On company (1 = very negative impact, 5 = no impact, 10 = very positive impact) 1 2 3 4 5 6 7 8 9 10	Own image 1 2 3 4 5 6 7 8 9 10	On your customer 1 2 3 4 5 6 7 8 9 10
1	Back load potential	Back load possibilities	□□□□□□□□□□	□□□□□□□□□□	□□□□□□□□□□
2	Location	Based within 5 miles	□□□□□□□□□□	□□□□□□□□□□	□□□□□□□□□□
3	On-time pickup/delivery	Consistently on time	□□□□□□□□□□	□□□□□□□□□□	□□□□□□□□□□
4	Transit time reliability	Erratic/unpredictable	□□□□□□□□□□	□□□□□□□□□□	□□□□□□□□□□
5	Capability	Expertise/equipment	□□□□□□□□□□	□□□□□□□□□□	□□□□□□□□□□
6	Reputation	Good reputation	□□□□□□□□□□	□□□□□□□□□□	□□□□□□□□□□
7	Back load potential	High equipment costs	□□□□□□□□□□	□□□□□□□□□□	□□□□□□□□□□
8	Price	Higher price	□□□□□□□□□□	□□□□□□□□□□	□□□□□□□□□□
9	Customer service	Ignores complaints	□□□□□□□□□□	□□□□□□□□□□	□□□□□□□□□□
10	Flexibility	Inconsiderate of needs	□□□□□□□□□□	□□□□□□□□□□	□□□□□□□□□□
11	Supply chain performance	Integrates with SCM	□□□□□□□□□□	□□□□□□□□□□	□□□□□□□□□□
12	Shipment information	Internet tracing	□□□□□□□□□□	□□□□□□□□□□	□□□□□□□□□□
13	Capability	Lack facilities	□□□□□□□□□□	□□□□□□□□□□	□□□□□□□□□□
14	Short transit time	Longer transit time	□□□□□□□□□□	□□□□□□□□□□	□□□□□□□□□□
15	Price	Lower price	□□□□□□□□□□	□□□□□□□□□□	□□□□□□□□□□
16	Loss/damage record	No damage	□□□□□□□□□□	□□□□□□□□□□	□□□□□□□□□□
17	Supply chain performance	No data links etc	□□□□□□□□□□	□□□□□□□□□□	□□□□□□□□□□
18	Shipment information	No information	□□□□□□□□□□	□□□□□□□□□□	□□□□□□□□□□
19	Location	Over 5 miles away	□□□□□□□□□□	□□□□□□□□□□	□□□□□□□□□□
20	Reputation	Poor reputation	□□□□□□□□□□	□□□□□□□□□□	□□□□□□□□□□
21	Loss/damage record	Regular damage/loss	□□□□□□□□□□	□□□□□□□□□□	□□□□□□□□□□
22	Congestion/risk of delay	Reliable transit time	□□□□□□□□□□	□□□□□□□□□□	□□□□□□□□□□
23	Customer service	Responds to queries	□□□□□□□□□□	□□□□□□□□□□	□□□□□□□□□□
24	Flexibility	Short notice booking	□□□□□□□□□□	□□□□□□□□□□	□□□□□□□□□□
25	Short transit time	Shorter transit time	□□□□□□□□□□	□□□□□□□□□□	□□□□□□□□□□
26	Transit time reliability	Smooth/predictable	□□□□□□□□□□	□□□□□□□□□□	□□□□□□□□□□
27	Congestion/risk of delay	Unpredictable arrival	□□□□□□□□□□	□□□□□□□□□□	□□□□□□□□□□
28	On-time pickup/delivery	Unpredictable/late	□□□□□□□□□□	□□□□□□□□□□	□□□□□□□□□□
29	Reliability	Very reliable	□□□□□□□□□□	□□□□□□□□□□	□□□□□□□□□□
30	Reliability	Very unreliable	□□□□□□□□□□	□□□□□□□□□□	□□□□□□□□□□

Figure A4.1 – Salience questionnaire

A small exploratory exercise was carried out to evaluate the salience of potential determinants of choice in order to assist selection for using in the main study. The determinants were measured against three beneficiaries of utility gain or loss, namely the exporting firm, the receiving firm and the individual making the choice.

In this exploratory exercise, five people familiar with the transport industry (employees of shipping companies and exporters) were asked to determine the "salience" of the various determinants already identified as "important" in terms

of their occurrence in past studies. To facilitate the exercise the determinants were given both positive and negative descriptions and the group asked to rate the importance of each description under three headings, namely, "Impact on company", "Impact on own image" and "Impact on Customer". The question card is shown as Figure A4.1.

Although this preliminary assessment is fairly simple, it objectively identifies potentially salient determinants to be tested in the empirical part of the study.

Identification of potentially "salient" determinants of transportation choice

Potential determinant of choice	Positive (Assumed to define "chosen" carrier)	Negative (Assumed to define "unchosen" carrier)	Impact of on company		Impact of own image		Impact of on customer		Score	Rank
			+ve	-ve	+ve	-ve	+ve	-ve		
Congestion/risk of delay	Reliable transit time	Unpredictable arrival	5.5	7.5	5.0	10.0	5.5	10.0	44	1
Loss/damage record	No damage	Regular damage/loss	3.0	10.5	3.5	10.5	3.0	10.0	41	2
Supply chain performance	Integrates with SCM	No data links etc.	8.5	5.0	5.5	7.0	8.5	5.0	40	3
Flexibility	Short notice booking	Inconsiderate of needs	5.0	7.5	7.0	8.5	3.0	6.5	38	4
Shipment information	Internet tracing	No information	4.0	4.5	4.5	8.5	5.0	10.0	37	5
Capability	Expertise/equipment	Lack facilities	5.5	7.0	5.5	8.5	3.0	7.0	37	5
Location	Based within 5 miles	Over 5 miles away	2.0	10.5	5.0	5.0	5.5	8.5	37	5
Reliability	Very reliable	Very unreliable	2.5	8.5	2.0	10.0	2.5	10.0	36	8
On-time pickup/delivery	Consistently on time	Unpredictable/late	2.5	7.5	2.0	10.5	2.0	10.0	35	9
Transit time reliability	Smooth/predictable	Erratic/unpredictable	3.0	6.5	4.5	4.0	8.5	8.0	35	9
Customer service	Responds to queries	Ignores complaints	8.0	3.5	6.0	3.5	5.0	6.5	33	11
Back load potential	Back load possibilities	High equipment costs	5.0	10.5	10.5	0.5	3.0	3.0	33	11
Price	Lower price	Higher price	2.0	5.0	2.5	5.5	7.5	5.0	28	13
Reputation	Good reputation	Poor reputation	3.0	3.5	3.0	6.0	4.5	4.5	25	14
Short transit time	Shorter transit time	Longer transit time	2.0	2.5	5.0	5.0	2.5	2.5	20	15

Source: Author

Table A4.1 – Identification of potential salient determinants of choice

Table A4.1 shows the average scores of the group and the overall ranking of the inferred "salience". Some of the attributes are congruent with those identified as important in previous studies. It can be seen that in many cases the "negative case" is far more influential than the corresponding "positive case", especially where this concerns a negative impact on the decision-maker.

By examining the potential salience in this manner, the opportunity is created for other factors that have been identified in the literature review to be brought into consideration, namely reputation, through positive marketing, and the risk perception of congestion and delays through negative influences. The inclusion of supply chain performance reflects the growing importance of transport and logistics within the wider environment of business dynamics.

Appendix 5

Ethical Policy employed in this research

Based on Internet Research Guidelines

published by the Market Research Society

For further information and access to the full guidelines, please go to:

http://www.mrs.org.uk/standards/downloads/revised/active/internet_mar06.pdf

Introduction

This ethical policy is based on the MRS Code of Conduct (revised 2005) and provides the ethical framework under which this Internet based transportation survey has been carried out. Research is founded upon the willing co-operation of the public and of business organisations. It relies on the confidence of those involved that it is conducted honestly, objectively, without unwelcome intrusion and without harm to respondents. Its purpose is to collect and analyse information and not to create sales or to influence the opinions of anyone participating. Every respondent is assured that this research project is carried out in strict compliance with this Ethical Policy and that the rights and privacy of individuals taking part are fully respected.

Where a particular issue is addressed in this study (e.g. the Privacy Statement) the wording used is shown in this text as "*bold italic*".

Section 1: Conducting the research

A **Respondents' cooperation is voluntary**

1. The anonymity of Respondents will be preserved unless they have given their informed consent for their details to be revealed or for attributable comments to be passed on.

    Comment: We will be particularly careful if sample sizes are very small (as in the UK to Russia trade) that we will not inadvertently identify participating organisations, departments or individuals.

2. We will delete any responses given by the Respondent, if requested, and if this is reasonable and practicable.

B **Respondents will not be inconvenienced**

1. We will act honestly in dealings with Respondents, Clients (actual or potential), employers, employees, sub-contractors and the general public.

2. We will take reasonable steps to ensure all of the following:
   - that questions are fit for purpose;
   - that the design and content of questionnaires are appropriate for the
   - audience being researched;
   - that Respondents are able to answer the questions in a way that reflects the
   - view they want to express;
   - that Respondents are not led towards a particular answer;
   - that answers are not capable of being interpreted in an unambiguous way;
   - that personal data collected is relevant, not excessive and will be protected.

3. Respondents will not be misled when being asked to participate in the research project.

4 A Respondent's right to withdraw from a research project at any stage will be respected.

5. We will ensure that Respondents are able to check without difficulty our identity and bona fides, and of any individual working with us to conduct the study (including any university staff or lecturers).

6. We will ensure that all of the following are clearly communicated to Respondents:
   - the name of the person conducting the interview or piece of research (an Identity Card will be shown if face to face);
   - an assurance that the interview will be carried out according to this Ethical Policy
   - the general subject of the interview;
   - the purpose of the interview;
   - if asked, the likely length of the interview;
   - any costs likely to be incurred by the Respondent.

C. Respondents should give their informed consent

1. The research will conform to all national and international legislation relevant to the project including in particular the Data Protection Act 1998 or other comparable legislation applicable outside the UK.

2. We will act honestly in dealings with Respondents, employers, other organisations, sub-contractors and the general public.

3. Follow up interviews will only be carried out if the Respondent's permission has been obtained at the previous interview. The only exception to this is re-contact for quality control purposes.

4. Any re-contact will match the assurances given to Respondents at the time that permission was gained.

Section 2: Treatment of data

A. All respondents' anonymity will be safeguarded

1. Respondent details will not be passed on to another third party for research or any other purposes without the prior consent of the Respondent.

2. We will not knowingly make use of personal data collected illegally.

3. If Respondents have given consent for data to be passed on in a form which allows them to be personally identified, we will:
   demonstrate that they have taken all reasonable steps to ensure that it will only be used for the purpose for which it was collected and
   fully inform Respondents as to what will be revealed, to whom and for what purpose.

B. Safeguarding data

The research will conform to the national and international legislation relevant to a given project including in particular the Data Protection Act 1998 or other comparable legislation applicable outside the UK.

We will take reasonable steps to ensure that all hard copy and electronic lists containing personal data are held securely in accordance with the relevant data retention policies and/or contractual obligations.

We will take reasonable steps to ensure that all parties involved in the research are aware of their obligations regarding security of data.

We will take reasonable steps to ensure that the destruction of data is adequate for the confidentiality of the data being destroyed. For example, any personal data will be destroyed in a manner which safeguards confidentiality.

We will take steps to protect adequately any personal data collected or stored on Websites or servers. Especially sensitive or valuable information will be protected by reliable encryption techniques. If temporary storage of the personal data collected takes place on a server that is operated by a provider, we will place the provider under the obligation to take the necessary precautions to ensure that third parties cannot access the data on the server or during data transfer. As far as we know, this will not arise but, if it does, any temporary storage of the collected data on the server will be terminated at the earliest possible time.

In accordance with the Data Protection Act 1998, we have adequate safeguards in place, to ensure that when emails are sent in batches the email addresses of the respondents are not revealed to other respondents.

C. Findings

Users and the general public will not be misled about the reliability and validity of internet research findings. We will:
- follow sound sampling methods consistent with the purpose of the research and current technology.
- provide a clear definition of the sample universe used in a given research project, the research approach adopted, the number of responses achieved and the analysis methods wherever possible.
- We will provide appropriate reservations about the possible lack of projectability or other limitations of the research findings, for instance, resulting from non-response and other factors.

D. Privacy Policy Statements

1. In accordance with the MRS guidelines, we have developed a Privacy Policy. The Private Policy statement is made available on the research Web site (www.p5ec.com). For the purpose of auditing, a synopsis of the MRS guidelines is reproduced below together with our Privacy Policy (in italics):

2. Standard elements for privacy statements:
   - Statement of who is doing the research - This could include a hyperlink to the researcher's home page for more information.

     "This research is carried out by Peter Cave as part of a doctoral thesis under the supervision of Cardiff University, Business School (CARBS)."

   - Who is it for? - Explanation that each research project will contain information about the identity of the client, unless there are good reasons for not providing this information.

     "The research is non-funded and there is no commercial client. The information gathered as part of the research will not be used for commercial gain. The thesis, when it is completed, as with other academic research, will be made available in the public domain."

   - A guarantee that in all circumstances identities of individual respondents and their answers will be treated as confidential and will be used only for research purposes unless the respondent expressly requests or permits disclosure to a third party for other purposes.

     "The findings of the research will be aggregated and the identities of respondent, individuals or organisations, will be protected."

   - A statement offering assurance the researcher will not mislead the respondent.

*"The purpose of the research is to explore a possible
correlation between respondent typologies and their decision-
making preferences in the context of modal choice."*

- Co-operation is Voluntary – As with all forms of research, co-operation is
voluntary at all times.
   *"Participation in the study is completely voluntary.
   Respondents are expected to participate of their own free will
   based on a fully informed basis.*

- No personal information is sought from, or about, the respondents without
their prior knowledge and agreement.
   *"We are not interested in Respondents' personal details, except
   for the purpose of validation and communication. All personal
   data collected as part of the survey will be destroyed once the
   survey and findings have been published."*

- Withdrawal – The respondent is entitled to withdraw at any stage of the
research, or subsequently, and to ask that part or all of the record of the
research attributable to him/her is destroyed or deleted.
   *"Any respondent may withdraw from the study at any stage of
   the research, or subsequently, and all record of their
   participation in the research will be deleted."*

- Cookies & invisible processing – In accordance with the Privacy and
Electronic Communications Regulations, cookies or similar devices shall not
be used unless the subscriber or user of the relevant terminal equipment is:
   a. provided with clear and comprehensive information about the purpose
      of the storage of, or access to, that information; and
   b. given the opportunity to refuse the storage of, or access to, that
      information.
   *"In accordance with the Privacy and Electronic
   Communications Regulations, we will not make use of any
   cookies or similar devices."*

Peter Cave

Student responsible for the p5ec Transportation Study

and the web site (www.p5ec.co.uk)
Cardiff University

Appendix 6

Privacy Statement

Transportation Study

(p5ec)

This research is carried out by Peter Cave as part of a doctoral thesis
under the supervision of Cardiff University, Business School
(CARBS).

The research is non-funded and there is no commercial client. The
information gathered as part of the research will not be used for
commercial gain. The thesis, when it is completed, as with other
academic research, will be made available in the public domain.

The findings of the research will be aggregated and the identities of
respondent, individuals or organisations, will be protected.

Participation in the study is completely voluntary. Respondents are
expected to participate of their own free will, on a fully informed
basis.

We are not interested in Respondents' personal details, except for the
purpose of validation and communication. All personal data
collected as part of the survey will be destroyed once the survey
and findings have been published.

Any respondent may withdraw from the study at any stage of the
research, or subsequently, and all record of their participation in
the research will be deleted.

In accordance with the Privacy and Electronic Communications
Regulations, we will not make use of any cookies or similar
devices."

Peter Cave

Student responsible for the p5ec Transportation Study and the Web site
(www.p5ec.co.uk)
Cardiff University

Appendix 7

Questionnaire
Appendix 7.1

Questionnaire (Screenshot – Section 1)

Freight Transportation Survey

If you experience any problems, either with the web site or completing the questionnaire, please phone the
Freight Transportation Survey Help Desk on
020 7691 7348
(or phone me direct on 07932 164119)

You can save this spreadsheet at any time (use another file name) and return to it at a later time or date.

Section 1 - Transportation Decision

1.1 Select the answer that best describes who or what in your organisation initiates transportation reviews:

- You?
- Your boss?
- A transport team or similar group or committee?
- Another department such as sales and marketing?
- Corporate policy for cost reduction or periodic review?

1.2 If transport decisions are taken by a transport team or similar group or committee, do you chair the meeting or otherwise
have the power or authority to materially influence that forum?

- Yes
- No
- Not applicable (this option applies if you have not selected "A transport
  team or other group or committee" in 1.1 above)

1.3 What is generally the trigger for a transportation review (by definition there can only be one trigger):

- Deterioration in KPIs (Key Performance Indicators)?
- Corporate cost review?
- Complaints about performance from another department?
- Complaints about performance from your customers?
- Changes in product type?
- Changes in technology?
- Your desire to improve price/performance?
- Your dissatisfaction with aspects of the service?

1.4 Are the KPIs or other formal performance measures implemented by:

- You?
- Somebody else (Your boss, transport team, other department or senior
  management directive etc.)?
- Not applicable (this option applies if you have not selected "Deterioration
  in KPIs" in 1.3 above)

Appendix 7.2

Questionnaire (Screenshot – Section 2)

Section 2 - Existing Transport Arrangements

The questions in Section 2 all relate to each other. Their is a logical connection between the total number of separate shipments in question 2.1 and the number of different sea carriers, road carriers and rail carriers classified in 2.2, 2.2 and 2.3. How

Select a trade route (UK to Russia if possible but otherwise) UK to....   RUSSIA   (Country)

2.1 How many separate international surface transport* shipments (containers/trucks/consignments etc.) has your company made to that country in the last year?

- One?   ○
- More than one?   ○
- More than five?   ○
- More than ten?   ○
- More than twenty?   ○
- More than fifty?   ◉

* This study is concerned with surface freight transport modes, i.e. sea freight ("Sea"), road freight ("Road") and rail freight ("Rail"), not air freight.

2.2 How many different SEA carriers has your company used to that country in the last twelve months?

- None?   ○
- One?   ○
- More than one?   ◉

2.3 How many different ROAD carriers has your company used to that country in the last twelve months?

- None?   ○
- One?   ○
- More than one?   ◉

2.4 How many different RAIL carriers has your company used to that country in the last twelve months?

- None?   ○
- One?   ◉
- More than one?   ○

Appendix 7.3

Questionnaire (Screenshot – Section 3 – Questions 3.1 and 3.2)

Section 3 - Information Gathering

3.1 How do you go about gathering INTERNAL information to inform decision-making?

For the purpose of this question, informal information gathering refers, for example, to PODs (Proofs of Delivery) that are not rigorously enforced and monitored, and memos from other departments that are not supported by statistics or KPIs. Formal infor

Tick as many of the boxes that apply.	Informal	Formal
- On time pick up/delivery performance	☐	☑
- Analysis of customer complaints	☐	☑
- Review of claims and loss experience	☐	☐
- Shipment tracing review	☐	☑
- Transportation costs studies or audits	☐	☑
- Last experience of mode	☐	
- Own experience or advice from others	☐	

3.2 How do you go about gathering EXTERNAL information to inform decision-making?

For the purpose of this question, informal information gathering implies, for example, scanning (reading) texts, whilst formal methods typically extract and analyse quantitative data.

Tick as many of the boxes that apply.	Informal	Formal
- Tenders, proposals and quotations	☐	☑
- Market research	☑	☐
- Academic journals	☑	☐
- Trade journals	☑	☐
- Tariff bureaux	☑	☐
- Trade directories	☑	☐
- Trade associations	☑	☐
- Media/trade press	☑	☐
- Internet (web sites)	☑	☐
- Carrier marketing (brochures etc.)	☐	
- Other users of the mode/carrier	☐	
- General reading	☐	

Appendix 7.4

Questionnaire (Screenshot – Section 3 – Question 3.3)

3.3 Which search strategy best describes your information gathering when making a transportation decision?

- Review all information across feasible alternatives ○
- Review all information across suitable alternatives ●
- Review all information across limited alternatives ○
- Review some information across feasible alternatives ○
- Review some information across suitable alternatives ○
- Review some information across limited alternatives ○
- Review relevant information across feasible alternatives ○
- Review relevant information across suitable alternatives ○
- Review relevant information across limited alternatives ○

Appendix 7.5

Questionnaire (Screenshot – Section 4)

Section 4 - Change Management

4.1 Have your changed your freight transportation arrangements in the last twelve months?

- No, same carrier	○
- No, same carriers (more or less)	○
- Yes, same carrier but different terms (renegotiated price/service etc.)	◉
- Yes, same carriers but different terms (renegotiated price/service etc.)	○
- Yes, same mode but different carrier	○
- Yes, same mode but different carriers	○
- Yes, different mode	○

4.2 Have you made changes to the mode or carrier since assuming responsibility or have you just left alone?

- Same carrier - inherited	○
- Same carriers - inherited	◉
- Same mode - inherited (different carrier)	○
- Same mode - inherited (different carriers)	○
- Different mode and carrier	○
- Different mode and carriers	○

Appendix 7.6

Questionnaire (Screenshot – Section 1)

Section 5 - Determinants of Choice

5.1 Determinants of Dissatisfaction

The last time that you changed your transport arrangements, what aspect (rank 1 for worst) or aspects (rank 1 for worst to 3 for least worst) were you MOST DISSATISFIED with regarding the previous carrier/mode? Rank

Rank up to three aspects you were most dissatisfied with - 1 2 3

	1 Worst	2	3 Least worst
- Overall cost	◉	○	○
- On time pick up/delivery	○	○	○
- Loss/damage record	○	○	○
- Transit time reliability	○	◉	○
- Claims response	○	○	○
- Shipment information	○	○	○
- Overall transit time	○	○	◉
- Flexibility (ability to change pick up times/days etc.)	○	○	○
- Other (please specify)	○	○	○

Appendix 7.7

Questionnaire (Screenshot – Section 5 – Question 5.2 - ASP)

Transportation Survey - Determinants of Choice - Answer all 12 Choices

Which would you prefer?   Enter '1' or '2' in the box to the right

Simply make your choices here (1 or 2)

	Option 1	Option 2	
Choice 1	More flexibility	Better on time pick up/delivery	1
Choice 2	Better loss/damage record	Better shipment information	2
Choice 3	Faster claims response	Lower overall cost	1
Choice 4	Shorter transit time	More reliable transit time	

When you fill in the first box, the next box will appear here, and so on ...

It is important that the boxes are completed in sequence

When you have filled in all 12 boxes, an eight letter code will appear here. This will be copied automatically to the Results box at 5.2 on the Questionnaire.

ANALYSIS OF SECTION 5.2

Transportation Survey - Determinants of Choice - Answer all 12 Choices

Which would you prefer?   Enter '1' or '2' in the box to the right

Simply make your choices here (1 or 2)

	Option 1	Option 2	
Choice 1	More flexibility	Better on time pick up/delivery	1
Choice 2	Better loss/damage record	Better shipment information	2
Choice 3	Faster claims response	Lower overall cost	1
Choice 4	Shorter transit time	More reliable transit time	2
Choice 5	More flexibility	Better shipment information	1
Choice 6	Faster claims response	More reliable transit time	2
Choice 7	More flexibility	More reliable transit time	1
Choice 8	Better on time pick up/delivery	Better loss/damage record	2
Choice 9	Lower overall cost	Shorter transit time	1
Choice 10	Better loss/damage record	Lower overall cost	1
Choice 11	Better shipment information	Faster claims response	1
Choice 12	Better on time pick up/delivery	Shorter transit time	1

When you fill in the first box, the next box will appear here, and so on ...

It is important that the boxes are completed in sequence

NOW COMPLETE TABLE 2 - SERVICECHOICE

When you have filled in all 12 boxes, an eight letter code will appear here. This will be copied automatically to the Results box at 5.2 on the Questionnaire.

ANALYSIS OF SECTION 5.2   AHDECFBG

Appendix 7.8

Questionnaire (Screenshot – Section 6 – Question 6.1 – Choices 1 - 4)

Transportation Survey - Service Choice - Choice 1

Description	UK to Moscow	UK to Moscow
Cost per tonne	£49.14	£53.42
Transit time (days)	10.5	12.0
Reliability +/- 1 day	55%	40%
Reliability +/- 2 days	38%	55%
Reliability +/- 4 days	8%	5%
Fixed departure - time	No	No
Fixed departure - date	Yes	Yes
Fixed arrival - time	No	No
Fixed arrival - date	Yes	Yes
Frequency (days)	2	7
Lifts in transit	3	3
	Option 1	Option 2

Choose option 1 or 2 (type 1 or 2) for Choice 1   `1`

> Fill in your first choice here.... then scroll down to make your next choice.

Transportation Survey - Service Choice - Choice 2

Description	UK to Moscow	UK to Moscow
Cost per tonne	£42.73	£43.80
Transit time (days)	9.0	9.5
Reliability +/- 1 day	70%	83%
Reliability +/- 2 days	20%	12%
Reliability +/- 4 days	10%	6%
Fixed departure - time	No	Half
Fixed departure - date	Yes	Yes
Fixed arrival - time	No	No
Fixed arrival - date	Yes	Yes
Frequency (days)	7	1
Lifts in transit	2	1

Choose option 1 or 2 (type 1 or 2) for Choice 2   `2`

> Make your next choice here and then scroll down and so on.... There are twelve choices. When you have made all 12 choices an eight letter code will appear in the box at the bottom.

Transportation Survey - Service Choice - Choice 3

Description	UK to Moscow	UK to Moscow
Cost per tonne	£44.87	£59.35
Transit time (days)	9.0	10.0
Reliability +/- 1 day	70%	95%
Reliability +/- 2 days	20%	3%
Reliability +/- 4 days	10%	2%
Fixed departure - time	No	Yes
Fixed departure - date	Yes	Yes
Fixed arrival - time	No	No
Fixed arrival - date	Yes	Yes
Frequency (days)	2	1
Lifts in transit	2	0

Choose option 1 or 2 (type 1 or 2) for Choice 3   `2`

Transportation Survey - Service Choice - Choice 4

Description	UK to Moscow	UK to Moscow
Cost per tonne	£57.87	£62.32
Transit time (days)	11.0	10.0
Reliability +/- 1 day	68%	95%
Reliability +/- 2 days	29%	3%
Reliability +/- 4 days	3%	2%
Fixed departure - time	Half	Yes
Fixed departure - date	Yes	Yes
Fixed arrival - time	No	No
Fixed arrival - date	Yes	Yes
Frequency (days)	1	1
Lifts in transit	2	0

Choose option 1 or 2 (type 1 or 2) for Choice 4   `2`

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Appendix 7.9

Questionnaire (Screenshot – Section 6 – Question 6.1 – Choices 1 - 4)

Transportation Survey - Service Choice - Choice 1

Description	UK to Moscow	UK to Moscow
Cost per tonne	£49.14	£53.42
Transit time (days)	10.5	12.0
Reliability +/- 1 day	55%	40%
Reliability +/- 2 days	38%	55%
Reliability +/- 4 days	8%	5%
Fixed departure - time	No	No
Fixed departure - date	Yes	Yes
Fixed arrival - time	No	No
Fixed arrival - date	Yes	Yes
Frequency (days)	2	7
Lifts in transit	3	3
	Option 1	Option 2

Choose option 1 or 2 (type 1 or 2) for Choice 1   [1]

Fill in your first choice here... then scroll down to make your next choice.

Transportation Survey - Service Choice - Choice 2

Description	UK to Moscow	UK to Moscow
Cost per tonne	£42.73	£43.80
Transit time (days)	9.0	9.5
Reliability +/- 1 day	70%	83%
Reliability +/- 2 days	20%	12%
Reliability +/- 4 days	10%	6%
Fixed departure - time	No	Half
Fixed departure - date	Yes	Yes
Fixed arrival - time	No	No
Fixed arrival - date	Yes	Yes
Frequency (days)	7	1
Lifts in transit	2	1

Choose option 1 or 2 (type 1 or 2) for Choice 2   [2]

Make your next choice here and then scroll down and so on. There are twelve choices. When you have made all 12 choices an eight letter code will appear in the box at the bottom.

Transportation Survey - Service Choice - Choice 3

Description	UK to Moscow	UK to Moscow
Cost per tonne	£44.87	£59.35
Transit time (days)	9.0	10.0
Reliability +/- 1 day	70%	95%
Reliability +/- 2 days	20%	3%
Reliability +/- 4 days	10%	2%
Fixed departure - time	No	Yes
Fixed departure - date	Yes	Yes
Fixed arrival - time	No	No
Fixed arrival - date	Yes	Yes
Frequency (days)	2	1
Lifts in transit	2	0

Choose option 1 or 2 (type 1 or 2) for Choice 3   [2]

Transportation Survey - Service Choice - Choice 4

Description	UK to Moscow	UK to Moscow
Cost per tonne	£57.87	£62.32
Transit time (days)	11.0	10.0
Reliability +/- 1 day	68%	95%
Reliability +/- 2 days	29%	3%
Reliability +/- 4 days	3%	2%
Fixed departure - time	Half	Yes
Fixed departure - date	Yes	Yes
Fixed arrival - time	No	No
Fixed arrival - date	Yes	Yes
Frequency (days)	1	1
Lifts in transit	2	0

Choose option 1 or 2 (type 1 or 2) for Choice 4   [2]

Appendix 7.10

Questionnaire (Screenshot – Section 6 – Question 6.1 – Choices 5 - 8)

Transportation Survey - Service Choice - Choice 5

Description	UK to Moscow	UK to Moscow
Cost per tonne	£49.14	£43.80
Transit time (days)	10.5	9.5
Reliability +/- 1 day	55%	83%
Reliability +/- 2 days	38%	12%
Reliability +/- 4 days	8%	6%
Fixed departure - time	No	Half
Fixed departure - date	Yes	Yes
Fixed arrival - time	No	No
Fixed arrival - date	Yes	Yes
Frequency (days)	2	1
Lifts in transit	3	1

Choose option 1 or 2 (type 1 or 2) for Choice 5   1

Transportation Survey - Service Choice - Choice 6

Description	UK to Moscow	UK to Moscow
Cost per tonne	£59.35	£62.32
Transit time (days)	10.0	10.0
Reliability +/- 1 day	95%	95%
Reliability +/- 2 days	3%	3%
Reliability +/- 4 days	2%	2%
Fixed departure - time	Yes	Yes
Fixed departure - date	Yes	Yes
Fixed arrival - time	No	No
Fixed arrival - date	Yes	Yes
Frequency (days)	1	1
Lifts in transit	0	0

Choose option 1 or 2 (type 1 or 2) for Choice 6   1

Transportation Survey - Service Choice - Choice 7

Description	UK to Moscow	UK to Moscow
Cost per tonne	£49.14	£59.35
Transit time (days)	10.5	10.0
Reliability +/- 1 day	55%	95%
Reliability +/- 2 days	38%	3%
Reliability +/- 4 days	8%	2%
Fixed departure - time	No	Yes
Fixed departure - date	Yes	Yes
Fixed arrival - time	No	No
Fixed arrival - date	Yes	Yes
Frequency (days)	2	1
Lifts in transit	3	0

Choose option 1 or 2 (type 1 or 2) for Choice 7   1

Transportation Survey - Service Choice - Choice 8

Description	UK to Moscow	UK to Moscow
Cost per tonne	£53.42	£42.73
Transit time (days)	12.0	9.0
Reliability +/- 1 day	40%	70%
Reliability +/- 2 days	55%	20%
Reliability +/- 4 days	5%	10%
Fixed departure - time	No	No
Fixed departure - date	Yes	Yes
Fixed arrival - time	No	No
Fixed arrival - date	Yes	Yes
Frequency (days)	7	7
Lifts in transit	3	2

Choose option 1 or 2 (type 1 or 2) for Choice 8   2

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Appendix 7.11

Questionnaire (Screenshot – Section 6 – Question 6.1 – Choices 12 - 12)

Transportation Survey - Service Choice - **Choice 9**

Description	UK to Moscow	UK to Moscow
Cost per tonne	£44.87	£57.87
Transit time (days)	9.0	11.0
Reliability +/- 1 day	70%	68%
Reliability +/- 2 days	20%	29%
Reliability +/- 4 days	10%	3%
Fixed departure - time	No	Half
Fixed departure - date	Yes	Yes
Fixed arrival - time	No	No
Fixed arrival - date	Yes	Yes
Frequency (days)	2	1
Lifts in transit	2	2

Choose option 1 or 2 (type 1 or 2) for Choice 9   `1`

Transportation Survey - Service Choice - **Choice 10**

Description	UK to Moscow	UK to Moscow
Cost per tonne	£42.73	£44.87
Transit time (days)	9.0	9.0
Reliability +/- 1 day	70%	70%
Reliability +/- 2 days	20%	20%
Reliability +/- 4 days	10%	10%
Fixed departure - time	No	No
Fixed departure - date	Yes	Yes
Fixed arrival - time	No	No
Fixed arrival - date	Yes	Yes
Frequency (days)	7	2
Lifts in transit	2	2

Choose option 1 or 2 (type 1 or 2) for Choice 10   `1`

Transportation Survey - Service Choice - **Choice 11**

Description	UK to Moscow	UK to Moscow
Cost per tonne	£43.80	£62.32
Transit time (days)	9.5	10.0
Reliability +/- 1 day	83%	95%
Reliability +/- 2 days	12%	3%
Reliability +/- 4 days	6%	2%
Fixed departure - time	Half	Yes
Fixed departure - date	Yes	Yes
Fixed arrival - time	No	No
Fixed arrival - date	Yes	Yes
Frequency (days)	1	1
Lifts in transit	1	0

Choose option 1 or 2 (type 1 or 2) for Choice 11   `1`

Transportation Survey - Service Choice - **Choice 12**

Description	UK to Moscow	UK to Moscow
Cost per tonne	£53.42	£57.87
Transit time (days)	12.0	11.0
Reliability +/- 1 day	40%	68%
Reliability +/- 2 days	55%	29%
Reliability +/- 4 days	5%	3%
Fixed departure - time	No	Half
Fixed departure - date	Yes	Yes
Fixed arrival - time	No	No
Fixed arrival - date	Yes	Yes
Frequency (days)	7	1
Lifts in transit	3	2

Choose option 1 or 2 (type 1 or 2) for Choice 12   `1`

Appendix 7.12

Questionnaire (Screenshot – Section 6 – Question 6.1 – Result)

Transportation Survey - Service Choice - Choice 12

Description	UK to Moscow	UK to Moscow
Cost per tonne	£53.42	£57.87
Transit time (days)	12.0	11.0
Reliability +/- 1 day	40%	68%
Reliability +/- 2 days	55%	29%
Reliability +/- 4 days	5%	3%
Fixed departure - time	No	Half
Fixed departure - date	Yes	Yes
Fixed arrival - time	No	No
Fixed arrival - date	Yes	Yes
Frequency (days)	7	1
Lifts in transit	3	2

Choose option 1 or 2 (type 1 or 2) for Choice 12 ☐

When you have made all twelve service choices an eight letter code will appear here. This sequence will be copied automatically to the Results box at 6.1 on the Questionnaire.

'Choices boxes' 1 - 12 must be either '1' or '2'

ANALYSIS OF SECTION 6.1 [ ]

Transportation Survey - Service Choice - Choice 12

Description	UK to Moscow	UK to Moscow
Cost per tonne	£53.42	£57.87
Transit time (days)	12.0	11.0
Reliability +/- 1 day	40%	68%
Reliability +/- 2 days	55%	29%
Reliability +/- 4 days	5%	3%
Fixed departure - time	No	Half
Fixed departure - date	Yes	Yes
Fixed arrival - time	No	No
Fixed arrival - date	Yes	Yes
Frequency (days)	7	1
Lifts in transit	3	2

Choose option 1 or 2 (type 1 or 2) for Choice 12 [1]

NOW COMPLETE
TABLE 3 - ROUTE CHOICE

When you have made all twelve service choices an eight letter code will appear here. This sequence will be copied automatically to the Results box at 6.1 on the Questionnaire.

ANALYSIS OF SECTION 6.1 [AFDHCEBG]

Appendix 7.13

Questionnaire (Screenshot – Section 6 – Question 6.2 – Choices 1 - 4)

Transportation Survey - Route Choice - Choice 1

Mode	Road	Rail
Description	One nominated road carrier	Rail service
Route	Channel Tunnel/ferry through Poland to Russia - Moscow	Channel Tunnel/ferry through Poland with rail gauge transhipment at Brest, then to Moscow
Cost per tonne	£59.35	£53.42
Transit time (days)	10.0	12.0
Reliability +/- 1 day	95%	40%
Reliability +/- 2 days	3%	55%
Reliability +/- 4 days	2%	5%
Fixed departure - time	Yes	No
Fixed departure - date	Yes	Yes
Fixed arrival - time	Yes	No
Fixed arrival - date	Yes	Yes
Frequency (days)	1	7
Lifts in transit	0	3
	Option 1	Option 2

Choose option 1 or 2 (type 1 or 2) for Choice 1   `2`

Transportation Survey - Route Choice - Choice 2

Mode	Sea	MB Road
Description	One nominated sea carrier	Several suitable road carriers
Route	Shipment by sea from a UK port to St Petersburg then delivery by road/rail to Moscow	Channel Tunnel/ferry through Poland to Russia - Moscow
Cost per tonne	£42.73	£62.32
Transit time (days)	9.0	10.0
Reliability +/- 1 day	70%	95%
Reliability +/- 2 days	20%	3%
Reliability +/- 4 days	10%	2%
Fixed departure - time	No	Yes
Fixed departure - date	Yes	Yes
Fixed arrival - time	Yes	No
Fixed arrival - date	Yes	Yes
Frequency (days)	7	1
Lifts in transit	2	0

Choose option 1 or 2 (type 1 or 2) for Choice 2   `1`

Transportation Survey - Route Choice - Choice 3

Mode	MB Sea	MB Road/Sea
Description	Several suitable sea carriers	Mixture of road and sea carriers
Route	Shipment by sea from a UK port to a BalticSea port then delivery by road/rail to Moscow	Either by road via Channel Tunnel/ferry or by sea via a Baltic Sea port to Moscow
Cost per tonne	£44.87	£43.80
Transit time (days)	9.0	9.5
Reliability +/- 1 day	70%	83%
Reliability +/- 2 days	20%	12%
Reliability +/- 4 days	10%	6%
Fixed departure - time	No	Half
Fixed departure - date	Yes	Yes
Fixed arrival - time	Yes	No
Fixed arrival - date	Yes	Yes
Frequency (days)	2	1
Lifts in transit	2	1

Choose option 1 or 2 (type 1 or 2) for Choice 3   `2`

Transportation Survey - Route Choice - Choice 4

Mode	MB Road/Rail	MB Sea/Rail
Description	Mixture of road carriers and rail services	Mixture of sea carriers and rail services
Route	Either by road via Channel Tunnel/ferry or by rail with rail gauge transhipment at Brest then to Moscow	Either by sea via UK port and Baltic Sea port or by rail with rail gauge transhipment at Brest
Cost per tonne	£57.87	£49.14
Transit time (days)	11.0	10.5
Reliability +/- 1 day	68%	55%
Reliability +/- 2 days	29%	38%
Reliability +/- 4 days	3%	8%
Fixed departure - time	Half	No
Fixed departure - date	Yes	Yes
Fixed arrival - time	Yes	No
Fixed arrival - date	Yes	Yes
Frequency (days)	1	2
Lifts in transit	2	3

Choose option 1 or 2 (type 1 or 2) for Choice 4   `2`

Questionnaire (Screenshot – Section 6 – Question 6.2 – Choices 5 - 8)

Transportation Survey - Route Choice - Choice 5

Mode	Rail	Sea
Description	Rail service	One nominated sea carrier
Route	Channel Tunnel/ferry through Poland with rail gauge transhipment at Brest, then to Moscow	Shipment by sea from a UK port to St Petersburg then delivery by road/rail to Moscow
Cost per tonne	£53.42	£42.73
Transit time (days)	12.0	9.0
Reliability +/- 1 day	40%	70%
Reliability +/- 2 days	55%	20%
Reliability +/- 4 days	5%	10%
Fixed departure - time	No	No
Fixed departure - date	Yes	Yes
Fixed arrival - time	Yes	No
Fixed arrival - date	Yes	Yes
Frequency (days)	7	7
Lifts in transit	3	2

Choose option 1 or 2 (type 1 or 2) for Choice 5   2

Transportation Survey - Route Choice - Choice 6

Mode	MB Road/Sea	MB Sea/Rail
Description	Mixture of road and sea carriers	Mixture of sea carriers and rail services
Route	Either by road via Channel Tunnel/ferry or by sea via a Baltic Sea port to Moscow	Either by sea via UK port and Baltic Sea or by rail with rail gauge transhipment at Brest
Cost per tonne	£43.80	£49.14
Transit time (days)	9.5	10.5
Reliability +/- 1 day	83%	55%
Reliability +/- 2 days	12%	38%
Reliability +/- 4 days	6%	8%
Fixed departure - time	Half	No
Fixed departure - date	Yes	Yes
Fixed arrival - time	Yes	No
Fixed arrival - date	Yes	Yes
Frequency (days)	1	2
Lifts in transit	1	3

Choose option 1 or 2 (type 1 or 2) for Choice 6   1

Transportation Survey - Route Choice - Choice 7

Mode	Sea	MB Road/Sea
Description	One nominated sea carrier	Mixture of road and sea carriers
Route	Shipment by sea from a UK port to St Petersburg then delivery by road/rail to Moscow	Either by road via Channel Tunnel/ferry or by sea via a Baltic Sea port to Moscow
Cost per tonne	£42.73	£43.80
Transit time (days)	9.0	9.5
Reliability +/- 1 day	70%	83%
Reliability +/- 2 days	20%	12%
Reliability +/- 4 days	10%	6%
Fixed departure - time	No	Half
Fixed departure - date	Yes	Yes
Fixed arrival - time	Yes	No
Fixed arrival - date	Yes	Yes
Frequency (days)	7	1
Lifts in transit	2	1

Choose option 1 or 2 (type 1 or 2) for Choice 7   1

Transportation Survey - Route Choice - Choice 8

Mode	Road	MB Road
Description	One nominated road carrier	Several suitable road carriers
Route	Channel Tunnel/ferry through Poland to Russia - Moscow	Channel Tunnel/ferry through Poland to Russia - Moscow
Cost per tonne	£59.35	£62.32
Transit time (days)	10.0	10.0
Reliability +/- 1 day	95%	95%
Reliability +/- 2 days	3%	3%
Reliability +/- 4 days	2%	2%
Fixed departure - time	Yes	Yes
Fixed departure - date	Yes	Yes
Fixed arrival - time	Yes	No
Fixed arrival - date	Yes	Yes
Frequency (days)	1	1
Lifts in transit	0	0

Choose option 1 or 2 (type 1 or 2) for Choice 8   1

Questionnaire (Screenshot – Section 6 – Question 6.2 – Choices 12 - 12)

Transportation Survey - Route Choice - Choice 9

Mode	MB Sea	MB Road/Rail
Description	Several suitable sea carriers	Mixture of road carriers and rail services
Route	Shipment by sea from a UK port to a BalticSea port then delivery by road/rail to Moscow	Either by road via Channel Tunnel/ferry or by rail with rail gauge transhipment at Brest, then to Moscow
Cost per tonne	£44.87	£57.87
Transit time (days)	9.0	11.0
Reliability +/- 1 day	70%	68%
Reliability +/- 2 days	20%	29%
Reliability +/- 4 days	10%	3%
Fixed departure - time	No	Half
Fixed departure - date	Yes	Yes
Fixed arrival - time	Yes	No
Fixed arrival - date	Yes	Yes
Frequency (days)	2	1
Lifts in transit	2	2

Choose option 1 or 2 (type 1 or 2) for Choice 9   1

Transportation Survey - Route Choice - Choice 10

Mode	Road	MB Sea
Description	One nominated road carrier	Several suitable sea carriers
Route	Channel Tunnel/ferry through Poland to Russia - Moscow	Shipment by sea from a UK port to a BalticSea port then delivery by road/rail to Moscow
Cost per tonne	£59.35	£44.87
Transit time (days)	10.0	9.0
Reliability +/- 1 day	95%	70%
Reliability +/- 2 days	3%	20%
Reliability +/- 4 days	2%	10%
Fixed departure - time	Yes	No
Fixed departure - date	Yes	Yes
Fixed arrival - time	Yes	No
Fixed arrival - date	Yes	Yes
Frequency (days)	1	2
Lifts in transit	0	2

Choose option 1 or 2 (type 1 or 2) for Choice 10   2

Transportation Survey - Route Choice - Choice 11

Mode	Rail	MB Sea/Rail
Description	Rail service	Mixture of sea carriers and rail services
Route	Channel Tunnel/ferry through Poland with rail gauge tran-shipment at Brest, then to Moscow	Either by sea via UK port and Baltic Sea port or by rail with rail gauge transhipment at Brest
Cost per tonne	£53.42	£49.14
Transit time (days)	12.0	10.5
Reliability +/- 1 day	40%	55%
Reliability +/- 2 days	55%	38%
Reliability +/- 4 days	5%	8%
Fixed departure - time	No	No
Fixed departure - date	Yes	Yes
Fixed arrival - time	Yes	No
Fixed arrival - date	Yes	Yes
Frequency (days)	7	2
Lifts in transit	3	3

Choose option 1 or 2 (type 1 or 2) for Choice 11   2

Transportation Survey - Route Choice - Choice 12

Mode	MB Road	MB Road/Rail
Description	Several suitable road carriers	Mixture of road carriers and rail services
Route	Channel Tunnel/ferry through Poland to Russia - Moscow	Either by road via Channel Tunnel/ferry or by rail with rail gauge transhipment at Brest, then to Moscow
Cost per tonne	£62.32	£57.87
Transit time (days)	10.0	11.0
Reliability +/- 1 day	95%	68%
Reliability +/- 2 days	3%	29%
Reliability +/- 4 days	2%	3%
Fixed departure - time	Yes	Half
Fixed departure - date	Yes	Yes
Fixed arrival - time	Yes	No
Fixed arrival - date	Yes	Yes
Frequency (days)	1	1
Lifts in transit	0	2

Choose option 1 or 2 (type 1 or 2) for Choice 12   1

Appendix 7.16

Questionnaire (Screenshot – Section 6 – Question 6.2 – Result)

Transportation Survey - Route Choice - Choice 12

Mode	MB Road	MB Road/Rail
Description	Several suitable road carriers	Mixture of road carriers and rail services
Route	Channel Tunnel/ferry through Poland to Russia - Moscow	Either by road via Channel Tunnel/ferry or by rail with rail gauge transhipment at Brest, then to Moscow
Cost per tonne	£62.32	£57.87
Transit time (days)	10.0	11.0
Reliability +/- 1 day	95%	68%
Reliability +/- 2 days	3%	29%
Reliability +/- 4 days	2%	3%
Fixed departure - time	Yes	Half
Fixed departure - date	Yes	Yes
Fixed arrival - time	Yes	No
Fixed arrival - date	Yes	Yes
Frequency (days)	1	1
Lifts in transit	0	2

Choose option 1 or 2 (type 1 or 2) for Choice 12 ☐

'Choices boxes' 1 - 12 must be either '1' or '2'

ANALYSIS OF SECTION 6.2 [ ]

Transportation Survey - Route Choice - Choice 12

Mode	MB Road	MB Road/Rail
Description	Several suitable road carriers	Mixture of road carriers and rail services
Route	Channel Tunnel/ferry through Poland to Russia - Moscow	Either by road via Channel Tunnel/ferry or by rail with rail gauge transhipment at Brest, then to Moscow
Cost per tonne	£62.32	£57.87
Transit time (days)	10.0	11.0
Reliability +/- 1 day	95%	68%
Reliability +/- 2 days	3%	29%
Reliability +/- 4 days	2%	3%
Fixed departure - time	Yes	Half
Fixed departure - date	Yes	Yes
Fixed arrival - time	Yes	No
Fixed arrival - date	Yes	Yes
Frequency (days)	1	1
Lifts in transit	0	2

Choose option 1 or 2 (type 1 or 2) for Choice 12 [1]

RETURN TO THE QUESTIONNAIRE
AND GO TO SECTION 7 - TYPOLOGY

ANALYSIS OF SECTION 6.2 [CFHBEADG] [ ]

Questionnaire (Screenshot – Adaptive Stated Preference Results on Main Questionnaire)

5.2 Determinants of choice

Go to question 6.1

ANALYSIS OF SECTION 5.2   DEAGFBHC

Section 6 - Modal Choice

6.1 Service Choice

Go to question 6.2

ANALYSIS OF SECTION 6.1   FDHAECGB

6.2 Route Choice

Go to Section 7

ANALYSIS OF SECTION 6.2   AFDGCEHB

Appendix 7.18

Questionnaire (Screenshot – Section 7 – Questions 7.01 – 7.36)

Section 7 - Typology

The following test is a Jungian Typology Test. We are trying to relate different personality types to particular transportation choices. Your personal results will be kept strictly confidential but if you provide us with your name home and address (option

Please answer all the questions.

Question	Answer
7.01 As a rule, current preoccupations worry you more than your future plans	○ Yes ● No
7.02 You find it difficult to talk about your feelings	○ Yes ● No
7.03 You feel at ease in a crowd	● Yes ○ No
7.04 You do your best to complete a task on time	● Yes ○ No
7.05 You are strongly touched by the stories about people's troubles	○ Yes ● No
7.06 You are more interested in a general idea than in the details of its realisation	○ Yes ● No
7.07 Strict observance of the established rules is likely to prevent a good outcome	● Yes ○ No
7.08 Often you prefer to read a book than go to a party	○ Yes ● No
7.09 You tend to rely on your experience rather than on theoretical alternatives	○ Yes ● No
7.10 It's difficult to get you excited	○ Yes ● No
7.11 You rapidly get involved in social life at a new workplace	● Yes ○ No
7.12 It is in your nature to assume responsibility	● Yes ○ No
7.13 You frequently and easily express your feelings and emotions	● Yes ○ No
7.14 You often think about humankind and its destiny	● Yes ○ No
7.15 You believe the best decision is one that can be easily changed	● Yes ○ No
7.16 You are a person somewhat reserved and distant in communication	○ Yes ● No
7.17 You prefer to act immediately rather than speculate about various options	○ Yes ● No
7.18 You trust reason rather than feelings	● Yes ○ No
7.19 You spend your leisure time actively socializing with a group of people, attending parties, shopping, etc.	● Yes ○ No
7.20 You usually plan your actions in advance	● Yes ○ No
7.21 Your actions are frequently influenced by emotions	○ Yes ● No
7.22 You often contemplate about the complexity of life	○ Yes ● No
7.23 You often do jobs in a hurry	○ Yes ● No
7.24 You find it difficult to speak loudly	○ Yes ● No
7.25 You get bored if you have to read theoretical books	○ Yes ● No
7.26 You value justice higher than mercy	● Yes ○ No
7.27 The more people with whom you speak, the better you feel	● Yes ○ No
7.28 You like to keep a check on how things are progressing	● Yes ○ No
7.29 You easily empathize with the concerns of other people	● Yes ○ No
7.30 You are more inclined to experiment than to follow familiar approaches	● Yes ○ No
7.31 You avoid being bound by obligations	○ Yes ● No
7.32 You prefer to isolate yourself from outside noises	○ Yes ● No
7.33 It's essential for you to try things with your own hands	● Yes ○ No
7.34 You think that almost everything can be analyzed	● Yes ○ No
7.35 You are usually the first to react to a sudden event: the telephone ringing or unexpected question	● Yes ○ No
7.36 You take pleasure in putting things in order	● Yes ○ No

Appendix 7.19

Questionnaire (Screenshot – Section 7 – Questions 7.37 – 7.72)

7.37 You feel involved when watching TV soaps	○ Yes	● No
7.38 You easily understand new theoretical principles	● Yes	○ No
7.39 The process of searching for solution is more important to you than the solution itself	● Yes	○ No
7.40 You usually place yourself nearer to the side than in the centre of the room	○ Yes	● No
7.41 When solving a problem you would rather follow a familiar approach than seek a new one	○ Yes	● No
7.42 You try to stand firmly by your principles	● Yes	○ No
7.43 It is easy for you to communicate in social situations	● Yes	○ No
7.44 You are consistent in your habits	● Yes	○ No
7.45 You willingly involve yourself in matters which engage your sympathies	● Yes	○ No
7.46 You easily perceive various ways in which events could develop	● Yes	○ No
7.47 A thirst for adventure is close to your heart	● Yes	○ No
7.48 You prefer meeting in small groups to interaction with lots of people	○ Yes	● No
7.49 When considering a situation you pay more attention to the current situation and less to a possible	● Yes	○ No
7.50 You consider the scientific approach to be the best	● Yes	○ No
7.51 You enjoy having a wide circle of acquaintances	● Yes	○ No
7.52 You are almost never late for your appointments	● Yes	○ No
7.53 You readily help people while asking nothing in return	● Yes	○ No
7.54 You often spend time thinking of how things could be improved	● Yes	○ No
7.55 Your decisions are based more on the feelings of a moment than on the careful planning	○ Yes	● No
7.56 You prefer to spend your leisure time alone or relaxing in a tranquil family atmosphere	○ Yes	● No
7.57 You feel more comfortable sticking to conventional ways	○ Yes	● No
7.58 Objective criticism is always useful in any activity	● Yes	○ No
7.59 You enjoy being at the centre of events in which other people are directly involved	○ Yes	● No
7.60 You know how to put every minute of your time to good purpose	● Yes	○ No
7.61 You are easily affected by strong emotions	○ Yes	● No
7.62 You are always looking for opportunities	● Yes	○ No
7.63 Deadlines seem to you to be of relative, rather than absolute, importance	○ Yes	● No
7.64 After prolonged socializing you feel you need to get away and be alone	○ Yes	● No
7.65 Your desk, workbench etc. is usually neat and orderly	● Yes	○ No
7.66 You tend to be unbiased even if this might endanger your good relations with people	● Yes	○ No
7.67 You like to be engaged in an active and fast-paced job	● Yes	○ No
7.68 You have good control over your desires and temptations	● Yes	○ No
7.69 You tend to sympathize with other people	● Yes	○ No
7.70 You easily see the general principle behind specific occurrences	● Yes	○ No
7.71 You are inclined to rely more on improvisation than on careful planning	○ Yes	● No
7.72 You get pleasure from solitary walks	○ Yes	● No

Appendix 7.20

Questionnaire (Screenshot – Section 8)

Section 8 - Respondent Details

The following information is useful but not essential to validate the survey. If you want to remain completely anonymous you can click on the "Submit" button now. If you would like to receive a copy of your typology analysis and a copy of the research whe

8.1 First name

8.2 Last name

8.3 Title

8.4 Email

8.5 Address

Post Code

Your address details will be used only for the purpose of sending you a cheque or copies of your typology analysis and final report (as applicable)

Appendix 7.21

Questionnaire (Screenshot – Section 12)

We do not want to know the name of the company you work for but it would be useful to put your transport preferences into the context of the type of business you work for, the trading pattern and your experience in your decision making role.

9.1 Sector

9.2 Size

9.3 Trading pattern

9.4 Freight type

9.5 Your age in years   53

9.6 Your time in post in years   16

Appendix 7.22

Questionnaire (Screenshot – Section 10)

Section 10 - Acknowledgement

Thank you for taking part in this survey. As a small token of our appreciation for your contribution, we would like to "buy you a drink". If you have provided your name and address we will send you a cheque for £5. However, if you would prefer, we will provide you with your typology analysis and a copy of the final report.

10.1 Please send me a cheque for £5 to the above address, or

... send me my typology analysis (home address only) plus a copy of the final report (email link).

10.2 Please acknowledge my contribution in the final report, or

... I am happy to have contributed but wish to remain totally anonymous.

Appendix 7.23

Questionnaire (Screenshot – Error report and final instructions)

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Appendix 8

Validity and Reliability of Humanmetrics typology test

Comparative validation

Jung Typology Test vs 16PF[1]

Pearson's coefficients of correlation whose value exceeds 0.50

	E-I	T-F
Extraversion	0.76	
Utilitarian/Sensitive		0.58

Jung Typology Test vs KTS[2]

	E-I	S-N	T-F	J-P
E-I	0.79			
S-N		0.74		
T-F			0.76	
J-P				0.77

Reliability

Split-Half

Pearson's coefficient of correlation

E-I	S-N	T-F	J-P
0.81	0.79	0.8	0.8

Test-Retest

Pearson's coefficient of correlation

	E-I	S-N	T-F	J-P
Less than one week	0.83	0.79	0.78	0.81
More than one week	0.79	0.76	0.76	0.78

Notes
1. 16PF - Personality test developed by Raymond Cattell in 1949
2. KTS (Keirsey Temprement Sorter) Designed by David Keirsey PhD

Appendix 9

Mapping of the Humanmetrics typology test

Analysis results of Jungian typology test

Question	I/E	S/N	T/F	J/P	Question	I/E	S/N	T/F	J/P	Question	I/E	S/N	T/F	J/P
1		+x%			25		+x%			49		+x%		
2			+x%		26			+x%		50			+x%	
3	-x%				27	-x%				51	-x%			
4				+x%	28				+x%	52				+x%
5			-x%		29			-x%		53			-x%	
6					30		-x%			54		-x%		
7				-x%	31				-x%	55				-x%
8	+x%				32	+x%				56	+x%			
9		+x%			33		+x%			57		+x%		
10			+x%		34			+x%		58				
11	-x%				35	-x%				59	-x%			
12				+x%	36				+x%	60				+x%
13			-x%		37			-x%		61			-x%	
14		-x%			38		-x%			62		-x%		
15				-x%	39				-x%	63				-x%
16	+x%				40	+x%				64	+x%			
17		+x%			41		+x%			65				
18			+x%		42			+x%		66				
19	-x%				43	-x%				67	-x%			
20				+x%	44				+x%	68				+x%
21			-x%		45			-x%		69			-x%	
22		-x%			46		-x%			70		-x%		
23				-x%	47				-x%	71				-x%
24	+x%				48	+x%				72	+x%			

Note: Actual values omitted. Value of "x" varies from question to question.

Source: Author

Table A9.1 – Analysis results of Jungian typology test

The mapping of the Jungian psychometric test was carried out by analyzing 191 separate sample cases (1 x vanilla "Yes" case/72 "No" variations, 1 x vanilla "No" case/72 "Yes" variations and 45 case-by-case comparisons). From this analysis the movement of the bipolar results on their respective continuums was assessed, for the impact on position on the bi-polar scales.

The actual values have been omitted from Table A9.1 in order to protect proprietary information.

Appendix 10

Issues addressed by the Quality and Expert Groups using the Evaluation Booklet

- **Cognitive (for each question in sections 1 to 6 plus 8):**
    - Do you understand the question?
    - What do you think the question is asking (please paraphrase)?
    - If you think it can be asked in a better way, please specify.
    - Do you perceive any opportunity for ambiguity that needs to be excluded?
    - Is the context help panel helpful? Should it be amended or extended (please provide details)?

- **Cognitive (for adaptive sp question in sections 5.1, 6.1 and 6.2):**
    - Did you find this part of the questionnaire easy to use?
    - If not, please specify the aspects you found difficult.
    - Did you have to use the alternative Excel spreadsheets?
    - If so, did you have any difficulty downloading these?

- **Presentation:**
    - Is the background to the Web site the right colour? If not, please specify preference.
    - Do you find the navigation of the Web site easy to use?
    - Are the information pages useful or distracting?
    - In the questionnaire, all the questions except the qualifying questions are on one page. Do you find this easy to use?
    - Would you prefer each section on the questionnaire to be shown on a separate page?

- **Technical:**
    - Did you experience any problems using the Web site or questionnaire?
    - If so, please specify.
   - Was the loading time for the questionnaire acceptable?

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- Was your browser compatible with the functionality used in adaptive sp questions in 5.1, 6.1 and 6.2?
- **Face validity (for each question 1 to 6 plus 8):**
  - Please evaluate the questionnaire against the list of propositions provided.
  - Does the question individually address one of the propositions (for each question)?
  - Overall, does the questionnaire do what it purports to do, address the propositions in the study?

Appendix 11

Validation of the main instrument

1 Instrument evaluation

This appendix is concerned with the objectivity of the research. There are three measures by which survey instruments may be evaluated, namely, reliability, internal validity and external validity. Reliability is the degree to which a measurement procedure yields consistent results; internal validity is the degree to which a measure actually measures what it is intended to measure and external validity, or generalisability, exists when research findings apply beyond the specific case examined (Brym and Lie, 2005). In this section, the various concepts of reliability, validity and generalisability are discussed, and tests proposed by which the objectivity of the research can be evaluated.

Instrument Evaluation
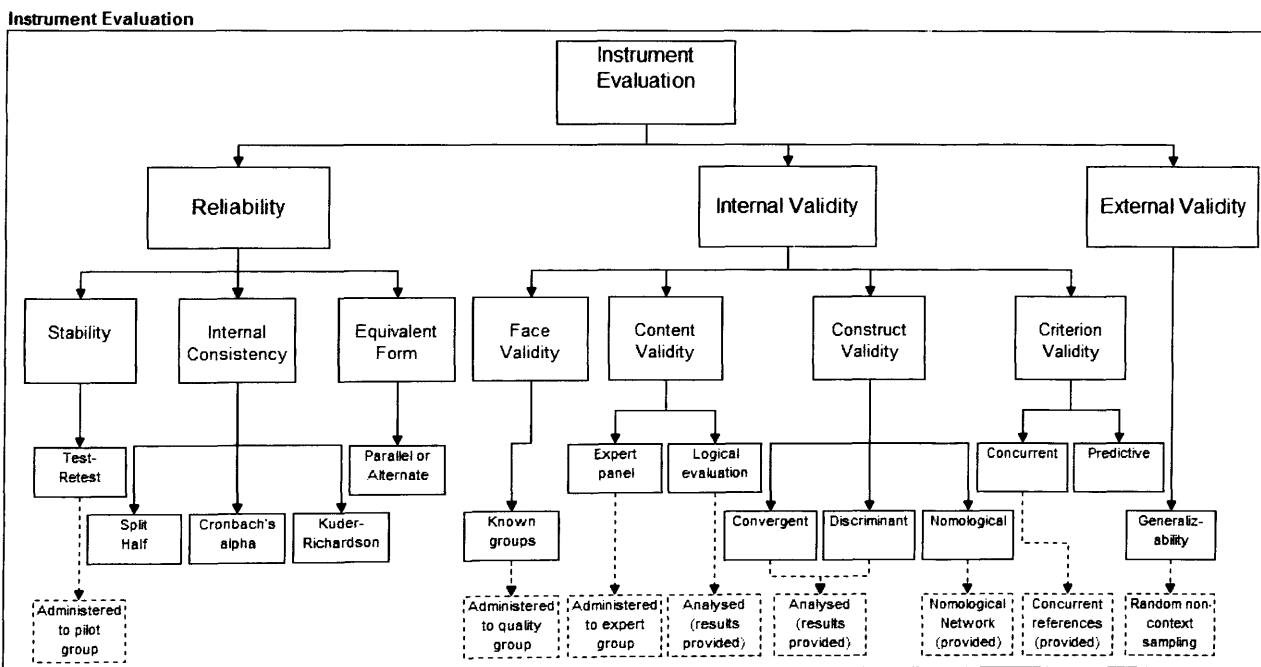
Source: Author

Figure A11.1 – Instrument Evaluation

Reliability is the measure of consistency of a questionnaire. There are three main forms of reliability (see Figure A11.1). The first measures stability and tests whether the questionnaire produces the same results each time it is administered, the second set measures internal consistency, and compares how different scales on the same form observe the same construct, and a third, equivalent form, measures whether two forms of the same test produce the same results.

The *test-retest* method applies the same test to the same group of people with an interval between the tests. Reliability is established by regressing the results of the two tests and obtaining strong positive correlation. Care has to be taken that the interval is not too short (two weeks is reasonable) as the respondent's ability to remember the answers will inflate the results; or too long, where maturity and changes in the environment will depress the index (Domino and Domino, 2006b). This test was applied to the respondents to the pilot study.

The *equivalent-form* method (sometimes referred to as alternate or parallel form) measures the similarity between two forms of the test measuring identical constructs. The test is performed by administering two parallel forms to the same sample and then correlating the scores obtained to yield a reliability coefficient. The two forms may be administered concurrently or with a short interval in between. It is only applicable when two (or more) forms are used, or found necessary, to measure the constructs and, thus is not appropriate for this study.

Internal consistency tests reveal whether a test is homogeneous in its content. There three main methods of establishing internal consistency. These are split-half, Cronbach's alpha test and Kuder-Richardson Formula (Fink and Kosecoff, 2005a).

The split-half method is really a class of tests, as there are a number of techniques that all do roughly the same thing. Split-half methods essentially compare one-half of the questionnaire with the other. There are several different

ways that the questionnaire can be divided, The various techniques include, first-half last-half, odd and even numbered questions, random splitting and balanced halves. The way that the questionnaire is split can create a bias that introduces a variance that is not attributable to the latent variable being measured. For example, with first half last half, if the questionnaire is long, the respondents may become systematically fatigued, such that the two halves would appear to be different. Thus, with all the forms of the test, the way that the questionnaire is split may be more significant than the strength of the relationship between the items - which is what the tests purport to measure (Devellis, 2003).

Another measure of internal consistency is Cronbach's alpha test. This test regresses each question against the other questions in the instrument. Strong positive correlation is widely taken to imply a high reliability or low response variance. Unfortunately, it can also mean that answers to one question affect the answers to another question giving a high correlation. Equally, a low value can indicate low correlation or it may mean that the items do not measure the same construct (Groves et al, 2004).

Cronbach's alpha is a generalisation of a coefficient introduced by Kuderand Richardson (1937) (Kuder-Richardson Formula 20 or KR20) (Jaeger,1993) to estimate the reliability of dichotomous scales (yes/no etc.) (Devellis, 2003b).

Because of the different types of questions used in the questionnaire in this study, measuring different parts of the construct, none of the internal consistency measures was considered helpful or appropriate in terms of determining the reliability of the instrument.
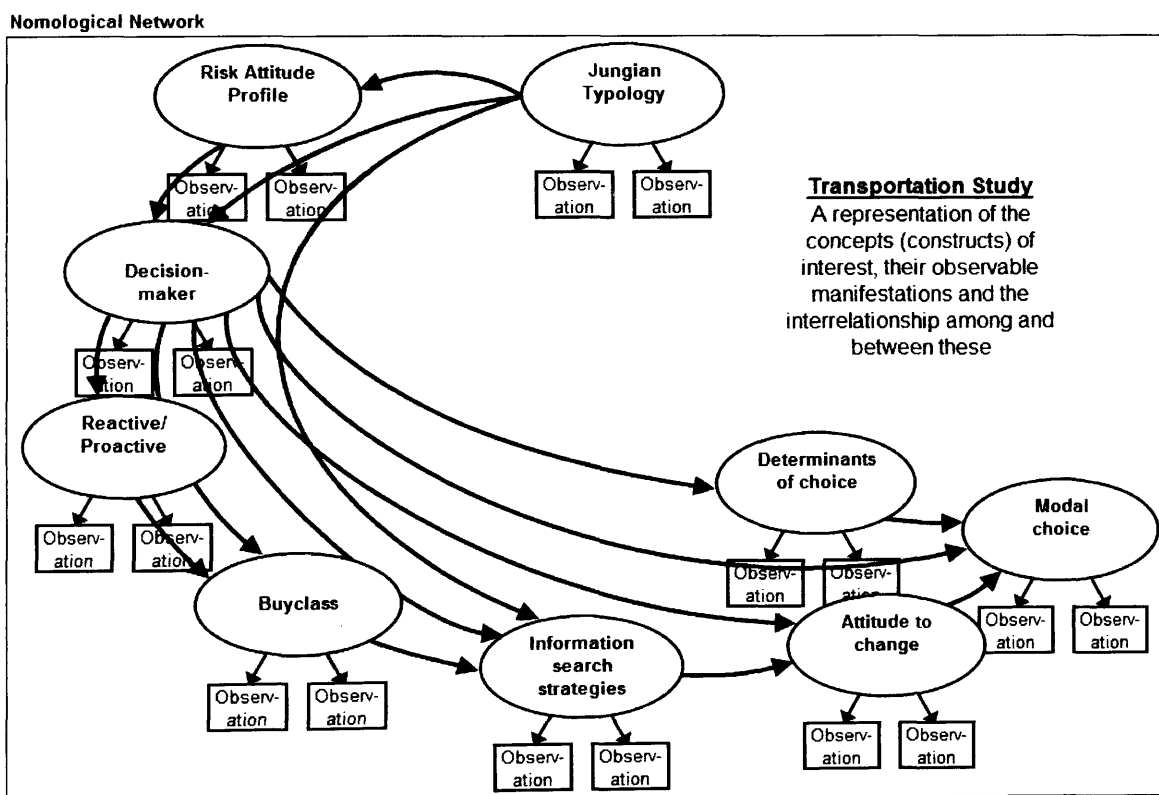
3   Internal validity

There are various definitions of validity, such as the concern with "the adequacy of the scale as a measure of a specific variable" (Devellis, 2003). However, in simple terms, validity is the degree to which an instrument

measures what it is intended to measure (Brym and Lie, 2005). There are four main types of internal validity:

- Face validity;
- Content validity;
- Construct validity; and
- Criterion validity.

Face validity simply means the validity at face value. Face validity, as Nunnally (1978) notes, concerns judgments about an instrument after it is devised, focusing on the extent to which it "looks like" it measures what it is intended to measure (Carmines, 1979). As a technique on its own, face validity has little merit, but legitimately forms part of content validity and, thus, is part of the process of assessing construct validity.

Nomological Network

Source: Author

Figure A11.2 – Nomological Network

Content Validity is the second basic type of internal validity. Content validity refers to the accuracy with which the questions reflect the characteristics

they are supposed to investigate (Fink and Kosecoff, 2005b). In other words, the content of the questionnaire (operationalisation) is compared with the content for the construct it is testing. At the basic level, this is achieved through face validity, which effectively forms part of the content validation process. A more objective approach involves making a detailed description of the content domain of the construct(s) in order to produce an inventory against which the content of the questionnaire may then be checked. Content and face-value validity were evaluated as part of a pretesting programme.

Construct validity is the degree by which certain explanatory concepts (constructs), derived from a theory, can be accounted for by the performance on a particular measure. Construct validity requires that the instrument is made up of a sufficiently well defined set of measures that they preclude "subjective" judgments (Yin, 2003). Construct validity is a process that subsumes other methods of assessing validity and includes content, as already discussed, convergent, discriminant, and nomological validity. *Convergent* validity is established by accumulating evidence that focuses on a single, well-defined construct. *Discriminant* validity, on the other hand, relies on conceptual dissimilarity between two constructs that are not supposed to be associated *Nomological* validity is considered to be the degree to which predictions based on a formal theoretical network containing the concept under scrutiny (see Figure A11.2) are confirmed (Netemeyer, Bearden & Sharma, 2003). Nomological analysis assesses the degree to which constructs that are considered to be theoretically related, can be shown to be empirically related (i.e., their measures correlate significantly in the predicted direction). In this study, construct validity is evaluated as part of the pretesting of the questionnaire.

The final type of internal validity measure is *criterion validity*. This is essentially a comparison between the scores obtained in the study and those produced in another, external, predictor − the criterion. There are two forms of criterion validity; concurrent that relates to performance at approximately the same time, and predictive that relates to some future performance. *Concurrent* validity is established by administering a new survey and an already established survey measuring the same constructs (Fink and Kosecoff, 2005). The only

related surveys to this study are those relating to determinants of choice and modal choice, but none of them (as far as is known) measure the same constructs, i.e. the correlation between determinants of choice and determinants of dissatisfaction, or the relationship between the decision-maker's typology and the modal choice process. *Predictive* validity can only be assessed once the results of the study are established by testing them on some future sample.

4   External validity

The final measure of validity to be considered is external validity or generalisability. *Generalisability* is the ability of an instrument to perform objectively on new instances, or populations other than those that were used to inform its development, i.e. if the model is adapted to another context, will it be equally as effective? (Fink and Kosecoff, 2005d). In this case, the study has been developed in the context of transportation choice in the trade between the United Kingdom and Russia. External validity could be established by administering the questionnaire, mutatis mutandi, to another strata of the same population or a completely different population.

These operationalisation of the measures of validity appropriate to this experiment are detailed in Section 5.6 (page 234) and the results shown in Section 6.2 (page 247). The results are discussed in Section 7.4 (page 341).

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Appendix 12

Null Hypothesis

Null Hypothesis stated for each Proposition in the Study

Proposition Alternative hypothesis (H$_a$)	Null hypothesis (H$_o$)
1 All decision-makers will respond to reactive triggers to review transport arrangements but only Explorers and (possibly) Improvers will be proactive seeking improvements or new solutions	There is no significant difference ($\alpha > 0.05$) between the triggers that Explorers and Improvers respond to (proactive) and those to which Conformers respond
2 Explorers tend to be in the new buy-class. Improvers in the modified rebuy class and Conformers in the rebuy class	There is no significant difference ($\alpha > 0.05$) between the preference towards buy class for Explorers. Improvers and Conformers
3 Conformers tend towards limited search strategies (LSS) concentrating on the current mode and service. Improvers also tend to use limited search strategies (LSS) but across all feasible alternatives. and Explorers are more likely to use comprehensive search techniques (CSS) across all feasible alternatives.	There is no significant difference ($\alpha > 0.05$) between the predecisional search strategies adopted by Explorers. Improvers and Conformers
4 Explorers. whatever mode they are currently using. are likely to weigh the feasible options and select the mode most suitable according to the information available (new buy or modified rebuy) Improvers will tend to remain with the current mode (not exclusively) but look for service improvements (modified rebuy). Conformers will tend to remain with the mode. service and carrier currently used. except if they have inherited an option they perceive to be too risky. in which case they may change to a less risky option (rebuy or. modified rebuy)	There is no significant difference ($\alpha > 0.05$) between the revealed change behaviour (inertia). with regard to transportation choice. for Explorers. Improvers and Conformers
5 Determinants of choice are actually determinants of dissatisfaction arising from the most recently used transportation choice.	There is a significant difference ($\alpha \leq 0.05$) between the determinants of choice and the determinants of dissatisfaction arising from the most recently used transportation choice.
6 For shipments between the UK and Russia. Explorers are most likely to use a multimodal option based on sea transport. Improvers are most likely to use a "Many Baskets" approach which may include road and sea transport. and Conformers are most likely to limit themselves to one option. most probably road based	There is no significant difference ($\alpha > 0.05$) between the transportation choices made by Explorers. Improvers and Conformers

Source: Author

Appendix 13

Statistical methods used for Propositions 1 to 4

The methods adopted to evaluate the relationship between the various data sets exploring Propositions 1 to 4 are all based on the difference between concordant and discordant pairs (Stamatis, 2003). A concordant pair (P) is simply a pair of cases in which one member of the pair is higher than the other member on both variables. Conversely, a discordant pair (Q) is a pair of cases in which one member of the pair is higher than the other member on one of the variables, but lower on the other variable. By simply counting the concordant and discordant pairs in a data set, a measure of the association can be established (Table A13.1).

Concordant and Discordant Pairs

Calculation for 3 x3 table for concordant pairs (P)

a	b	c		a	b	c		a	b	c		a	b	c
d	e	f		d	e	f		d	e	f		d	e	f
g	h	i		g	h	i		g	h	i		g	h	i

$P=a(e+f+h+i)$ $+b(f+i)$ $+d(h+i)$ $+e(i)$

Calculation for 3 x3 table for discordant pairs (Q)

a	b	c		a	b	c		a	b	c		a	b	c
d	e	f		d	e	f		d	e	f		d	e	f
g	h	i		g	h	i		g	h	i		g	h	i

$Q=c(d+e+g+h)$ $+f(g+h)$ $+b(d+g)$ $+e(g)$

Figure A13.1 – Concordant and Discordant pairs

Having counted the number of discordant pairs there are several ways of reporting the association. Although there are descriptive terms which represent the monotonicity (the pattern by which distribution increases or decreases), for the purpose of this study three measures are used for testing the propositions. These are:

- Association (Goodman or Krastal's Gamma – γ);

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- Strength of the association (Kendal's tau-c and tau-b);
- Significance (Chi-squared).

Tied pairs

	x		
	a	b	Tied on x: Tx = ac + bd
y	c	d	Tied on y: Ty = ab + b + cd + b

Source: Author

Table A13.2 – Tied pairs

Goodman or Krastal's Gamma simply standardizes the difference between concordant and discordant pairs. If there are an equal number of concordant as discordant pairs, gamma will equal zero ($\gamma = 0$). A zero does not necessarily mean a null hypothesis, except in a two by two table. If there is a greater number of concordant than discordant pairs gamma will be positive ($\gamma > 0$), usually indicating an association in line with, although not necessarily supporting the proposition (see below for significance). Conversely, if gamma is negative ($\gamma < 0$) this may indicate an inverse relationship with the proposition. Gamma is calculated as follows (where P = concordant and Q = discordant pairs):

$$\gamma = \frac{P - Q}{P + Q}$$

Another measure used in this part of the study is Kendal's tau-c (τ_c). Although tau-c is used to analyse the 3 x 3 tables arising from most of the data relating to Propositions 1 to 4, tau-b (τ_b) is discussed first as it exposes the difference in approach from the Gamma measure. Whereas Gamma considers only the number of concordant and discordant pairs, tau-b brings the ties between pairs into consideration (see Table A13.2).

The ties on each variable in a pair are considered separately (but not the ties on both variables). Thus, T_x is the number of ties involving the first variable (x) and T_y is the number of ties involving the second variable (y). The value for

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tau-b will always be more conservative than Gamma as a result of taking the ties into consideration. Tau-b is calculated as follows:

$$\tau_b = \frac{P - Q}{\sqrt{(P + Q + T_x)(P + Q + T_y)}}$$

Unfortunately, tau-b is only suitable for tables where the number of columns and the number of rows are equal (i.e. $r = c$) (Rafter, 2002). Tau-c can be used for any r x c table and is specified here as (m is the number of rows or columns depending on which is greater):

$$\tau_c = \frac{2m(P - Q)}{n^2(m - 1)}$$

The chi-squared is a test of statistical significance. Statistical significance indicates the degree of confidence for accepting or rejecting an hypothesis. It is a non-parametric test (the data does not need to be normally or nearly normally distributed) and, consequently, accepts weaker, less accurate data as input than a parametric tests (e.g. t-tests and analysis of variance). Thus, although it is reasonably flexible in the type of data that can be tested it has less status in terms of rigorous statistical analysis. Despite the flexibility there are certain requirements that should be observed:

- The sample must be randomly drawn from the population.;
- Data must be reported in raw frequencies (not percentages);
- Measured variables must be independent;
- Values/categories on independent and dependent variables must be mutually exclusive and exhaustive;
- Observed frequencies cannot be too small.

There are two forms of chi-squared. The first, the "goodness of fit", simply tests whether a set of observed (O) frequencies are a good fit for a pattern of expected (E) frequencies (f_o and f_e respectively) (Hinton, 2005). It is important to note that, by definition, the number of observations in each set will be the same and, in this form, is not suitable for analysing the data from Propositions 1 – 4.

However, the specification is of interest as the second form, the "test for independence", is derived from this.

$$\chi^2 = \Sigma \frac{(f_o - f_e)^2}{f_e}$$

The chi-squared test for independence is of more interest because the opposite of independence is association. The test for independence operates in the same way as the goodness of fit, except that the expected frequencies, against which the observed frequencies are compared, are not available, and have to be calculated. The expected frequency is specified for each observed frequency providing a mathematical distribution.

$$\text{Expected value of a cell } (f_e) = \frac{row\ total\ x\ column\ total}{overall\ total}$$

By substituting these values (f_e) in the formula above for goodness of fit, we get the chi-squared value for comparing variables in a bivariate table as follows:

$$\chi^2 = \Sigma \left(\frac{(O - E)^2}{E} \right)$$

Although the chi-squared indicates the magnitude (not sign because of the squaring function) of the relationship this in itself does improve on the gamma or tau measures. In order to assess whether an alternative hypothesis should be accepted or rejected, the result should be interpreted against some accepted criterion or yardstick (critical value). The probability used in this study is $\alpha \leq 0.05$ (95%). The value tabulated in the chi-squared table (a) is given by the conjunction of this α value and the degrees of freedom (DF). Degrees of freedom are a function of the number of rows (r) and columns (c) in the table.

$$DF = (c - 1) \times (r - 1)$$

In the analysis of the propositions 1 – 4 two forms of bivariate table are used, namely 3 x 3 and 2 x 2. Thus the α values used for evaluation are:

- 3 x 3 table   DF = (3 − 1) x (3 − 1) = 4 $\alpha \le 0.05$ $\chi^2 = 9.4880$

- 2 x 2 table   DF = (2 − 1) x (2 − 1) = 1 $\alpha \le 0.05$ $\chi^2 = 3.8410$

Thus, if the chi-squared values calculated from the observations are less than these values it will be taken that the distribution is not significant and the proposition (alternative hypothesis) should be rejected. If the calculated value exceeds the value from the table then, based on a probability of $\alpha \le 0.05$ the proposition should be accepted.

MS Excel formula used

Measures of Association (2 x 2) - Observed

Trigger	Non-Expl.	Explorer	Total
Not Pro-A	AAA	BBB	CCC
Proactive	DDD	EEE	FFF
Total	GGG	HHH	JJJ
tau-b	KKK	Con	LLL
tau-c	MMM	Dis	NNN
Gamma	PPP	Tied on X	QQQ
Chi-squared	RRR	Tied on Y	SSS
DF	TTT		
α = 0 05	UUU		

Metric	Cell	Function/Formula
Σ Not Pro-A	CCC	=SUM(AAA BBB)
Σ Proactive	FFF	=SUM(DDD EEE)
Σ Non-Exp	GGG	=SUM(AAA DDD)
Σ Explorer	HHH	=SUM(BBB EEE)
Σ Total	JJJ	=SUM(GGG HHH)
Con[cordant]	LLL	=(AAA*EEE)
Dis[cordant]	NNN	=(BBB*DDD)
Tied on X	QQQ	=+(AAA*DDD)+(BBB*EEE)
Tied on Y	SSS	=+((AAA*BBB)+BBB)+((DDD*EEE)+EEE)
Tau-b	KKK	=(LLL-NNN)/(SQRT((LLL+NNN+SSS)*(LLL+NNN+QQQ)))
Tau-c	MMM	=(2*(IF(COUNT(AAA BBB)<COUNT(BBB EEE) COUNT(AAA BBB) COUNT(BBB EEE))) *((++(AAA*EEE)-(BBB*DDD))))/(SUM(AAA EEE)*SUM(AAA EEE) *(IF(COUNT(AAA BBB)<COUNT(BBB EEE) COUNT(AAA BBB) COUNT(BBB EEE))-1))
Gamma	PPP	=((AAA*EEE)-(BBB*DDD))/((AAA*EEE)+(BBB*DDD))
Chi-squared	RRR	=(+JJJ*(((AAA*EEE)-(BBB*DDD))*((AAA*EEE)-(BBB*DDD))))/(CCC*FFF*HHH*GGG)
DF	TTT	=(COUNT(AAA DDD)-1)*(COUNT(AAA BBB)-1)

Source: Author

Table A13.3 – MS Excel formula used

In order to automate the analysis from the Web based returns an MS Excel spreadsheet was used to analyse the data from the questionnaire and calculating the various statistical measures. Although Excel includes several useful functions, including "CHITEST" it does not include the measures required here. Thus, the method of calculation (based on the formulas above) is shown in Table A13.3. The results obtained uning MS Excel were checked using SPSS.

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Appendix 14.1

Background analysis to Table 6.13 (Service Choice)

SERVICE CHOICE ANALYSIS

Rank Respondent	1st Choice	2nd Choice	3rd Choice	4th Choice	5th Choice	6th Choice	7th Choice	8th Choice
1	Invalid response							
2	C	E	A	H	D	F	B	G
3	A	E	C	G	B	H	D	F
4	C	E	A	H	F	B	D	G
5	D	E	A	H	C	F	G	B
6	D	F	A	G	E	C	B	H
7	C	E	A	G	D	F	B	H
8	F	D	H	A	E	C	G	B
9	C	F	B	H	E	D	G	A
10	D	F	H	A	E	C	G	B
11	D	E	H	A	C	F	G	B
12	B	F	D	H	C	E	G	A
13	H	D	F	A	C	E	B	G
14	D	F	H	A	C	E	G	B
15	C	E	A	G	D	F	B	H
16	C	F	A	H	D	E	G	B
17	F	D	H	A	E	C	G	B
18	C	E	A	G	D	F	B	H
19	F	D	H	A	E	C	G	B
20	D	E	A	H	C	F	B	G
21	F	A	C	H	E	B	D	G
22	D	E	G	A	F	C	H	B
23	F	D	H	A	C	E	G	B
24	D	E	A	H	C	F	G	B
25	C	E	H	A	D	F	G	B
26	C	F	H	A	D	E	B	G
27	C	E	H	A	D	F	B	G
28	D	F	B	H	G	C	E	A
29	F	D	H	A	C	E	G	B
30	C	E	B	H	D	F	A	G
31	D	E	G	A	C	F	B	H
32	D	E	G	A	C	F	H	B
33	D	E	A	H	C	F	B	G
34	D	E	A	H	C	F	G	B
35	C	E	H	B	D	F	A	G
36	D	E	A	H	C	F	G	B
37	F	C	H	A	D	E	G	B
38	D	E	A	H	F	C	G	B
39	F	D	A	G	C	E	H	B
40	F	A	H	C	D	E	G	B
41	C	E	A	G	D	F	B	H
42	D	E	H	A	F	C	G	B
43	F	D	H	A	C	E	G	B
44	F	D	H	A	C	E	G	B
45	C	E	A	H	F	B	D	G
Overall	**D**	**E**	**C**	**A**	**F**	**H**	**G**	**B**

Choice	1st	2nd	3rd	4th	5th	6th	7th	8th
A	1	2	17	19	0	0	2	3
B	1	0	3	1	1	3	12	23
C	14	1	2	1	17	9	0	0
D	16	9	1	0	13	1	4	0
E	0	24	0	0	7	12	1	0
F	11	8	1	0	5	18	0	1
G	0	0	3	7	1	0	22	11
H	1	0	17	16	0	1	3	6

Rank	1	2	3	4	5	6	7	8
Reverse rank	8	7	6	5	4	3	2	1

Score	= 8 x n	= 7 x n	= 6 x n	= 5 x n	= 4 x n	= 3 x n	= 2 x n	= 1 x n	Total	Rank
A	8	14	102	95	0	0	4	3	226	4
B	8	0	18	5	4	9	24	23	91	8
C	112	7	12	5	68	27	0	0	231	3
D	128	63	6	0	52	3	8	0	260	1
E	0	168	0	0	28	36	2	0	234	2
F	88	56	6	0	20	54	0	1	225	5
G	0	0	18	35	4	0	44	11	112	7
H	8	0	102	80	0	3	6	6	205	6

Appendix 14.2

Background analysis to Table 6.14 (Route Choice)

ROUTE CHOICE ANALYSIS

Rank Respondent	1st Choice	2nd Choice	3rd Choice	4th Choice	5th Choice	6th Choice	7th Choice	8th Choice
1	Invalid response							
2	F	C	A	H	E	D	G	B
3	A	E	C	G	B	H	D	F
4	A	E	C	G	B	F	D	H
5	F	A	D	G	E	C	H	B
6	C	F	A	H	E	D	G	B
7	D	F	A	G	B	H	E	C
8	A	F	D	G	C	E	H	B
9	C	F	H	B	E	A	D	G
10	A	F	D	G	E	C	H	B
11	A	F	D	G	B	E	C	H
12	C	E	H	B	A	F	D	G
13	A	F	D	G	C	E	H	B
14	F	A	D	G	E	C	H	B
15	C	F	H	B	E	A	G	D
16	E	A	D	G	C	F	H	B
17	A	F	D	G	C	E	H	B
18	C	F	H	A	E	B	G	D
19	A	F	C	G	D	E	H	B
20	F	C	H	A	E	B	D	G
21	F	C	A	H	E	D	G	B
22	F	C	H	A	E	D	G	B
23	A	C	F	D	G	E	H	B
24	A	F	D	H	G	B	C	E
25	F	A	C	H	D	E	G	B
26	C	F	A	H	D	E	G	B
27	C	E	B	H	A	F	D	G
28	C	E	H	A	F	B	G	D
29	A	F	C	G	D	E	H	B
30	C	E	H	A	F	D	B	G
31	F	A	C	H	D	G	E	B
32	F	A	D	G	C	E	B	H
33	C	E	H	A	F	D	B	G
34	F	C	H	A	E	D	G	B
35	C	E	A	H	F	B	D	G
36	F	C	H	A	E	B	G	D
37	F	A	C	G	E	D	H	B
38	F	A	H	D	E	C	G	B
39	A	E	D	G	F	C	H	B
40	A	F	D	G	E	C	H	B
41	C	F	H	A	E	B	G	D
42	F	A	D	G	E	C	H	B
43	F	A	D	H	C	E	G	B
44	A	E	D	G	F	C	H	B
45	A	F	D	G	C	E	H	B
Overall	**A**	**F**	**C**	**E**	**D**	**H**	**G**	**B**

Choice	1st	2nd	3rd	4th	5th	6th	7th	8th
A	15	10	6	9	2	2	0	0
B	0	0	1	3	4	7	3	26
C	12	6	7	0	8	8	2	1
D	1	0	17	1	5	8	7	5
E	1	10	0	0	18	12	2	1
F	15	18	0	0	6	4	0	1
G	0	0	0	21	1	1	14	7
H	0	0	13	10	0	2	16	3

Rank	1	2	3	4	5	6	7	8
Reverse rank	8	7	6	5	4	3	2	1

Score	= 8 x n	= 7 x n	= 6 x n	= 5 x n	= 4 x n	= 3 x n	= 2 x n	= 1 x n	Total	Rank
A	120	70	36	45	8	6	0	0	285	1
B	0	0	6	15	16	21	6	26	90	8
C	96	42	42	0	32	24	4	1	241	3
D	8	0	102	5	20	24	14	5	178	5
E	8	70	0	0	72	36	4	1	191	4
F	120	126	0	0	24	12	0	1	283	2
G	0	0	0	105	4	3	28	7	147	7
H	0	0	78	50	0	6	32	3	169	6

Route Choice Details

Route Information	
ID No	189142
Mode	Road
Description	One nominated road carrier
Route	Channel Tunnel/ferry through Poland to Russia - Moscow

Service Attributes

Cost per tonne	£59 35
Transit time (days)	10
Reliability +/- 1 day	95%
Reliability +/- 2 days	3%
Reliability +/- 4 days	2%
Fixed departure - time	Yes
Fixed departure - date	Yes
Fixed arrival - time	Yes
Fixed arrival - date	Yes
Frequency	1
Lifts	0

Route Choice Details

Route Information	
ID No	596238
Mode	Rail
Description	Rail service
Route	Channel Tunnel/ferry through Poland with rail gauge transhipment at Brest, then to Moscow

Service Attributes

Cost per tonne	£53 42
Transit time (days)	12
Reliability +/- 1 day	40%
Reliability +/- 2 days	55%
Reliability +/- 4 days	5%
Fixed departure - time	No
Fixed departure - date	Yes
Fixed arrival - time	No
Fixed arrival - date	Yes
Frequency	7
Lifts	3

Route Choice Details

Route Information	
ID No	353360
Mode	Sea
Description	One nominated sea carrier
Route	Shipment by sea from a UK port to St Petersburg then delivery by road/rail to Moscow

Service Attributes

Cost per tonne	£42 73
Transit time (days)	9
Reliability +/- 1 day	70%
Reliability +/- 2 days	20%
Reliability +/- 4 days	10%
Fixed departure - time	No
Fixed departure - date	Yes
Fixed arrival - time	No
Fixed arrival - date	Yes
Frequency	7
Lifts	2

Route Choice Details

Route Information	
ID No	586655
Mode	MB Sea
Description	Several suitable sea carriers
Route	Shipment by sea from a UK port to a BalticSea port then delivery by road/rail to Moscow

Service Attributes

Cost per tonne	£44 87
Transit time (days)	9
Reliability +/- 1 day	70%
Reliability +/- 2 days	20%
Reliability +/- 4 days	10%
Fixed departure - time	No
Fixed departure - date	Yes
Fixed arrival - time	No
Fixed arrival - date	Yes
Frequency	2
Lifts	2

Route Choice Details

Route Information	
ID No	650665
Mode	MB Road/Sea
Description	Mixture of road and sea carriers
Route	Either by road via Channel Tunnel/ferry or by sea via a Baltic Sea port to Moscow

Service Attributes

Cost per tonne	£43 80
Transit time (days)	9.5
Reliability +/- 1 day	83%
Reliability +/- 2 days	12%
Reliability +/- 4 days	6%
Fixed departure - time	Half
Fixed departure - date	Yes
Fixed arrival - time	No
Fixed arrival - date	Yes
Frequency	1
Lifts	1

Route Choice Details

Route Information	
ID No	689753
Mode	MB Road/Rail
Description	Mixture of road carriers and rail services
Route	Either by road via Channel Tunnel/ferry or by rail with rail gauge transhipment at Brest

Service Attributes

Cost per tonne	£57 87
Transit time (days)	11
Reliability +/- 1 day	68%
Reliability +/- 2 days	29%
Reliability +/- 4 days	3%
Fixed departure - time	Half
Fixed departure - date	Yes
Fixed arrival - time	No
Fixed arrival - date	Yes
Frequency	1
Lifts	2

Route Choice Details

Route Information	
ID No	856456
Mode	MB Road
Description	Several suitable road carriers
Route	Channel Tunnel/ferry through Poland to Russia - Moscow

Service Attributes

Cost per tonne	£62 32
Transit time (days)	10
Reliability +/- 1 day	95%
Reliability +/- 2 days	3%
Reliability +/- 4 days	2%
Fixed departure - time	Yes
Fixed departure - date	Yes
Fixed arrival - time	Yes
Fixed arrival - date	Yes
Frequency	1
Lifts	0

Route Choice Details

Route Information	
ID No	142856
Mode	MB Sea/Rail
Description	Mixture of sea carriers and rail services
Route	Either by sea via a UK port and Baltic Sea port or by rail with rail gauge transhipment at Brest

Service Attributes

Cost per tonne	£49 14
Transit time (days)	10.5
Reliability +/- 1 day	55%
Reliability +/- 2 days	38%
Reliability +/- 4 days	8%
Fixed departure - time	No
Fixed departure - date	Yes
Fixed arrival - time	No
Fixed arrival - date	Yes
Frequency	2
Lifts	3

Appendix 15
Route and Service information